FINAL ENVIRONMENTAL ASSESSMENT FOR THE LOST CREEK *IN-SITU* URANIUM RECOVERY FACILITY LICENSE AMENDMENT FOR ROTARY VACUUM DRYER INSTALLATION

March 2013

Docket No. 40-9068
License No. SUA-1598

Prepared By:

U.S. Nuclear Regulatory Commission
Office of Federal and State Materials
and Environmental Management Programs
Division of Waste Management and Environmental Protection

Enclosure 2

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1 Introduction and Background

The U.S. Nuclear Regulatory Commission (NRC) prepared this Environmental Assessment (EA) in response to a January 6, 2012, application by Lost Creek ISR, LLC (LCI) (a wholly-owned subsidiary of UR-Energy, Inc. of Littleton, Colorado) to amend NRC License SUA-1598 (NRC, 2011a) to include yellowcake rotary vacuum drying as an option within the Central Processing Plant (CPP) at the Lost Creek *In-Situ* Uranium Recovery (ISR) Facility, and subsequent offsite shipment of vacuum dried yellowcake up to 909,000 kilograms (kg) [2 million pounds (lb)] per year (LCI, 2012a). The EA includes an evaluation of the potential environmental impacts of the action requested in LCI's license amendment application. The Lost Creek ISR Facility, which is currently under construction, is located in northeastern Sweetwater County, Wyoming (Figure 1-1), in the Wyoming West Uranium Milling Region (Figure 1-2) identified in NUREG-1910, "Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities" (GEIS) (NRC, 2009).

In-situ uranium recovery, also known as "solution mining" or in situ leaching, is a process using a solution called lixiviant to extract uranium from underground ore bodies in place (in other words, in situ). Lixiviant, which typically contains an oxidant such as oxygen and/or hydrogen peroxide mixed with sodium carbonate/bicarbonate or carbon dioxide in native groundwater, is injected through groundwater wells into the uranium ore body in a confined aquifer to dissolve the uranium. The resulting uranium solution is then pumped via recovery wells to the surface for processing to produce yellowcake, which is the solid form of mixed uranium oxides. Yellowcake is commonly referred to as U_3O_8, because that chemical compound comprises approximately 85 percent of the yellowcake produced by uranium recovery facilities. That product is transported to a uranium conversion facility, where it is transformed into uranium hexafluoride (UF_6), in preparation for fabricating fuel for nuclear reactors.

By letter dated March 20, 2008, LCI submitted an application to the NRC for a new source materials license for the proposed Lost Creek ISR Facility (LCI, 2008a). The NRC staff subsequently prepared a site-specific Supplemental Environmental Impact Statement (SEIS), NUREG-1910 Supplement 3 to the GEIS (NRC, 2011c), which evaluated the potential environmental impacts from LCI's proposal to construct, operate, conduct aquifer restoration, and decommission a uranium ISR facility at the Lost Creek Project site in Sweetwater County, Wyoming. In addition to the SEIS, the staff prepared a Safety Evaluation Report (SER) that evaluated the safety aspects of the license application (NRC, 2011b). Following the conclusion of both the environmental and safety reviews, on August 18, 2011, the NRC issued a license (SUA-1598) to LCI for the ISR facility (NRC, 2011a).

In the SEIS (NRC, 2011c), the NRC stated, "Given the estimated production flow rates and the anticipated uranium concentration of the pregnant lixiviant, the applicant has designed the process plant to manage 909,000 kg [2 million lb] per year of yellowcake slurry. The processing plant will not contain a dryer, and the yellowcake slurry will be shipped off site to a licensed facility for further processing. However, the applicant expects to produce approximately 455,000 kg [1 million lb] of yellowcake (U_3O_8) per year for a period of at least 8 years. This production rate is established by license condition as the maximum throughput for the processing plant." The NRC license that was subsequently issued includes the provision, "The annual production of yellowcake slurry shall not exceed 455,000 kg [1 million lb] equivalent of dried yellowcake

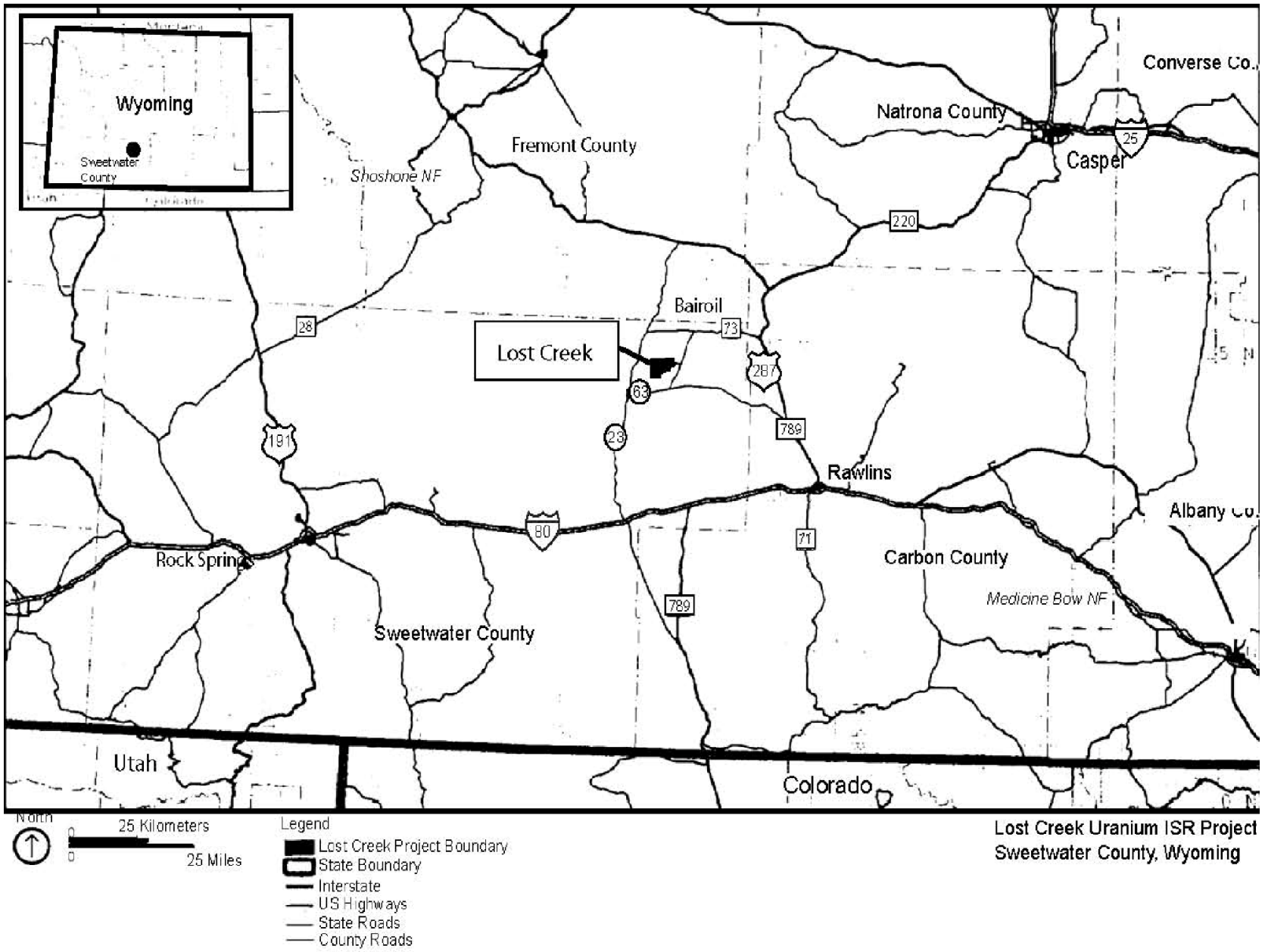

Figure 1-1
Project Location
Source: Lost Creek ISR SEIS (NRC 2011)

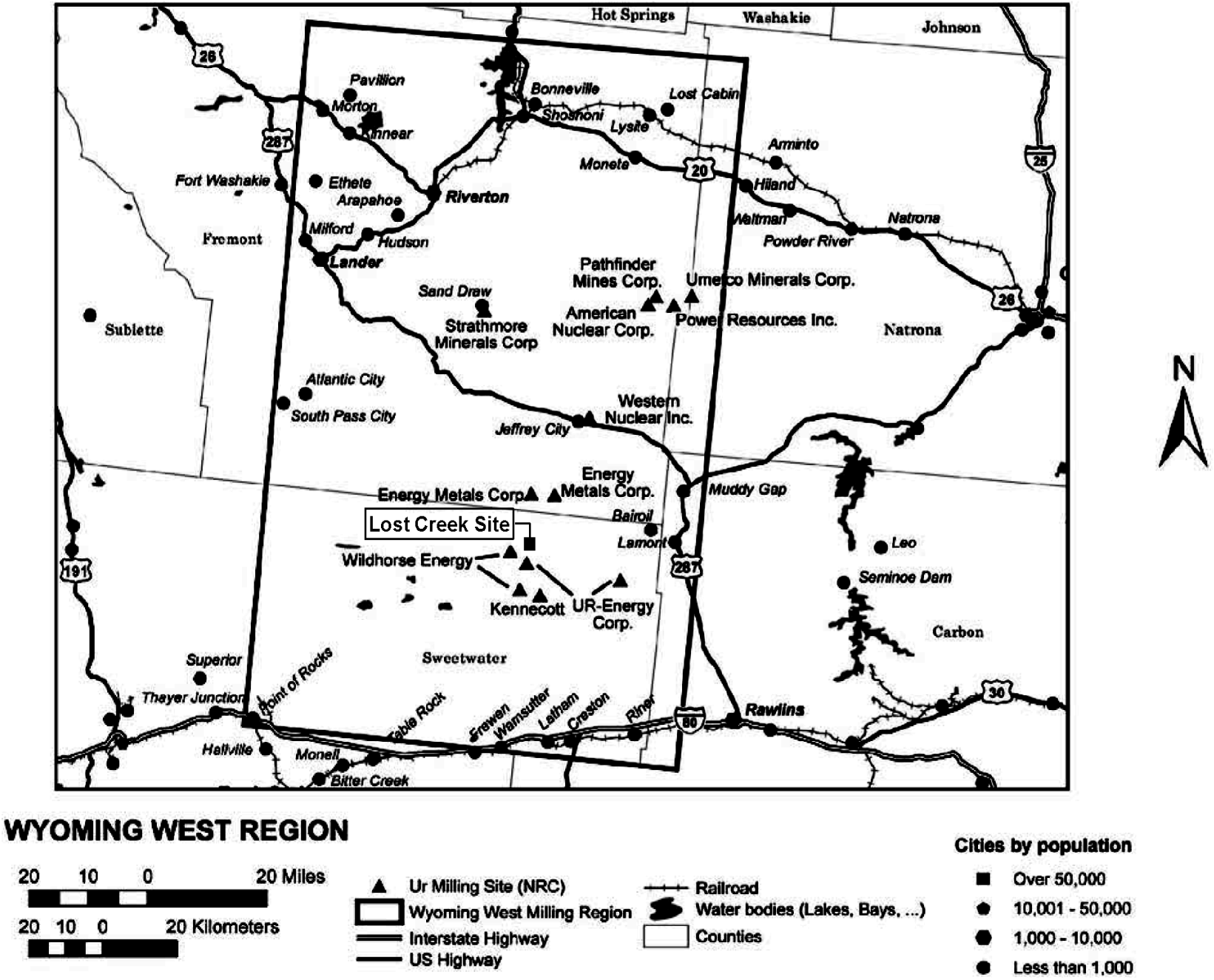

Figure 1-2
Wyoming West Uranium Milling Region
Source: ISR Milling Facilities GEIS (NRC 2009)

product." LCI is now requesting a license amendment to include yellowcake drying at the facility up to 909,000 kg [2 million lb] per year. The SEIS (NRC, 2011c) was largely prepared for an ISR facility designed to produce up to two million pounds equivalent of dried yellowcake product per year. However, because of LCI's expectation that the facility would produce approximately one million pounds of yellowcake per year during the initial years of production, the SEIS addressed the potential environmental impacts associated with only that amount for the following resource areas: Transportation, Groundwater, Air Quality, Public and Occupational Health, and Waste Management. By email dated November 29, 2012 (LCI, 2012b), LCI requested that their throughput of yellowcake be increased to 909,000 kg [2 million lb], as the facility was designed. The increased production of dry yellowcake is expected to come from 'loaded' (uranium enriched) resin from other uranium recovery facilities, including potential future satellite facilities owned by the licensee. Approximately 154 truckloads of resin are expected to come to Lost Creek from these facilities. Thus, this EA presents an evaluation of the potential environmental effects of the Lost Creek ISR Facility producing two million pounds of dry yellowcake per year for the five resources areas identified above, so that the license amendment for yellowcake drying can also include a provision to increase annual production to 909,000 kg [2 million lb] of dried yellowcake.

The NRC staff prepared this EA in accordance with NRC regulations in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," and NRC staff guidance document, NUREG-1748, "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs" (NRC, 2003a). The regulations in 10 CFR Part 51 implement Section 102(2) of the National Environmental Policy Act of 1969, as amended (NEPA).

The NRC staff is also conducting a detailed safety analysis of LCI's amendment request, compliant with 10 CFR Part 40, "Domestic Licensing of Source Material." This analysis will be documented in a separate SER, in accordance with the NRC staff guidance document, NUREG-1569, "Standard Review Plan for In-Situ Leach Uranium Extraction License Applications" (NRC, 2003b). The staff's decision whether to grant the license amendment, as proposed, will be based on both the EA and SER.

2 The Proposed Action

The proposed action is to include yellowcake rotary vacuum drying in the CPP at the Lost Creek ISR Facility, and subsequent offsite shipment of vacuum dried yellowcake up to 909,000 kg [2 million lb] per year. In the future, the licensee intends to increase the production of dry yellowcake by accepting loaded resin from other uranium recovery facilities, including potential future satellite facilities. This would not have an impact upon the flow rate from the Lost Creek well fields. The rotary vacuum drying is proposed to be added to LCI's uranium recovery and processing operation as a dryer circuit within the CPP (LCI, 2012a) (see Shop/Future Dryer Area in Figure 2-1).

The following description of the proposed action is based on supplemental information submitted by LCI with its January 6, 2012, license amendment application, specifically, the "Supplement to TR [Technical Report] Section 3.0 Description of the Proposed Facility" (LCI, 2012a). Figure 2-2 (Figure 1.5-2b in LCI's license amendment application [LCI, 2012a]) illustrates the plant process flow with the yellowcake vacuum dryer and offsite shipment steps. Figure 2-3 is the flow diagram for the rotary vacuum dryer system.

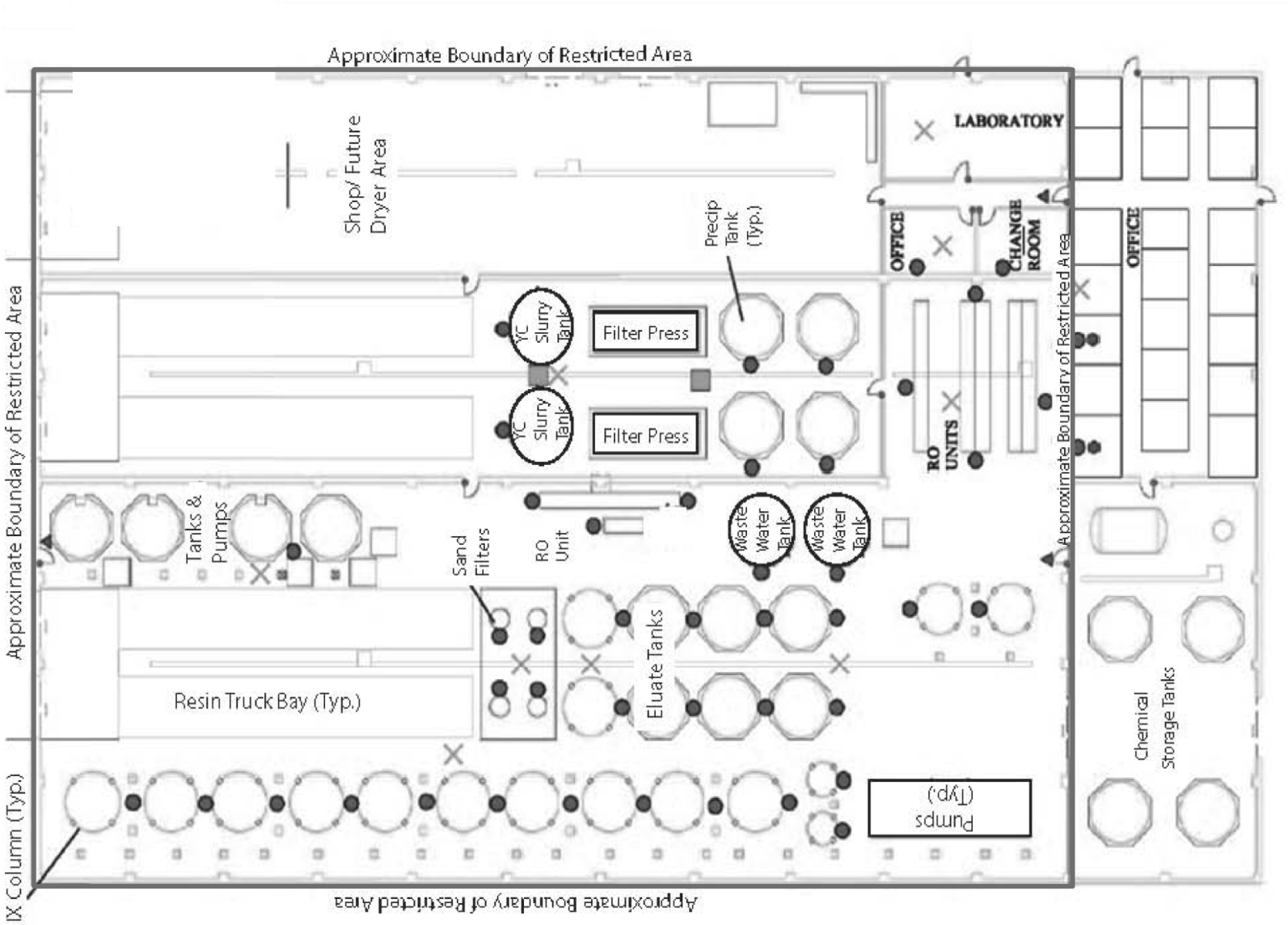

Figure 2-1
Central Processing Plant Floorplan
Source: NRC 2011

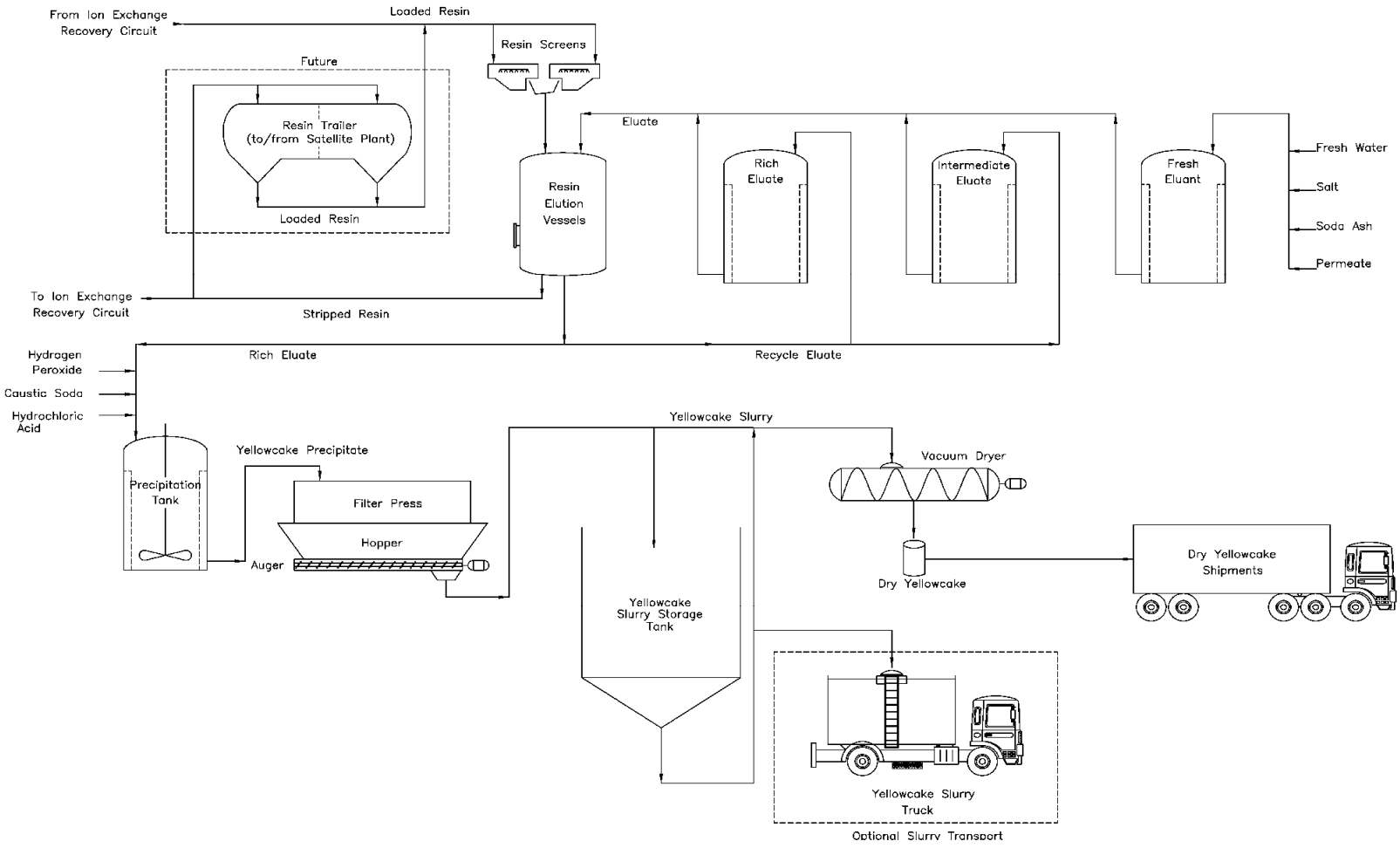

Figure 2-2
Plant Process Flow Diagram
Source: LCI 2011

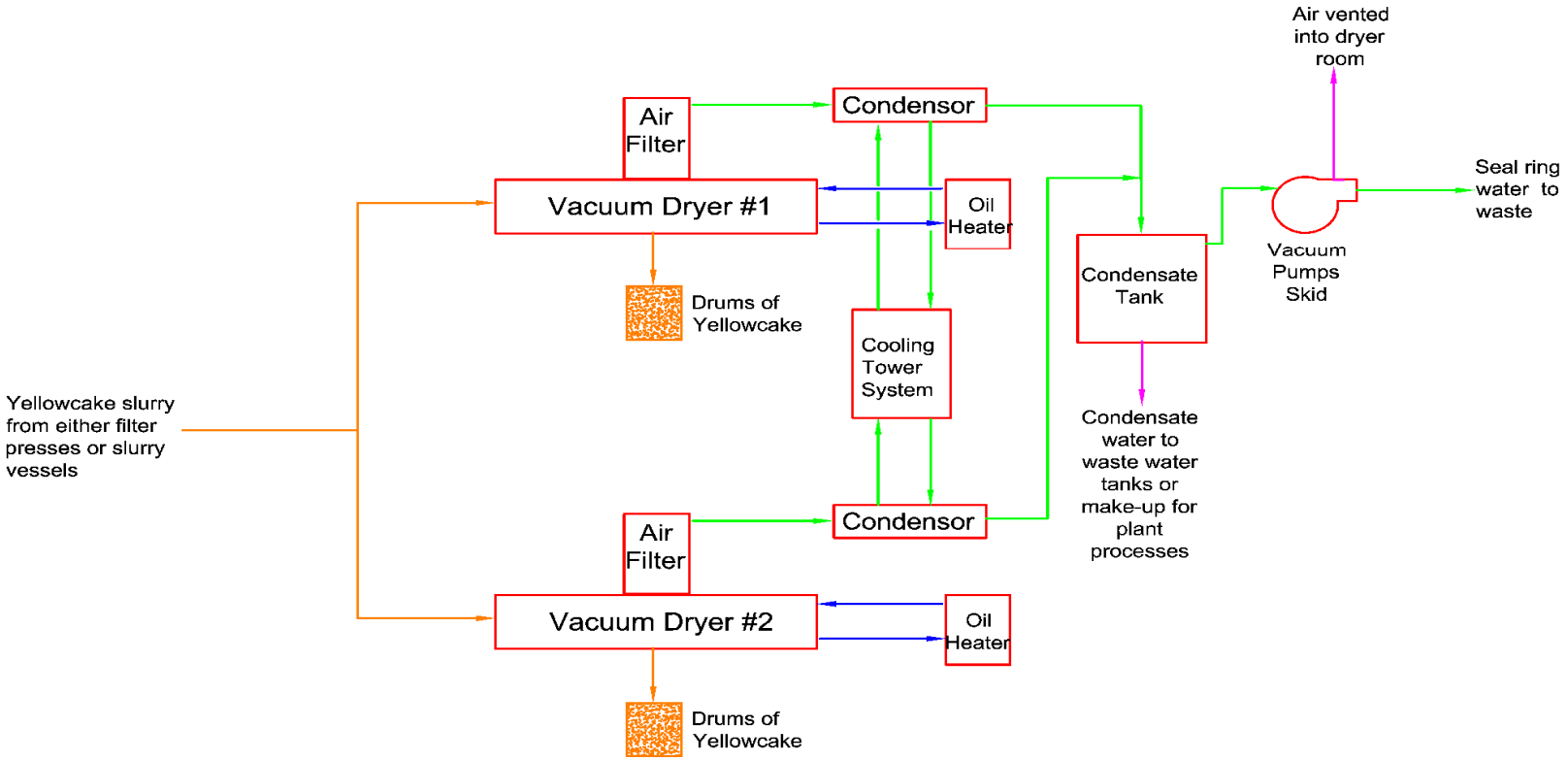

Figure 2-3
Rotary Vacuum Dryer Flow Diagram
Source: LCI 2012

The proposed action would add a fourth process circuit, a dryer circuit, to the original CPP design, which currently includes the following three process circuits: (1) ion exchange, (2) elution, and (3) precipitation (LCI, 2011). This would give the Lost Creek ISR facility the option of producing dried yellowcake as a final product, and shipping dried yellowcake directly to a conversion facility, such as the one in Metropolis, Illinois. The three process circuits in the original CPP configuration are designed to handle up to 909,000 kg [2 million lb] per year of dried yellowcake product (LCI, 2008c), and the dryer circuit would also be designed for 909,000 kg [2 million lb] per year (LCI, 2012b). Under the existing license, the Lost Creek ISR Facility would ship yellowcake slurry to an intermediate processing facility for drying, as described in the existing license (NRC, 2011a). Under the proposed action Lost Creek would have the option to ship dried yellowcake directly to a uranium conversion facility.

The proposed CPP drying circuit includes two separate drying systems, allowing the plant the flexibility to vary the output of dried product (up to 909,000 kg [2 million lb] per year of yellowcake) in the case of increased production rates or changes in scheduled maintenance (LCI, 2012b). The dryers would be a standard rotary vacuum design, each having its own ventilation system in order to prevent any dry yellowcake particulate from being circulated into other areas of the plant. The dryer circuit ventilation design provides the dryer room with negative pressure, inducing flow into the room (LCI, 2012a). Since vacuum dryers are designed to have little to no emissions (NRC, 2003b), there would be little potential for particulates to be released to the atmosphere. Final venting from the vacuum pump would be back into the dryer room.

The proposed drying circuit would produce a relatively small amount of waste products, consisting primarily of waste water (drum wash down and condensate tank waste). While most of this water would be recycled, when concentrations build up, these liquid effluents would be directed to the on-site holding ponds, before being deep-well injected in the Class I wells. Regarding solid wastes, even a smaller amount would be produced. Three sources of solid wastes are noted, bag house dust, bag filters and paint-sized chips from dried yellowcake drum wash down. Bag house filters would be changed annually (or bi-annually), based on historic information (LCI, 2012c). Paint-sized chips from the dried yellowcake drum wash down would be collected when the screen in the collection sump becomes clogged, and the wash down water can no longer be recirculated efficiently.

The drying process would be conducted in accordance with the safety requirements contained in 10 CFR Part 40, Appendix A, Criterion 8, which states, in part, “Milling operations must be conducted so that all airborne effluent releases are reduced to levels as low as is reasonably achievable.” Also, appropriate yellowcake dryer alarms would be installed. Additional description of the drying circuit operation is presented in Appendix A of this EA.

3 The Need for the Proposed Action

On August 18, 2011, LCI received NRC Materials License SUA-1598 for the Lost Creek ISR facility (NRC, 2011a). Under this license, the ISR facility’s CPP does not include a yellowcake dryer circuit. There are three processing circuits (ion exchange, elution, and precipitation) that produce a yellowcake slurry, which would be stored in holding tanks either inside the processing plant or in transport tanks parked in a secure (fenced) area of the facility for ultimate shipment offsite (Figure 2-2). Transport of yellowcake slurry would be carried out in compliance with NRC

and U.S. Department of Transportation regulations to an intermediate processing (drying) facility (Figure 2-1) licensed by the NRC or an Agreement State (NRC, 2011c). The proposed action would add a fourth process circuit (a dryer circuit), which would provide LCI with the option of producing dried yellowcake at the Lost Creek facility. The license amendment also includes a request to increase the production of dry yellowcake from 455,000 kg [1 million lb] to up to 909,000 kg [2 million lb]. The increased production at the Lost Creek facility would be caused by accepting loaded resin from other uranium recovery facilities and potential future satellite facilities. This would have no impact upon the flow rate from the existing Lost Creek well fields. As a result of these license amendments, the facility could ship dried yellowcake directly to uranium conversion facilities (LCI, 2012a), thus eliminating the step of transporting yellowcake slurry from the Lost Creek site to an intermediate processing facility before being shipped to a conversion facility (NRC, 2011c).

4 Environmental Impacts of the Proposed Action

This section addresses how environmental resources could be affected by the proposed action. A standard of significance has been established by NRC for assessing environmental impacts (NRC, 2003a). With the standards of the Council on Environmental Quality's NEPA regulations in 40 CFR Parts 1500 to 1508 as a basis, where appropriate, each impact is assigned one of the following three significance levels:

- SMALL: The environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.

- MODERATE: The environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.

- LARGE: The environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

4.1 Resource Areas Not Affected By the Proposed Action

As indicated in LCI's original license application (LCI, 2008a), the Lost Creek ISR Facility's CPP would be constructed to include an area specially designed for yellowcake drying equipment (see Figure 2-1), even though the original application did not including the drying equipment. Thus, the facility footprint would not be changed by the addition of the dryers and there would be no additional land disturbance.

The following resource areas are not expected to be affected by the increased production and the installation of the dryers as no new land disturbance (surface and subsurface) would take place. The dryer installation will take place internal to the CPP, in a space that was specifically designed for vacuum dryers. As a result, there would be no change in the following:

- Land Use – no additional land would be impacted and there would be no additional changes to land use.

- Geology and Soils – no additional surface or subsurface materials would need to be excavated.

- Water Resources – the wellfields would not change as a result of adding the vacuum dryers, nor would there be any additional surface water impacts from stream crossings.
- Ecological Resources– no additional vegetation would need to be removed from the site, nor would there be any additional wildlife disturbances.

- Visual and Scenic Resources – no additional impact to the visual landscape would result from the addition of the vacuum dryers inside an existing building.
- Noise – all additional noise from the vacuum dryers would be internal to the CPP, and trucks transporting dry yellowcake would not pass through any small settlements, in contrast to the slurry tanker trucks.

- Historic and Cultural Resources – there would be no additional effect on historic or cultural resources, as the dryers would be installed in an existing building, and no additional land would be disturbed.

- Socioeconomics – the few additional workers required to install, and later operate, the vacuum dryers, would have little or no additional impact upon the socioeconomics of the region.

- Environmental Justice – there would be no additional effect on environmental justice, as there would be no physical change to the CPP, and trucks hauling the dried yellowcake would not be passing through any specific areas of minority or low income populations.

In addition, the NRC addressed the impacts on aquifer restoration and decommissioning associated with the dryer system in the SEIS and determined that they were SMALL (NRC, 2011c).

4.2 Resource Areas Potentially Affected by the Proposed Action

As described in the sections below, the following five resource areas would be expected to be potentially affected by the installation or operation of the yellowcake dryer system at the Lost Creek facility:

- Transportation
- Groundwater
- Air Quality
- Public and Occupational Health
- Waste Management

4.2.1 Transportation Impacts

The proposed action to include yellowcake rotary vacuum drying in the CPP at the Lost Creek ISR Facility, and subsequent offsite shipment of dried yellowcake up to 909,000 kg [2 million lb] per year would have transportation impacts of only SMALL significance.
Since there would be only a slight increase in the number of vehicles entering the site for a short period when the dryers would be installed, the overall impact on transportation during construction would be SMALL. The most evident changes in transportation, and associated noteworthy potential impacts, would occur as a result of operation of the dryers.

During the operation of the facility without dryers, trucks carrying yellowcake slurry would exit the Lost Creek site using the east access road, then travel north and east to the intermediate processing (drying) facility at Christensen Ranch in Sussex, Johnson County, Wyoming (Figure 4-1) (NRC, 2011c). The proposed route for transportation of dried yellowcake from the Lost Creek site differs from this route. Trucks hauling dry yellowcake would exit the site to the west, then travel south and east to the uranium conversion facility in Metropolis in southern Illinois (Figure 4-2) (NRC, 2012a). The new route would not take the trucks through any small towns, such as Bairoil, Alcove, Midwest, or Edgerton in Wyoming. Thus, the proposed action would result in the elimination of nuisance impacts, such as truck noise, dust, odor and roadway degradation, along this route. Exiting the site to the west takes trucks to the Crooks Gap-Wamsutter Road. Heading south to Interstate 80 (I-80) at Wamsutter, there are no settlements the trucks would encounter; and the remainder of the trip to Metropolis, IL, would be on interstate highways (Figure 4-2) (NRC, 2012d).

Sweetwater County recently completed the placing of recycled asphalt pavement (from I-80) on approximately 15 miles of the Crooks Gap-Wamsutter Road (Sweetwater County, 2012). The recycled asphalt now reaches from I-80 in Wamsutter to the intersection of Lumen Road (County Road 4-23). This intersection is 20 miles south of where the western site access road intersects with the Crooks Gap-Wamsutter Road. According to the Sweetwater County Public Works Director, "…the condition of the road after placing the recycled pavement is a road that is between a gravel and plant mix pavement" (Sweetwater County, 2012). The amount of dust generated by vehicle traffic on the Crooks Gap-Wamsutter Road would be greatly reduced as a result of the placement of the recycled asphalt. In addition, with the (dry) yellowcake trucks traveling this route, the amount of gravel road encountered would be less than on the (slurry) yellowcake truck route.

Other notable transportation changes resulting from the Lost Creek facility producing dry yellowcake rather than yellowcake slurry would be the type and number of large trucks carrying uranium yellowcake to and from the site, and the resin trucks from other uranium recovery facilities and potential future satellite facilities.. The trucks that would carry the yellowcake slurry are tankers, and have a capacity of about 16,662 liters (L) [4,300 gallons (gal)] (16,364 kg [36,000 lb]), while the trucks carrying dry yellowcake would be trailers, having a capacity of 42 drums (each drum weighing about 364 kg [800 lb]) (LCI, 2012d). For the facility producing 909,000 kg [2 million lb] of dry yellowcake per year, approximately 50 to 60 trucks per year (or two trucks every 15 days) would leave the facility carrying dry yellowcake. This is in comparison to 70 to 90 trucks per year (or two trucks every 10 days) leaving the facility carrying yellowcake slurry of 70 percent solids.

As a result, there would be slightly less large truck traffic leaving and re-entering the facility on an annual basis. The main impact would be that the route used by the large trucks carrying dry yellowcake would not affect small settlements. The resin trucks, however, would likely use a portion (approx. 130 km [80 mi]) of the route used by the slurry tankers, accessing the Lost creek site from the east. The licensee estimated the number of resin trucks entering the Lost Creek facility to be about 154 per year. Each truck would have a capacity of approximately 30 cubic meters (cu m) [1,000 cubic feet (cu ft)] of resin (at a density of 10.4 kg per 0.028 cu m [6.5 lb per cu ft]). However, overall, the impacts from truck traffic resulting from the proposed action would be SMALL.

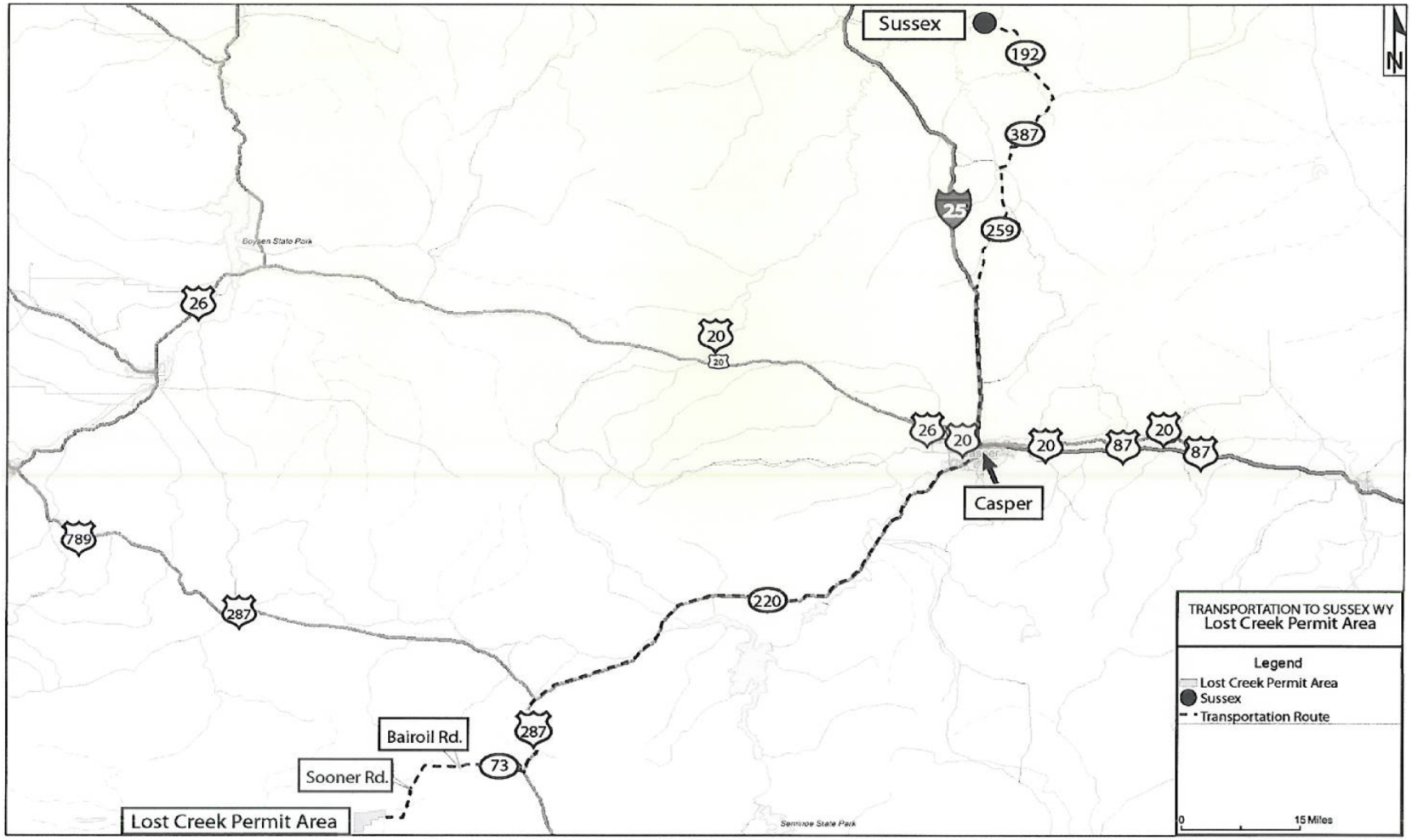

Figure 4-1
Transportation Route for Yellowcake Slurry
Source: NRC 2011

Figure 4-2
Transportation Route for Dry Yellowcake
Lost Creek Site to Metropolis, IL
Source: NRC 2012

Additionally, with fewer trucks carrying dry yellowcake than yellowcake slurry, there would also be the potential for fewer transportation accidents for the proposed action. If a truck carrying the yellowcake product is involved in an accident, and a spill occurs, the potential for impact on the environment would differ depending upon the nature of the product (slurry vs. dry yellowcake). For a tanker carrying the wet yellowcake slurry, the resources that could be affected by a spill are principally soils, surface water (if present), groundwater (if the spill is large enough to percolate throughout the vadose layer), and vegetation and wildlife (NRC, 2011c). For a trailer carrying dry yellowcake, a spill has the potential for dry yellowcake powder to become airborne. In this case, the principal resources potentially impacted would be air quality and public health. If the spill is large enough, there may also be deposition of dry yellowcake dust on nearby vegetation that may be ingested by wildlife. Analyses of operational transportation risks are addressed in detail in Section 4.2.2.2 of the GEIS, "Operation Impacts to Transportation" and found to be small (NRC, 2009). These analyses are bounding for the proposed action, including the resin trucks from the future satellite facility. Therefore, the operational transportation impacts of the proposed action are expected to be SMALL.

4.2.2 Groundwater Impacts

The proposed action to include yellowcake rotary vacuum drying in the CPP at the Lost Creek ISR Facility, and subsequent offsite shipment of dried yellowcake up to 909,000 kg [2 million lb] per year would have groundwater impacts of only SMALL significance.

The addition of the yellowcake vacuum dryers is not expected to significantly affect groundwater use or quality. Additional groundwater would be consumed mainly for two operations: (1) drum wash down; and (2) condensate tank makeup water. However, both of these operations would filter and reuse the water, with only a small amount needed for makeup. The water that can no longer be reused would be directed to the surface holding ponds on-site, and eventually be injected into the Class I deep disposal wells. Therefore, the impacts to groundwater from the operation of the yellowcake vacuum dryers would be SMALL.

The cumulative impacts to groundwater from the operation of the yellowcake vacuum dryers combined with the existing facility processing are also SMALL. The additional groundwater usage, and the additional waste water disposal (discussed below) would have little effect on the groundwater at the Lost Creek site.

4.2.3 Air Quality Impacts

The proposed action to include yellowcake rotary vacuum drying in the CPP at the Lost Creek ISR Facility, and subsequent offsite shipment of dried yellowcake up to 909,000 kg (2 million lb) per year would have air quality impacts of only SMALL significance.

The emissions from the yellowcake vacuum dryers, primarily particulates, are not expected to significantly affect air quality in the vicinity of the site because: (1) the dryers would be installed inside an existing building with their space having already been prepared (NRC, 2011c); and (2) vacuum dryers, inherently, having little potential for emissions (NRC, 2003b), as they have an inward leakage rate (negative pressure), generally less than 635 millimeters of mercury (mm Hg) [25 inches (in) Hg] (USEPA, 1994). Normal atmospheric pressure is 760 mm Hg [29.92 in Hg], measured at sea level. However, because the Lost Creek site is located at 2,133 meters

[7,000 feet] above sea level, the normal atmospheric pressure is 589 mm Hg [23.2 in Hg]. As a result, LCI plans to maintain the vacuum at 432 mm Hg [17.0 in Hg] (LCI, 2012e). Therefore, with a negative pressure of 152 mm Hg [6 in Hg], there would be little to no yellowcake powder escaping the dryers.

The only additional emission sources associated with the operation of the vacuum dryers are the propane heaters that would be used to heat the oil encased around the dryer drums, and a cooling tower to dissipate heat from the dryers (LCI, 2012f). Combustion emissions from vacuum dryer propane heaters are shown in Table 4-1. The propane heaters, while burning a relatively clean fuel, would still emit gaseous pollutants, such as nitrogen oxides (NO_x), carbon monoxide (CO), and organic compounds. In addition, depending upon the amount of sulfur in the propane, some sulfur dioxide (SO_2) would also be emitted. The impact of these propane heaters on the air quality of the region would be SMALL.

In addition to CO, greenhouse gases, such as carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O), are also produced during the combustion of propane (USEPA, 2008). Nearly all of the fuel carbon, however, (99.5 percent) is converted to CO_2 during the combustion process. The propane heaters proposed to be used by LCI would consume approximately 310 L [80 gal] of propane per hour (LCI, 2012f). Using the emission factors in Table 4-1, the carbon dioxide-equivalent (CO_2e) emission rate of 5,682 kg [12,500 lb] per 3,875 L [1,000 gal] of propane results in 1,754 metric tons (t) [1,930 tons (T)] per year of CO_2e emissions (based upon the facility producing 455,000 kg [1 million lb] of yellowcake per year, the dryers would be operating 12 hour per day, 6 days per week). LCI has estimated that each batch of yellowcake takes approximately 12 hours to dry (LCI, 2012g). In comparison, the gross CO_2e emissions for the entire State of Wyoming were 56 t [62 T] in 2005 (CCS, 2007). To put this into perspective, the proposed Lost Creek dryer heaters would emit less than 0.003 percent of the State of Wyoming CO_2e output. As a result, the impact on the air quality of the region would be SMALL.

Finally, the cooling tower system is designed to expel heat from the vacuum dryers. But, before it does that, the air must pass through the bag house (air filter) and condenser. The system is designed to exchange approximately 5×10^8 gram-calories [2 million Btu] per hour. Because the air is filtered, the cooling tower system would have air quality impacts of only SMALL significance.

4.2.4 Public and Occupational Health Impacts

The proposed action to include yellowcake rotary vacuum drying in the CPP at the Lost Creek ISR Facility, and subsequent offsite shipment of dried yellowcake up to 909,000 kg [2 million lb] per year would have public and occupational health impacts of only SMALL significance.

TABLE 4-1

VACUUM DRYER PROPANE COMBUSTION EMISSIONS AND EMISSION FACTORS

Emission	Propane Emission Factor[1] (kg/3875 L [lb/1,000 gal])	Emissions kg/day [lb/day]
PM Filterable	0.09 [0.2]	0.09 [0.2]
PM Condensable	0.23 [0.5]	0.23 [0.49]
PM Total	0.32 [0.7]	0.31 [0.69]
SO2	0.05 [0.1]	0.05 [0.99]
NOx	5.9 [13]	5.8 [12.9]
N2O	0.41 [0.9]	0.40 [0.89]
CO2	3.4 [7.5]	3.3 [7.4]
TOC	0.45 [1.0]	0.44 [0.99]
CH4	0.09 [0.2]	0.09 [0.2]
CO2e	5,682 [12,500]	5,625 [12,369]

Source: EPA 2009
1 Based on 989.6 gallons of propane used in a 12-hr day

The addition of the yellowcake vacuum dryers is not expected to affect the public outside the physical confines of the plant. The area inside the CPP where the yellowcake dryers are to be installed has its own ventilation system and operates under a negative pressure, which would prevent yellowcake particulate from escaping to the outside (LCI, 2012h). In addition, the dryers also operate under a negative pressure (as described in the previous section). Thus, the public health impacts of the operation of the dryers would be SMALL.

When workers transfer the fully dried yellowcake from the vacuum dryers to 213-L [55-gal] steel drums, they would become subject to exposure to uranium dust and radioactivity (LCI, 2012e). However, the following safety features would be installed to protect the workers: (1) the drums would be loaded using a "sealing/metering" valve; (2) the filled drums would be placed beneath a dryer discharge hood, where an airlock system seals the hood against the drum; (3) drums would be removed from the hood by closing the metering valve and lowering the drum from the hood; (4) drums would be allowed to further cool for about 4 hours before sealing; and (5) sealed drums would be carefully washed and inspected before being moved to the drum storage area outside the dryer room (LCI, 2012a). In addition, there would also be the potential for exposure to workers when bag house filters are exchanged, every 1 or 2 years (NRC, 2012a). This filter exchange would be performed in compliance with 10 CFR Part 20.1703 "Use of Individual Respiratory Protection Equipment." Therefore, because of these precautions, the impact to the occupational health of workers would be SMALL.

Analyses of potential accidents involving yellowcake dryers (fire and explosion) are addressed in NUREG/CR-6733, "A Baseline Risk-Informed, Performance-Based Approach for In Situ Leach Uranium Extraction Licensees" and found to be SMALL (NRC, 2001). These analyses are bounding for the proposed action. Therefore, the impacts to public and occupational health of accidents are expected to be SMALL.

4.2.5 Waste Management Impacts

The proposed action to include yellowcake rotary vacuum drying in the CPP at the Lost Creek ISR Facility, and subsequent offsite shipment of dried yellowcake up to 909,000 kg [2 million lb] per year would have waste management impacts of only SMALL significance.

The drying process (circuit) would generate radiological and non-radiological solid and liquid wastes that must be handled and disposed of properly. Solid wastes generated by the drying process would come mostly from the bag house operation, and would consist of the bag filters. It is anticipated that the bag filters would be changed once every one to two years. The bag filters are considered low-level radioactive waste, and would be treated as Atomic Energy Act Section 11e.(2) byproduct material, and disposed of in a licensed facility in accordance with 10 CFR 40.28. Other solid wastes generated by the drying process would include a minor amount of paint chip-sized particles from the (spray) wash down of the filled yellowcake drums. This small amount would be treated as non-radiological waste, and disposed of with other municipal solid wastes (LCI, 2012f). Since this constitutes a minimal addition of solid waste, waste management impacts of the proposed action associated with radiological and non-radiological solid waste management and disposal are expected to be SMALL.

Liquid effluents generated by the drying process come principally from two sources: (1) the condensate tank; and (2) the sealed drum wash down process. The condensate tank would

require about 969 to 1,938 L [250 to 500 gal] of water for each batch of yellowcake dried. A majority of the water would be re-used, until the concentration of solids in the water increases to a point where the recycled water needs to be disposed (LCI, 2012f). This liquid (non-recyclable) effluent would be directed to the deep Class I injection wells, where the lixiviant "bleed" is disposed (WDEQ, 2010). The sealed drum wash down water would be collected, filtered, and also re-used. The wash down water would consist mostly of non-radiological materials, but could contain some yellowcake. Approximately 19 to 39 L [5 to 10 gal] of water would be used to wash down each sealed drum. Each dryer load (batch) would produce four to seven filled drums, depending upon the moisture content of the slurry. This would occur once every 12 hours. Five batches are projected to be completed each week. As a result, about 20 to 35 drums would be washed down each week. The non-recyclable (high solids concentration) effluent would be directed to the surface storage ponds onsite (LCI, 2012f). Since this constitutes a minimal addition of liquid waste, waste management impacts of the proposed action associated with radiological and non-radiological liquid waste management and disposal are expected to be SMALL.

5 Environmental Impacts of the Alternatives to the Proposed Action

5.1 No-Action

Under the no-action alternative, the Lost Creek ISR Facility would operate without a yellowcake drying system, but would still produce yellowcake slurry as allowed by the NRC license. All structures, components, and operations of the facility would remain unchanged, as presently licensed. The overall site would be unchanged, including land uses, traffic into and out of the site, and energy development. The potential environmental impacts associated with the installation of the rotary vacuum (yellowcake) dryers to transportation, groundwater, air quality, public and occupational health, and waste management would be avoided.

5.2 Other Alternatives Considered

In addition to the rotary vacuum dryer, three other types of dryers were considered by LCI: (1) multi-hearth dryer; (2) filter dryer; and (3) pharmaceutical dryers (LCI, 2012h). For reasons discussed below, these alternatives were eliminated from further consideration in this EA.

5.2.1 Multi-Hearth Dryer

The multi-hearth dryer is an extremely efficient dryer. However, it was not considered a good match for the ISR process for the following reasons: (1) the Lost Creek ISR Facility uses a batch process to recover uranium, and this dryer would not work well as part of a batch process; (2) this dryer would require a Venturi scrubber for exhaust to prevent airborne particulates from being released to the atmosphere, which would require additional waste water disposal; and (3) this dryer would yield a much less soluble product that is more difficult to expel from the body if there is an uptake (UDEQ, 2010).

5.2.2 Filter Dryer

The filter dryer eliminates two-stage drying. However, although it has the ability to wash, press, and dry in a single unit, it is maintenance intensive. Most of the maintenance work would have to be performed inside the unit, and this would present workers with additional occupational health hazards.

5.2.3 Pharmaceutical Dryer

The pharmaceutical dryer was considered because it can handle fine powders. However, it was ruled out because of its small capacity (i.e., its use would not be feasible).

6 Agencies and Persons Consulted

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7 Conclusion

The proposed action to include yellowcake rotary vacuum drying in the CPP at the Lost Creek ISR Facility, and subsequent offsite shipment of dried yellowcake up to 909,000 kg [2 million lb] per year is not expected to result in significant additional impacts to the environment for the following reasons: 1) the licensee would increase production at the Lost Creek facility in the future by utilizing loaded resins from other uranium recovery facilities, including potential future satellite facilities (this would not increase [impact] the flow rate from the existing Lost Creek well fields); and 2) the dryers would be installed in a pre-existing space inside the CPP, there would be no physical changes to the footprint or structure of the building. As a result, there would be no additional impacts to the following resources: land use; geology and soils; water resources; ecological resources; visual and scenic resources; noise; historic and cultural resources; socioeconomics; and environmental justice. The resources that could be potentially affected are transportation, groundwater, air quality, public and occupational health, and waste management.

Based on the information presented in this EA describing the proposed action, the need for the proposed action, the alternatives to the proposed action, the environmental impacts of the proposed action and alternatives, and the agencies consulted, the NRC has determined that the proposed action will not have a significant impact on the quality of the human environment and does not warrant the preparation of an Environmental Impact Statement. Accordingly, the NRC has determined that a finding of no significant impact is appropriate.

This finding and any related environmental documents are available for public inspection through the NRC's Agencywide Document Access and Management System (ADAMS) that may be accessed from the NRC's Electronic Reading Room at http://www.nrc.gov/reading-rm/adams.html.

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Appendix A – Description of the Drying Circuit Operation

The following description, which has been reviewed by NRC staff, is taken from the January 6, 2012 license amendment application from Lost Creek ISR, LLC (LCI, 2012):

> The basic operation of the dryer circuit would be as follows:
> - Yellow cake slurry, consisting of between 40 and 70 percent solids, would enter the dryer through a feed line. The slurry would come from either a filter press or a yellowcake slurry vessel, and would not exceed 95 percent of the dryer capacity. The slurry line would be flushed after loading to prevent slurry from setting up (hardening) in the line.
>
> - The vacuum, which is maintained during drying, would be pulled through a filter that sits on top of the dryer. Any airborne uranium would be captured in the filter elements (the elements consist of bags, cartridges, or the equivalent). The differential pressure across the filter would be monitored. As the differential pressure increases, indicating that the filter elements are being clogged with the airborne uranium, the operator would clean, or replace, the elements.
>
> - During the drying cycle, the vacuum pressure, steam temperature, oil temperature and the level of the condensate tank would be monitored and plotted against drying time to assist in tracking drying progress.

- Once a vacuum level of 10 inches (in) Hg has been reached, the oil heater would begin sending the hot (thermal) oil to the dryer. The heat is applied to the dryer through a hot oil recirculation system. The hot oil is pumped through the jacket (outside) of the dryer and back to the oil heater. An optional heating system, which could also be installed, includes pumping the hot oil through the rotating shaft and arms.

- The start of the oil heating system would also trigger the start of the cooling water system. The cooling water system is in place to condense the steam that comes out of the dryer into water before it goes into the condensate tank.

- Once the drying cycle is complete, the yellowcake would be allowed to cool before being loaded into DOT approved steel drums. The dryness of the product would be determined from monitoring drying time, temperature, and changes in vacuum.

- The dryer operator would load the yellowcake into 55-gallon drums through the use of a sealing valve/metering valve system on the bottom of the dryer. Each drum would be placed underneath a hood and the air lock system will "seal" the dryer discharge hood against the drum. The sealing valve would then opened to allow product to leave the dryer and drop into the drum through the use of a metering valve. Each dryer load is expected to fill between 4 and 7 drums, depending on the solid content of the slurry.

- Full drums would be removed by closing the metering valve and lowering the drum from the hood. Point source ventilation would be used to control any dust when the 'seal' between the drum and the hood is broken.

- Full drums would then be allowed to cool for a minimum of 4 additional hours before being sealed. The drums would be in good condition with no penetrations or significant dents with sharp angles. The drum lids would have gaskets in good condition.

- Sealed drums would be carefully washed and inspected before being moved to the drum storage area outside the dryer room.

Reference

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