POLICY ISSUE
(Notation Vote)

March 12, 1999 SECY-99-013

FOR: The Commissioners

FROM: William D. Travers
Executive Director for Operations

SUBJECT: RECOMMENDATIONS ON WAYS TO IMPROVE THE EFFICIENCY OF NRC REGULATION AT *IN SITU* LEACH URANIUM RECOVERY FACILITIES

PURPOSE:

To obtain Commission approval of the staff's recommendations to withdraw from the active regulation of ground water and solar evaporation ponds at *in situ* leach (ISL) uranium recovery facilities, and to seek Commission direction on the approach to be taken in staff guidance documents regarding how to classify waste discharge from ISL facilities.

SUMMARY:

The U.S. Nuclear Regulatory Commission (NRC) has historically regulated operations at ISL facilities under the authority of the Atomic Energy Act of 1954, as amended (AEA). The uranium recovery industry, however, believes that NRC's regulation of ground water at these facilities is duplicative of the ground-water protection programs administered by the U.S. Environmental Protection Agency (EPA) or EPA authorized States under the Safe Drinking Water Act (SDWA). The industry also has raised concerns about staff guidance documents that it believes preclude the disposal of certain types of wastes generated at ISL facilities at uranium mill tailings impoundments. In this paper, the staff discusses the industry's concerns and provides recommendations to the Commission on ways to address the issues raised.

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BACKGROUND:

The techniques of ISL uranium recovery were developed in the 1970s as the demand for uranium declined, resulting in a need for more cost-efficient extraction techniques so uranium mining companies could remain profitable in a less certain market. Currently, ISL extraction is the predominant method of uranium recovery in the United States. ISL techniques involve the use of wells to circulate local ground water, fortified with oxygen and carbon dioxide, to leach uranium at depth from the host rock. The liberated uranium is recovered in a central processing facility. Details of the ISL process are provided in Attachment 1.

The staff has been engaged in discussions over the past several years with the uranium recovery industry regarding ways to eliminate what the industry perceives as dual regulation of ground water at ISL facilities. The National Mining Association (NMA), which represents a number of companies involved in uranium recovery, submitted the report, "Recommendations for a Coordinated Approach to Regulating the Uranium Recovery Industry" (hereafter White Paper), to the Commission in April 1998, expressing its concerns on several issues. Two issues raised by NMA, and addressed in the White Paper, are: (a) NRC's jurisdiction over ground-water protection at ISL facilities and (b) concerns over staff guidance on the discharge of liquid effluents from ISL facilities, both of which are addressed in this paper. The following paragraphs discuss the industry's positions in more detail, and provide staff's recommendations to the Commission on ways to address these concerns.

DISCUSSION:

Dual Regulation of Ground Water

Over the past several years, the industry has argued that NRC's regulation of ground water is duplicative of the ground-water protection programs required by the SDWA and administered by the EPA or EPA-authorized States. EPA and the States protect ground-water quality through the Underground Injection Control (UIC) program, under the SDWA. As presented in NMA's White Paper, the industry believes that NRC's review and licensing activities are another form of regulation covering the same issues.

Historically, NRC has imposed conditions on ISL operations to ensure that ground-water quality is maintained during licensed activities and that actions are taken to ensure the restoration of ground-water quality before the license is terminated. The specific conditions imposed in an ISL license have typically been the result of NRC's independent review, as documented in safety evaluation reports and appropriate environmental assessment reports. In February 1998, staff institutionalized its review process for ISLs, including a detailed evaluation of ground-water activities, in a draft Standard Review Plan for ISL facility license applications (SRP) that was published for public comment. Following the comment period, staff held a public workshop on the SRP to discuss the issues raised. At present, the SRP has been finalized but has not yet been published. As noted below, the staff intends, subject to Commission agreement, to publish the SRP and use it in licensing reviews until the rulemaking for new 10 CFR Part 41 (SECY 99-011) has been completed.

In addition to NRC's review, licensees must also obtain a UIC permit from the EPA or the EPA-authorized State before uranium recovery operations can begin. EPA or the authorized State conducts many of the same types of reviews as NRC. This is evidenced by NRC routinely incorporating ground-water protection limits from a State's permitting program into specific license requirements, and staff routinely accepting specific methodologies and guidance developed by EPA for ground-water monitoring programs and well construction.

The industry's preferred approach for addressing dual regulation in the wellfield is for NRC to determine that it does not have jurisdiction in the wellfield. NRC's position on its authority and jurisdiction over ISL operations is that NRC does have jurisdiction over ground water in the wellfield. However, to address the industry's dual regulation concerns, staff requested that the Office of the General Counsel (OGC) determine whether NRC could rely on the actual (or expected) existence of a permit, issued by EPA or an EPA-authorized State under the UIC program, as a basis for NRC to withdraw from active regulation of the ground water at ISL facilities currently under its jurisdiction. OGC concluded that the Commission could exercise its discretion and rely on the UIC permit for the protection of ground water. NRC would still retain jurisdiction over the wellfield and ground water, under the Agency's AEA authority; but would simply defer active regulation to EPA or the EPA-authorized State, not unlike the way transportation issues are addressed with the Department of Transportation.

OGC recommended that the Commission adopt a rulemaking to codify the approach above, and consider the development of a Memorandum of Understanding (MOU) with EPA or the EPA-authorized States. Further, OGC has advised the staff that completing a rulemaking before changing the Agency's practice would provide the technical and legal rationale for the Agency's change in its previous practice and guidance.

Staff implementation of these actions would be pursued as part of a rulemaking for a new Part 41, as presented in SECY 99-011. Staff considers that public health and safety and the environment will be adequately protected by relying on the EPA UIC program as the sole active regulatory authority for ground-water issues at ISL facilities. As noted earlier, this is based on the fact that many aspects of the staff's review rely on EPA standards, methodologies, and guidance. The staff will look to the Commission for direction on the timing of the rulemaking, as well as on whether to pursue an MOU with EPA or the EPA-authorized States. Consideration should be given to the fact that if NRC chooses to pursue an MOU with EPA, the cost of such an MOU would be passed on to licensees through increased 10 CFR Part 171 fees.

It should be noted that the staff did receive some comments on this subject during its August 1998 public meetings which were held to gather information to support the staff's evaluation of the uranium recovery program and the need to develop a new Part 41. The Southwest Research Information Center (SRIC), an environmental organization currently intervening in the Hydro Resources, Inc., Crownpoint application, recommended that NRC not eliminate its review of ground-water protection at ISL facilities, because, in SRIC's view, NRC regulation was complementary, and not duplicative, of the UIC program. The State of Wyoming expressed its opinion that NRC's efforts on ISL ground-water issues were not needed. Industry representatives advocated that NRC adopt the position in the NMA White Paper.

In adopting this approach to regulating ground water at ISLs, staff estimates that a savings of 1.5 full time equivalents (FTE) per year could be realized. These savings would come from a reduction in licensing reviews and inspection support in the ISL ground-water area. These savings would not be realized, however, until NRC completed the Part 41 Rulemaking which, if pursued, could not be completed before early Calender Year 2001.

Disposal of Solar Evaporation Pond Sludges

Before 1995, the staff practice for addressing the disposal of evaporation ponds sludges relied upon a broad reading of the definition of 11e.(2) byproduct material. This broad reading only addressed discrete surface wastes capable of controlled disposal and did not distinguish between wastes generated at various phases of an ISL operation.

The staff issued two guidance documents in 1995 to address issues in the uranium recovery program. The first, "Staff Technical Position on Effluent Disposal at Licensed Uranium Recovery Facilities" (hereinafter, the effluent guidance), was intended to provide uranium recovery licensees with flexibility regarding the disposal of various types of liquid effluents generated during the operation of their facilities. In issuing this guidance, the staff took a more narrow view of the definition of 11e.(2) byproduct material. It differentiated between the various waste waters generated during ISL operations on the basis of their origin and whether uranium was extracted for its source material content during that phase of the operation. Waste waters and the associated solids produced during the uranium extraction phase of site operations, called "production bleed" (see Figure 7 in Attachment 1) were classified as AEA section 11e.(2) byproduct material and therefore subject to regulation by NRC. Conversely, waste waters and the resulting solids produced after uranium extraction (i.e., during ground-water restoration activities) are classified as "mine waste waters" (see Figure 8 in Attachment 1), and therefore are subject to regulation by individual States under their applicable mining programs. These wastes are considered naturally occurring radioactive material (NORM). However, because licensees often dispose of waste waters from uranium extraction and post-extraction activities in the same evaporation ponds, the resulting solids are a commingled waste consisting of 11e.(2) byproduct material and sludges derived from mine waste water.

In the second guidance document, "Final Revised Guidance on Disposal of Non-Atomic Energy Act of 1954, Section 11e.(2) Byproduct Material in Tailings Impoundments" (hereinafter, the disposal guidance), the staff identified 10 criteria that licensees should meet before NRC could authorize the disposal of AEA material other than 11e.(2) byproduct material in tailings impoundments. One of these criteria prohibits the disposal of radioactive material not covered by the AEA, including NORM. This criterion was intended to avoid the possibility of dual regulation of the radioactive constituents in the impoundments, since individual States are responsible for radioactive materials not covered by the AEA. These two guidance documents were subsumed in the draft SRP and would remain incorporated in the yet-to-be published final SRP.

The industry is concerned that, taken together, these two guidance documents leave no option for the disposal of radioactively contaminated sludges from ISL evaporation ponds. The reason for this concern is that the 11e.(2) byproduct material is commingled with a NORM waste, and is prohibited from disposal in a tailings impoundment by the disposal guidance. The industry contends that the staff's waste classification, based on the origin of the waste water (i.e., from the extraction or restoration phase) at an ISL facility, makes the disposal of such sludges in a mill tailings impoundment, as required under Criterion 2 of 10 CFR Part 40, Appendix A, impossible; even though the sludges derived from waste waters produced throughout a facility's life cycle are physically, chemically, and radiologically identical.

Options

The staff identified four options for addressing the industry's concerns related to the disposal of evaporation pond sludges generated at ISL facilities. Each option impacts the extent of NRC regulation of ISL facilities, but will still provide for the adequate protection of public health and safety and the environment.

1. Maintain Current Distinction Between Waste Waters. Under this option, the staff would retain its current narrow view of the classification of 11e.(2) byproduct material. This approach distinguishes between waste waters produced during uranium extraction and those generated after extraction during ground-water restoration, as described in the effluent guidance. Evaporation pond sludges associated with uranium extraction waste waters would continue to be classified as 11e.(2) byproduct material. Those associated with waste waters resulting from post-extraction activities would continue to be classified as a mine waste and subject to State regulation. Public health and safety and the environment will continue to be protected under this option, because the handling and disposal of the sludges would be evaluated and approved by regulatory agencies with health, safety and environmental responsibilities, either the NRC or a relevant State agency.

   The principal advantage of this option is that characterization of post-extraction liquid effluents in this manner is more consistent with how EPA views such waste under 40 CFR Part 440, which addresses, in part, effluent discharges from uranium mining operations.

   This option has several disadvantages. First, to avoid sending non-AEA material to tailings impoundments licensed to receive 11e.(2) byproduct material for disposal, licensees must physically separate contaminated wastes before disposal at uranium mill tailings sites. Alternatively, licensees can construct separate evaporation ponds to avoid commingling extraction and post-extraction waste waters. Licensees are also required to determine accurately (and support with acceptable documentation) the origins and percentages of waste waters disposed of in evaporation ponds. Such determinations will be essential in determining the extent of NRC's jurisdiction over the pond sludges.

   In addition, radioactively contaminated material not regulated by NRC would likely be disposed onsite at ISL facilities, thus creating numerous small waste disposal sites in the western United States. Although these wastes will pose long-term hazards comparable to 11e.(2) byproduct material waste, the disposal sites would not be subject to the long-term care provisions of the Uranium Mill Tailings Radiation Control Act of 1978, as amended (UMTRCA). The States would review and approve the disposal of this material under their existing mining regulations. NRC still would be required to consider the environmental impacts of onsite disposal under the National Environmental Policy Act of 1969 (NEPA), as amended, when licensing new ISL operations and reviewing closure of existing ISL facilities. Under this option, there would be no change in staff resources.

Finally, commingled evaporation sludges may have already been disposed at uranium mill tailings impoundments. Consequently, the disposal of these sludges would have to be "grandfathered" as acceptable to avoid NRC/State dual regulation of the radioactive constituents in the tailings impoundments, which is discouraged in the disposal guidance.

2. Classify All Liquid Effluents as 11e.(2) Byproduct Material. Under this option, the NRC would take the broad view that any waste water generated during or after the uranium extraction phase of site operations, and all evaporation pond sludges derived from such waste waters, would be classified as 11e.(2) byproduct material. The staff would make no legal distinction among the waste waters produced at different stages in a facility's life cycle. Public health and safety and the environment will continue to be protected under this option, because the handling and disposal of the sludges would be evaluated and approved by a regulatory agency with health, safety and environmental responsibilities, the NRC.

   The principal advantage of this option is that NRC's regulatory authority over various aspects and phases of the ISL extraction and post-extraction (i.e., ground-water restoration) operations would be unambiguous. All radioactively contaminated materials generated at ISL facilities would be 11e.(2) byproduct material and, therefore, under NRC jurisdiction. In addition, all radioactively contaminated materials would be transported for offsite disposal, as required by Criterion 2 of Part 40, Appendix A. This would include evaporation pond sludges, wellfield piping, and central facility storage and processing tanks. Therefore, previous NRC conclusions made in environmental assessments and impact statements concerning the offsite disposal of radioactive materials would remain unchanged.

   Staffing resources in uranium recovery would increase slightly with Option 2 [less than 0.5 FTE per year] to accommodate (1) the need to review the designs for evaporation ponds currently used solely to impound post-production waste waters against Criterion 5A of Part 40, Appendix A, and (2) the possible inclusion of such ponds under NRC's Dam Safety Program (DSP). Additional increases in staffing resources may be necessary if more ISL facilities commence operation in response to some future rise in the demand for uranium.

3. Classify Only Post-Ion Exchange Wastes as 11e.(2) Byproduct Material. Under this option, NRC would take a narrow view of the definition of 11e.(2) byproduct material. Staff would regulate only discrete surface wastes and effluents resulting from the production of yellowcake occurring after the ion-exchange (IX) portion of the uranium extraction process at the resin elution column, and at the precipitation tanks (see Figure 7 of Attachment 1). All other waste waters generated throughout the life of ISL operations would be classified as "mine waste waters." They would be outside NRC's authority, and therefore not subject to NRC regulation. The other waste waters generated to protect ground water during uranium extraction (see "Production Bleed" in Figure 7 of Attachment 1) and those

produced during ground-water restoration activities after uranium extraction would not be subject to NRC regulation (see Figure 8 of Attachment 1). Wastes generated from "mine waste waters" would be regulated by the State.

The view presented in the NMA White Paper is that the production bleed is generated primarily from a mining activity that is not subject to NRC regulation. The White Paper view is that NRC authority does not start until the mining solutions reach the elution stage of the facilities, where uranium is concentrated. Although the production bleed also aids in the concentration of uranium, it is not primarily associated with uranium extraction. Rather, its primary purpose is to ensure the flow of ground water towards the wellfield, thus helping protect the ground water outside of the mining area. Because of this, the NMA asserts that the production bleed can be reclassified as a "mine waste water." The waste waters generated from the IX portion of the uranium recovery process at the resin elution column would be classified as 11e.(2) byproduct material. This waste would have to be disposed of off-site in uranium mill tailings impoundments licensed to receive 11e.(2) byproduct material or an 11e.(2) disposal facility consistent with Criterion 2 of Part 40, Appendix A. The volume of this waste would likely be small and would not require management in an evaporation pond.

This option would be a change in how NRC has previously classified the waste waters produced during uranium extraction. As discussed in Option 1, under the current distinction between waste waters, the staff has classified all waste waters produced during uranium extraction as 11e.(2) byproduct material and those produced during ground-water restoration activities as "mine waste waters." Under Option 3, NRC would no longer classify "production bleed" as 11e.(2) byproduct material. This waste is generated as part of ensuring both the protection of ground water and as an aid in extracting uranium. Consequently, a clear distinction must be made whether the waste is produced directly from the processing of ore for its uranium content or primarily for the protection of ground water in order to determine how the waste is regulated. By taking a view that 11e.(2) byproduct material is only associated with those portions of the operation which concentrate uranium to levels of source material, NRC would relinquish authority over the portions of the operations that deal with uranium extraction, such as the wellfield. Some litigation risk may be associated with revising NRC's opinion of its authority and its past practices. OGC has advised the staff that completing a rulemaking before changing the Agency's practice would provide the technical and legal rationale for the Agency's change in its previous practice and guidance.

Public health and safety and the environment will continue to be protected under this option, because the handling and disposal of the vast majority of the sludges would be evaluated and approved by regulatory agencies with health, safety and environmental responsibilities. Essentially, these would be the relevant State agencies, under existing mine lands reclamation programs. NRC would continue to evaluate and approve the sludge disposal from waste waters generated after the IX process. The design and safety monitoring of evaporation pond structures would be performed by the State, under its existing DSP.

The principal advantage of this option is that NRC's regulatory program over various aspects and phases of the ISL mining process would be limited to radiation protection issues in the central processing plant and satellite facilities. This results in a savings of less than 0.5 FTE per year for the licensing of new ISL facilities and NRC's DSP.

Evaporation pond designs would not need to be reviewed against Criterion 5A of Part 40, Appendix A, because the ponds would not contain materials subject to NRC jurisdiction. In addition, ISL ponds would no longer be covered under NRC's DSP, since such ponds would not be regulated by NRC nor related to NRC's health and safety mission.

An additional advantage is the unambiguous regulatory landscape for radioactively contaminated evaporation pond sludges. The appropriate State agencies would be the sole regulators for these materials, which would likely be classified as Technologically Enhanced Naturally Occurring Radioactive Materials (TENORM).

However, as with Option 1, radioactively contaminated material no longer subject to NRC regulation could be disposed onsite at ISL facilities. This would create numerous small waste disposal sites in the western United States not subject to the long-term care provisions of UMTRCA, even though the waste contained in these disposal sites will pose the same long-term risks as 11e.(2) byproduct material of the same volume. However, the disposal of this material would be reviewed and approved by the States under their existing mining regulations, consistent with what is done today for that portion of ISL waste not classified as 11e.(2) byproduct material. NRC still would be required to consider the environmental impacts of onsite disposal under NEPA, when licensing new ISL operations and reviewing closure of existing ISL facilities.

Additionally, the previous disposals of commingled evaporation sludges in tailings impoundments would have to be "grandfathered" as acceptable to avoid NRC/State dual regulation of the radioactive constituents in the impoundments, as discouraged in the disposal guidance. Any future disposal of commingled sludges in tailings impoundments would also have to be precluded to avoid similar potential for dual regulation.

4. Clarify the Classification of Wastes at ISL facilities by Legislative Initiative

Because Option 3 involves changing the NRC's standing opinion of its authority and past practice, a clarification from Congress through a legislative initiative to amend the UMTRCA may be desirable. Under Option 4, staff would work with the Office of Congressional Affairs and OGC to develop a legislative package that would explicitly prescribe NRC's authority pertaining to 11e.(2) byproduct material at ISL facilities as those wastes associated with the portions of the process that result in the concentration of uranium for its source material content. The legislative initiative would also be coordinated with the Agreement States, since this change would impact the Agreement State programs.

The advantages and disadvantages for Option 4 are the same as Option 3, with the exception that litigative risk associated with NRC redefining its authority and practice would be eliminated.

Summary of Regulatory Impact of Options

The regulatory oversight of the various waste-water streams under each of the four previously described options is summarized in the following table.

Regulatory Oversight of Waste-Water Streams Under Various Options

Solids from Waste-water Streams	Option 1	Option 2	Option 3	Option 4
Production Bleed	NRC	NRC	State/EPA	State/EPA
Discrete Processing Wastes	NRC	NRC	NRC	NRC
Restoration Waste Waters	State/EPA	NRC	State/EPA	State/EPA

The staff considers that Options 1, 2, 3 and 4 are all properly protective of public health and safety and the environment. However, Option 1 would not simplify the regulation of the evaporation pond sludges, nor reduce the NRC regulatory burden on licensees. By contrast, Options 2, 3, and 4 are equally consistent with the goal of eliminating dual regulation and clarifying the regulatory landscape for evaporation pond sludges. The staff has a preference for Option 4 or Option 3 on the basis that they maintain regulatory oversight of the material through the appropriate State agencies, but reduce the regulatory burden of licensees by removing duplicative NRC oversight. Option 2 would not allow a reduction in NRC's regulatory burden on licensees, and could lead to an increase in staff resources, if the demand for uranium increases.

Attachments 2 and 3 are differing professional views [(DPVs); as allowed under Management Directive (MD) 10.159)] on this recommendation, submitted by staff members on October 20, and November 19, 1998. The DPVs express the opinions that NRC should not relinquish authority over liquid effluent releases from ISL facilities nor relinquish the regulation of sludges from processing or wellfield activities. Additionally, such a relinquishing of authority, according to the DPVs, may not comport with a plain English reading of the definitions in the AEA. Thus, the DPVs advocate adopting Option 2 as the soundest regulatory approach. A panel reviewed these DPVs in accordance with the procedures in MD 10.159. The findings from the panel were:

(1) Revise this paper to incorporate the panel's findings;

(2) Consider the arguments in the DPVs in any future rulemaking; and

(3) Reevaluate whether Option 1 in this paper should be continued.

Overall, the staff has made changes to incorporate issues from the panel report. As noted below, the staff had already planned to incorporate this issue into any future rulemaking. With respect to recommendation (3), the staff has determined that Option 4 or Option 3 is still the preferred option. In either case, the staff will continue with the current approach, Option 1, until the option selected by the Commission can be implemented. Also, subject to Commission agreement, the staff intends to publish its final SRP and use it in licensing reviews until the rulemaking for new Part 41 (SECY 99-011) has been completed. A copy of the panel's report without the attachments is provided in Attachment 4.

RESOURCES:

If the dual regulation of ground water is eliminated by relying on the existing UIC program and Option 4 or Option 3, as recommended above, is implemented, the staff would be able to reallocate a total of 2.0 FTE (1.5 FTE to eliminate dual regulation and 0.5 FTE for Option 4 or Option 3) per year from the uranium recovery program to other high-priority work in the Office of Nuclear Material Safety and Safeguards. As noted earlier, these savings would not be realized until the FY 2002 budget, which is the first following the projected completion of Part 41.

RECOMMENDATIONS:

That the Commission:

1. Approve the staff's recommendation for NRC to rely on the EPA UIC program, thus removing NRC from the review of ground-water protection issues at ISL facilities;

2. Select an option for prescribing the extent of NRC's regulatory control at ISL facilities and the regulatory position of what constitutes 11e.(2) byproduct material at ISL facilities;

3. Note that if the Commission approves a rulemaking plan for a new Part 41 (SECY 99-011), the changes in items 1and 2 above would be codified as part of that rulemaking;

4. Agree to the staff's publication of the final SRP for ISL facility license applications, which includes the current staff practices of reviewing ground-water activities at ISLs and the approach outlined in Option 1, for use in licensing reviews until the rulemaking for the new Part 41 (SECY 99-011) has been completed;

5. Provide direction on whether staff should pursue development of an MOU with EPA or the EPA authorized States to formalize the basis on which NRC would withdraw from active regulation of the ground water at ISL facilities; and

6. Provide direction for staff to initiate coordination with the Agreement States if the legislative alternative is pursued under Option 4, or if NRC's opinion of its authority is changed under Option 3.

COORDINATION:

The Office of the General Counsel has reviewed this Commission Paper and has no legal objections. The Office of the Chief Financial Officer has reviewed this paper for resource implications and has no objection.

William D. Travers
Executive Director
for Operations

Attachments: – IN BP
1. Outline of ISL Mining Process
2. DPV dated October 20, 1998
3. DPV dated November 19, 1998
4. DPV Panel Report dated December 21, 1998
5. DPV Follow up dated January 20, 1999

Commissioners' completed vote sheets/comments should be provided directly to the Office of the Secretary by COB Thursday, April 22, 1999.

Commission Staff Office comments, if any, should be submitted to the Commissioners NLT April 16, 1999, with an information copy to the Office of the Secretary. If the paper is of such a nature that it requires additional review and comment, the Commissioners and the Secretariat should be apprised of when comments may be expected.

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In-Situ Leach Uranium Mining

by

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of the

Uranium Recovery Branch
Division of Waste Management
Office of Nuclear Material Safety
and Safeguards

October 1998

Attachment 1

In-Situ Leach Uranium Mining

1.0 Background

The techniques of in-situ leach (ISL) uranium mining were developed in the 1970s as the demand for uranium declined. As uranium prices fell, it became clear that more cost-efficient mining techniques had to be developed for uranium mining companies to remain profitable in a less certain market. In comparison to conventional mining techniques (e.g., open pit mining or underground stope mining), ISL mining allows the recovery of uranium from lower grade ores at a cheaper cost, while requiring fewer operational personnel.

However, not all types of uranium deposits are amenable to mining by the ISL technique. This method works best with uranium deposits which have been concentrated into roll-front deposits (Figure 1). The extent to which in-situ leaching can be conducted is limited by the suitability of the local hydrostratigraphy for containing and controlling mining solutions during the leaching process.

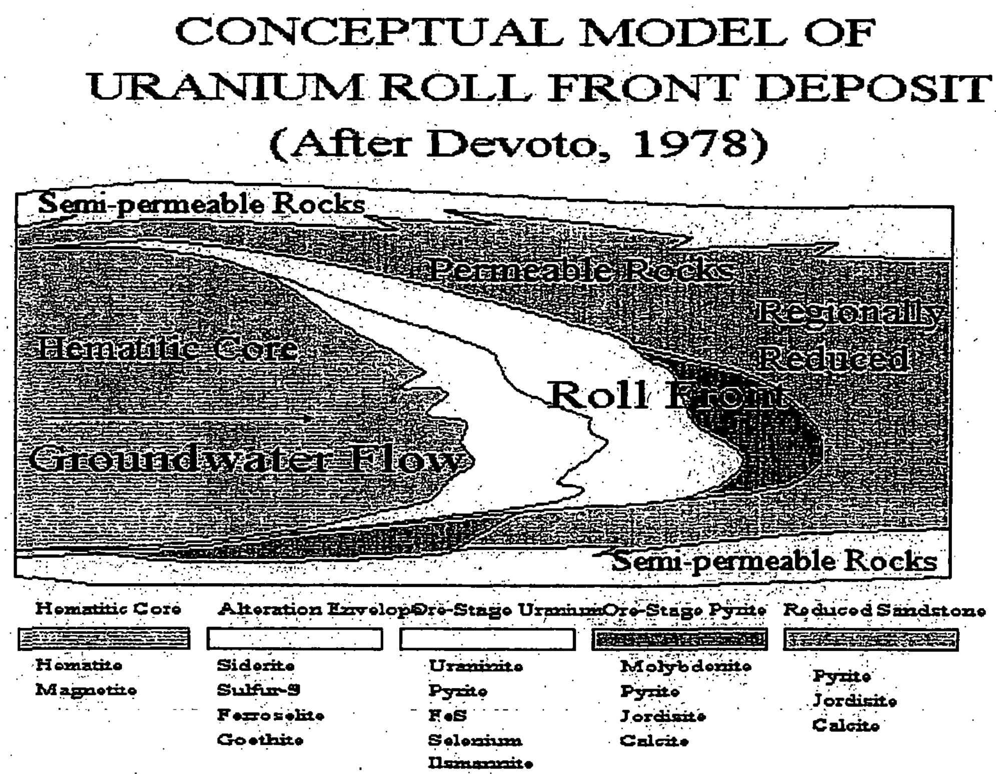

Figure 1. Conceptual Model of Uranium Roll Front Deposit (courtesy of Wyoming Mining Association)

ISL recovery of uranium also offers a number of environmental advantages over conventional mining methods. Because ISL techniques involve the circulation of local groundwaters (see following discussion), there is relatively minimal surface disturbance associated with this mining method. Conventional methods, on the other hand, can produce a significant impact on the environment due to, among other things, the resultant open pits and spoil piles. In addition, the in-situ method leaves underground aquifers physically intact, rather than excavated as in conventional operations. The greatest impact of the ISL extraction method is a temporary effect on the quality of the ore zone groundwater. This impact is termed temporary because, in most instances, the groundwater can be restored to appropriate standards.

2.0 The In-Situ Leach Process

Following exploratory drilling to define the boundaries of the uranium ore body(ies), licensees drill a number of injection and production wells across the mining area (Figure 2). These wells can be arranged in any of a number of geometric patterns depending on the ore body's configuration, the ore zone aquifer's permeability, and the licensee's preference; however, most often, wells are placed in a five- or seven-spot pattern (Figure 3). In these arrangements, a central production ("recovery") well is surrounded by either four or six injection wells. The spacing between the wells depends on the distribution of the uranium within the ore body, but generally, these wells are spaced approximately 50 to 100 feet from one another. During uranium production, there is a constant movement of mining solutions through the aquifer from the outlying injection wells to the internal recovery wells (see Figure 3).

Wellfields, which are composed of a number of production patterns, normally are developed and brought into production one at a time. Wellfields may range from 10 to 50 acres in size, and several wellfields together compose a "mine unit." See Figure 4 for a representative wellfield.

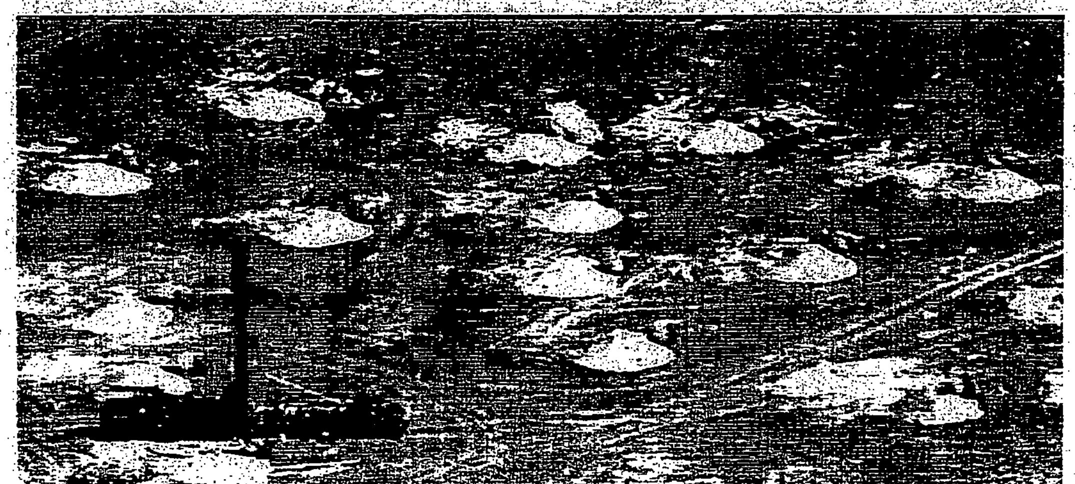

Figure 2. Wellfield installation. (courtesy of Wyoming Mining Association)

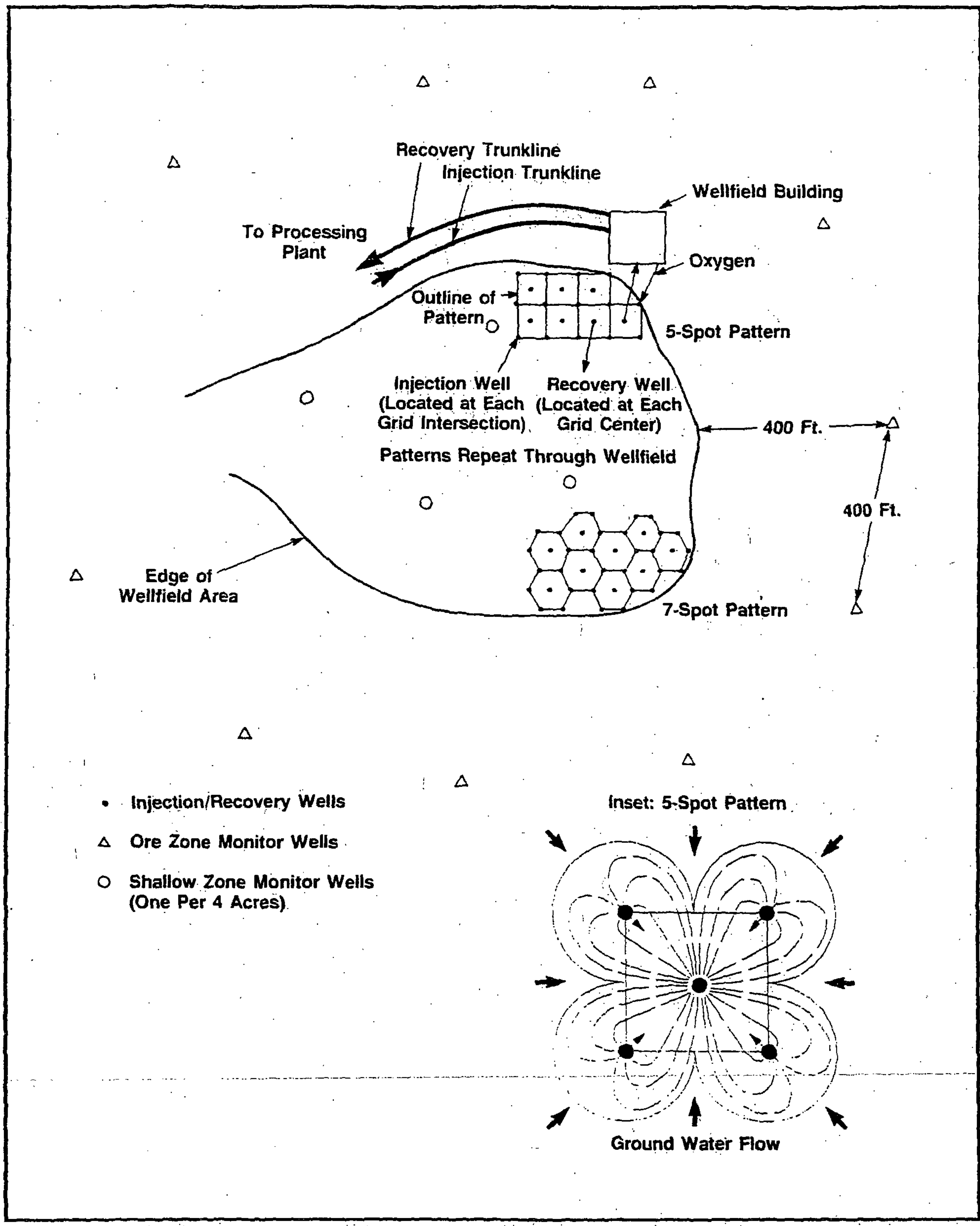

Figure 3. Schematic diagram of a wellfield showing injection/production well patterns, monitor wells, manifold building, and pipelines. (from NUREG-1508)

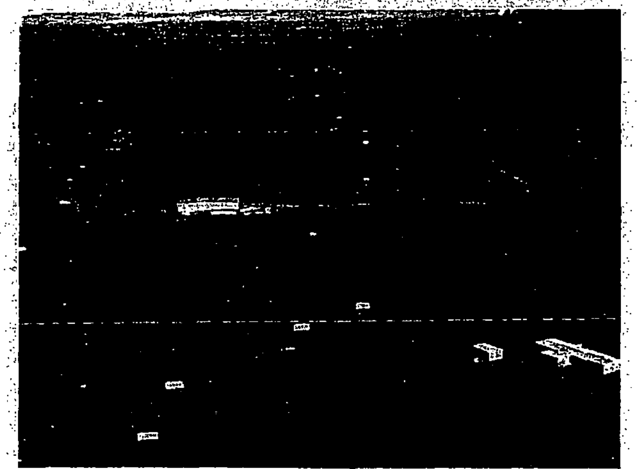

Figure 4. Representative wellfield. (courtesy of Power Resources, Inc. and Wyoming Mining Association)

For each wellfield, licensees are required to drill monitor wells which are screened in (i.e., open to) the ore zone aquifer, as well as in aquifers above and below the ore zone, if such aquifers exist. These monitor wells surround the wellfield pattern area to detect any mining solution that may migrate out of the production zone, either vertically and horizontally. In a properly designed and operated system, these "excursions" of ISL solutions should be rare due to the confining layers above and below the ore zone and the continual movement of the mining solution toward centrally-located recovery wells.

The actual leaching process (Figure 5) involves the circulation of the ore zone groundwater to which licensees may add oxygen, hydrogen peroxide, carbon dioxide, and carbonate or bicarbonate. This solution, known as "lixiviant," is pumped down the injection wells into the mineralized zones where it dissolves uranium from the host sandstone formation. The resulting uranium-bearing solution ("pregnant lixiviant") migrates through the pore spaces found in the sandstone, and is recovered via pumping from the production wells. Then, the pregnant lixiviant is transferred by pipeline(s) to a processing plant (either the main facility or a satellite facility) where the uranium is extracted. The now-barren leaching solution is recharged and returned to the production wellfield, where the process of uranium leaching continues.

Uranium concentrations in the pregnant lixiviant from individual production wells can exceed 100 mg/L. However, during mining, in addition to uranium, the ore zone groundwater becomes enriched with other minerals associated with the ore. Experience indicates that concentrations of trace metals such as arsenic, selenium, vanadium, iron, manganese, and radium may become elevated during the leaching process. Following the completion of uranium recovery in a particular mining area, licensees are required to restore the affected groundwater to appropriate standards, either pre-operational baseline conditions or pre-mining class-of-use limits.

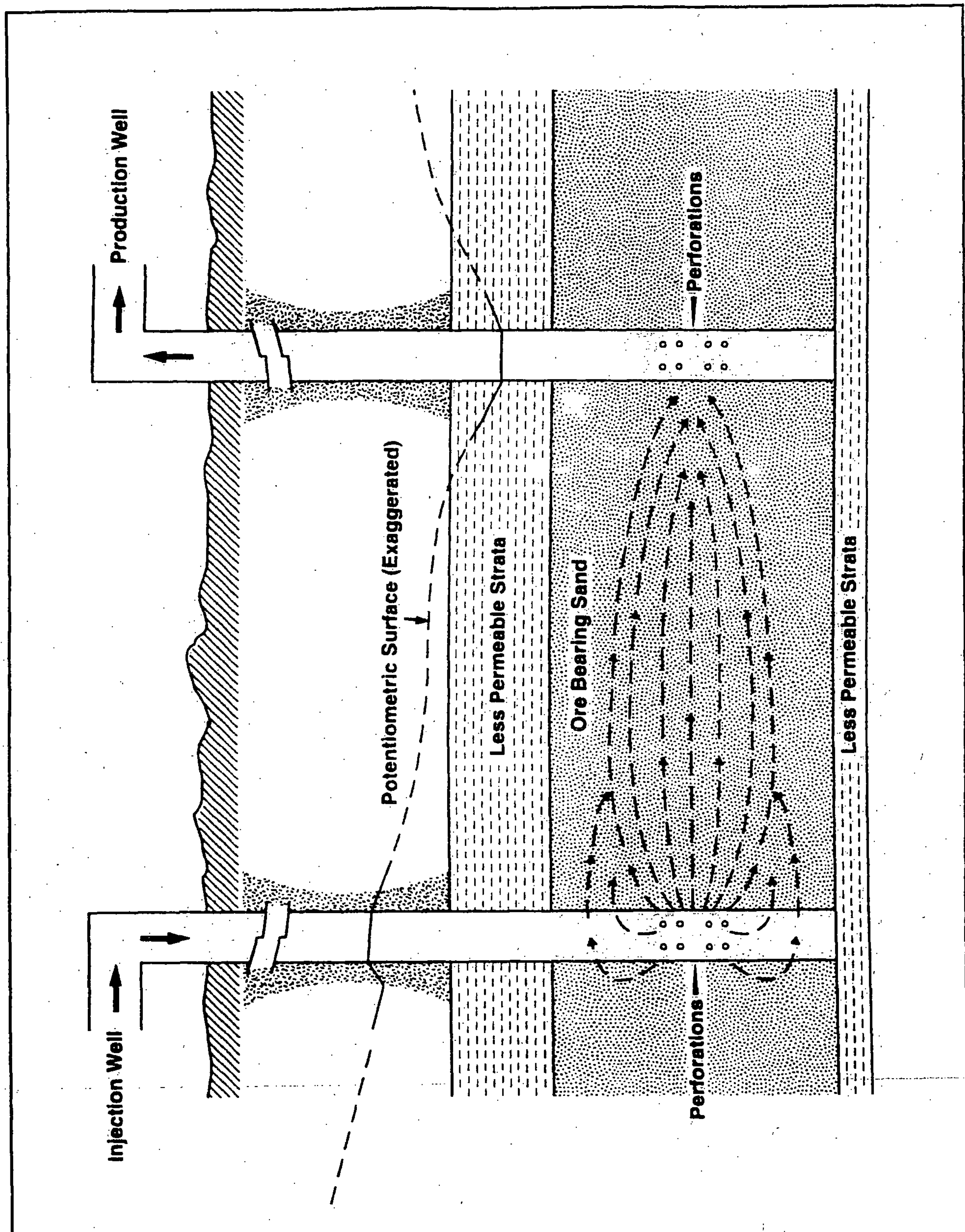

Figure 5. Schematic cross-section illustrating ore-zone geology and lixiviant migration from an injection well to a production well. (from NUREG-1508)

In the processing plant (see Figure 6), the pregnant lixiviant is stored either in a surge tank or pumped directly into a series of ion exchange (IX) columns. Within the columns, the uranium is adsorbed by ion exchange onto resin beads. As the resin becomes saturated with uranium, the IX column is taken off-line for the elution circuit. In this circuit , which can take place within the IX column or in a separate elution tank, the uranium is eluted, or stripped, from the resin by the passage of a strong chloride solution through the beads. If elution occurs in a tank, the resin beads are replaced in the IX column following this process for reuse. The resulting concentrated uranium solution (also known as "pregnant eluant"), with uranium concentrations on the order of approximately 20,000 mg/L, is then transferred to a holding tank.

When a sufficient volume of pregnant eluant is in storage, the final precipitation and drying process can begin. The uranium is precipitated from the pregnant eluant by the addition of hydrochloric acid, sodium hydroxide, and hydrogen peroxide. The resulting product is a uranium slurry that is approximately one-half water.

If at a satellite facility, this product can be shipped either as a slurry or a wet cake to the main facility for final drying and packaging. At the main processing plant, the slurry is dewatered using filter presses and then dried on-site using oil-fired, vacuum driers. The final product, known as yellowcake (Figure 6), is packed and sealed in 55-gallon drums prior to shipment off-site.

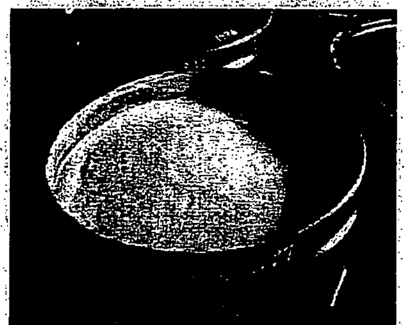

Figure 6. Dried yellowcake barreled and ready for shipment. (courtesy of COGEMA Mining, Inc. and Wyoming Mining Assn)

This uranium production cycle (Figure 7) continues until the ore zone is depleted to a point at which economic recovery is no longer feasible. At this point, the processes of groundwater restoration and wellfield decommissioning begin.

3.0 Groundwater Restoration

After ore extraction is complete in a wellfield, the licensee will begin groundwater restoration in the uranium-depleted ore zone, with the intent of reducing the concentration of mobilized constituents remaining in the groundwater. The primary goal of restoration, which is specified by license condition, is usually to return the affected groundwater quality, on a wellfield average, to pre-operational baseline conditions. If it is determined that a return to the pre-operational baseline conditions is not reasonably achievable using best practicable technology, a secondary goal is to return the groundwater quality to a use consistent for which the water was suitable prior to the ISL operations, based on the relevant State class-of-use standards.

3.1 <u>Establishing Pre-operational Baseline Water Quality</u>

Prior to mining in each wellfield, licensees are required to collect baseline groundwater quality data. These data are collected at a minimum density specified in the license or approved license application for the purposes of establishing the post-mining restoration standards for the wellfield.

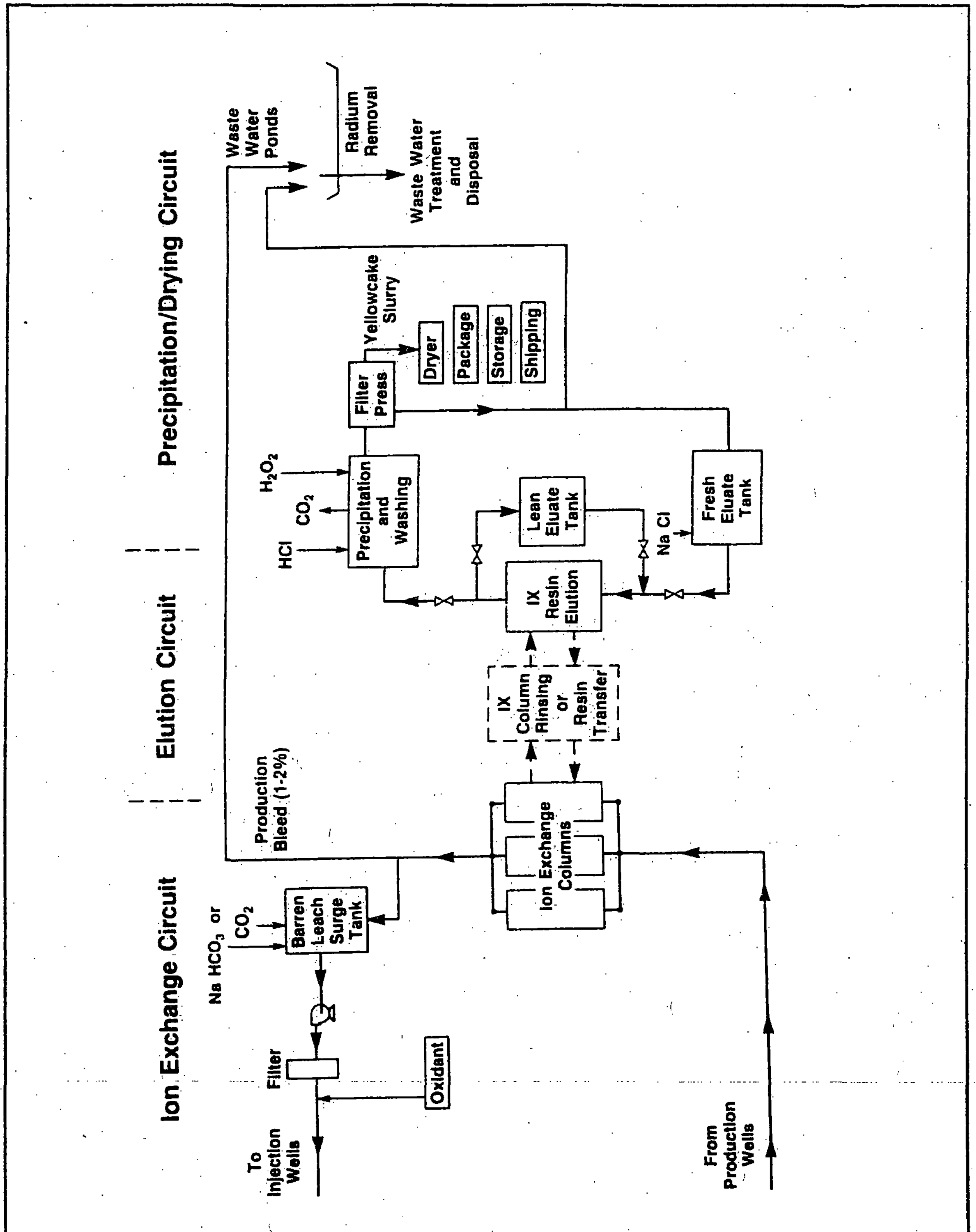

Figure 7. Schematic flow diagram of the in-situ leach uranium recovery process. (from NUREG-1508)

In the past, the licensees were required to submit the collected data and proposed restoration standards for NRC approval. However, with the move towards performance-based licenses, NRC has ceded the responsibility for reviewing the baseline groundwater data and establishing wellfield restoration standards to the licensees. NRC reviews a licensee's data and restoration standards during site inspections to ensure that approved methods for conducting the sampling and the associated determinations have been followed.

3.2 Groundwater Restoration Methodology

Licensees conduct groundwater restoration in accordance with an NRC-approved groundwater restoration plan. Based on experience gathered during the research and development (R&D) phase of the project and any commercial restoration, a licensee may implement all or a subset of the four basic methods for groundwater restoration that are identified below. A schematic of the groundwater restoration process is shown in Figure 8.

a. Groundwater Transfer

In this method, groundwater is recovered from a wellfield that is in the process of starting production and injected into the wellfield where restoration is commencing. In return, groundwater from the wellfield in restoration is recovered and injected into the wellfield that will be starting production. The intent of this direct transfer is to lower the constituent levels in the wellfield being restored by displacing water affected by ISL operations with baseline quality, pre-operational groundwater.

b. Groundwater Sweep

In this process, water is pumped without injection from the wellfield. This causes an influx of baseline quality (i.e., unaffected) groundwater from the perimeter of the wellfield which "sweeps" the mining-affected portion of the aquifer. This step also is intended to draw in the plume of affected water at the edges of the wellfield. Water retrieved in this fashion is not returned to the wellfield, but instead is disposed of through the waste water disposal system.

c. Groundwater Treatment

This process consists of extracting water from the ore zone, treating it to improve the water quality and either re-injecting the cleansed water (the permeate) into the ore zone or disposing of it through the waste water disposal system. IX and reverse osmosis (RO) are the methods used to treat the water, with IX used to remove uranium. After IX, if the permeate is re-injected, a reductant is added periodically to the permeate to induce, in the ore zone, the precipitation and immobilization of uranium and other trace elements that were dissolved during the extraction process.

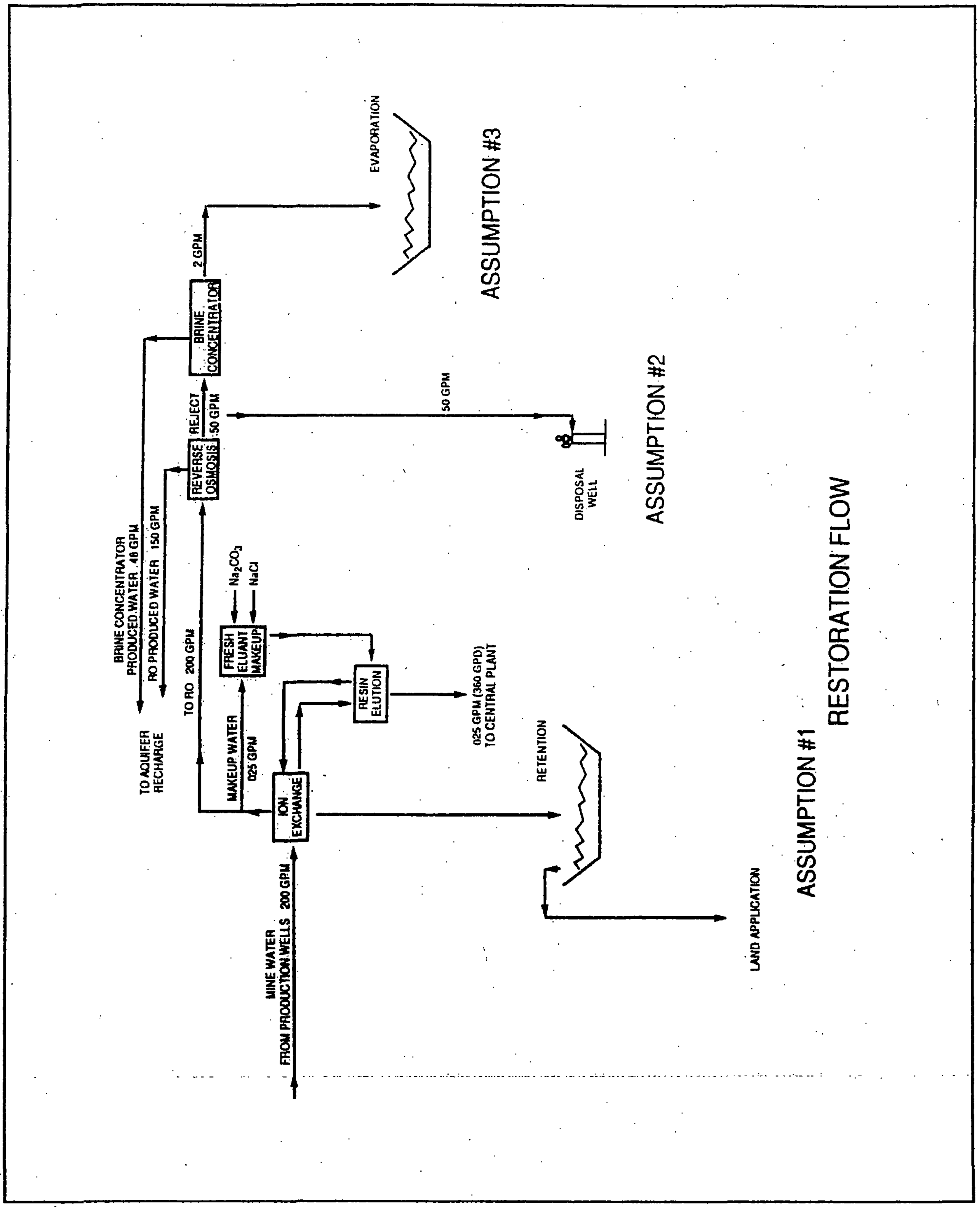

Figure 8. Schematic flow diagram of the groundwater restoration process. (from NUREG-1508)

A portion of the water recovered by this method can be sent to an RO unit. Prior to treatment by RO, the water is filtered, radium is settled out by treatment with barium chloride, and the pH is lowered to prevent calcium carbonate from plugging the RO membranes. Most often, the permeate from the RO unit is re-injected or, it can be disposed of like the concentrated brine that is also produced, through the waste water disposal system.

d. Wellfield Recirculation

Following completion of all or some of the methods above, the treated groundwater is recirculated through the ore zone, by pumping from production wells and re-injecting the recovered solutions into the injection wells, in an attempt to homogenize the groundwater.

Upon the completion of restoration in a wellfield, the licensee normally will implement a groundwater stabilization monitoring program in which particular wells are sampled and the samples analyzed at a specified frequency for a period of six months. If all the samples show that restoration values for all wells are maintained during this period, the licensee will consider restoration complete and will request of NRC and the appropriate State agency that the wellfield be declared restored. If water quality is not stabilized, further restoration work may be required.

4.0 Generation and Management of Wastes

4.1 Gaseous Effluents

Air emissions from operations will be primarily in the form of radon-222. Radon-222 is present in the orebody and is formed by the decay of radium-226. The radon dissolves in the lixiviant as it travels through the orebody to production wells, and when the lixiviant is processed at the surface, radon is released from solution. Radon can potentially be released to the environment either from the wellfields or the processing plant. While injection wells are generally closed and pressurized, they are periodically vented and radon-222 is released. At the processing facility, radon-222 normally is vented from recovery surge tanks and the IX columns into a manifold and emitted to the atmosphere outside the plant via an induced draft fan.

Licensees may employ yellowcake driers that operate under negative pressure. With these types of driers, there are no particulate emissions, because (1) particulates are controlled by bag filters and (2) moisture-laden air is recirculated through a closed-loop condenser where water condenses and entrains any remaining particulates.

Finally, there will be small quantities of gases, such as CO_2 and O_2, released from gas traps on the injection well pipelines.

Licensees are required to sample for specific radionuclides at various locations surrounding the site. The results of this sampling are submitted to NRC on a semiannual basis, in accordance with the requirements of 10 CFR 40.65.

4.2 <u>Liquid Wastes</u>

Liquid wastes from operations are generated from three sources: (1) wellfield development, (2) processing plant operations, and (3) groundwater restoration activities. NRC requires licensees to return all liquid effluents from process buildings and other process waste streams, with the exception of sanitary wastes, to the process circuit, or to dispose of the effluents through any of the NRC-approved waste disposal options. Possible NRC-approved options for the disposal of liquid wastes include: (1) solar evaporation ponds, (2) land application, or (3) deep well injection.

a. Solar Evaporation Ponds

The purpose of retention ponds is to store wastewater until treatment, promote evaporative loss of water which cannot be discharged to the environment, and maintain control of source and 11e.(2) by-product material found in the liquid effluents from solution mining. Above-grade impoundments are designed and constructed to meet specifications in NRC Regulatory Guide 3.11, "Design, Construction, and Inspection of Embankment Retention Systems for Uranium Mills" (NRC, 1977a). Licensees are required by license condition to perform and document inspections of the pond embankments, fences, and liners, as well as measurements of pond freeboard and checks of the leak detection system.

NRC requires licensees to maintain adequate freeboards in the evaporation ponds. These freeboard limits are designed to allow the evaporations ponds to accommodate a design precipitation event and associated wind-generated wave with an appropriate engineering safety factor. Additionally, licensees are required to maintain sufficient reserve capacity in the evaporation pond system to allow the transfer of one pond's contents to the other ponds in the event of a leak in any single pond.

The ponds are designed with double synthetic liners and a leak detection system consisting of underdrains which connect to leak detection standpipes. As part of the pond inspection program, licensees commit to analyzing water contained in the standpipes for leak indicator parameters any time a specified level or more of fluid is present. In the event of a leak verification, licensees are required by license condition to take specific actions, including notification of NRC.

b. Land Application of Treated Water

At some sites, liquid wastes generated as part of the ISL process are disposed of via land application (Figure 9). This involves the use of irrigation spigots to distribute these wastes across a designated region within the licensee's permit area. Typically, the wastes disposed of in this manner are those derived from the construction and development of wells at the project and from wellfield restoration activities (e.g., water treated by reverse osmosis). The irrigation sites may be designed with small berms to ensure that the fluids remain within the designated irrigation area and with fences to restrict livestock from grazing in these areas.

As part of a proposal to use land application as a disposal option, licensees analyze the projected exposures and health risks associated with the radioactive constituents that

Figure 9. Land application at Power Resources, Inc.'s Highland Uranium Project. (courtesy of PRI and W yoming Mining Association)

may reach the food chain, particularly through crops and vegetation. The estimated doses should be ALARA and within the dose limits of 10 CFR 20.1301. Licensees conduct periodic soil surveys to verify that contaminant levels in the soil do not exceed projected levels. Licensees also are required to obtain the appropriate State and Federal agency permits and to comply with the NRC regulatory provisions for site decommissioning.

c. Deep Well Injection

Licensees may dispose of some process fluids generated during operations via a deep disposal well. Fluids disposed in this manner typically are derived from two sources: the production bleed and the eluant bleed. The injection stream typically consists of a sodium-chloride brine, high in total dissolved solids, with significant amounts of sulfate and the radionuclides uranium and radium-226. Licensees may add scale and corrosion inhibitors to prevent fouling of the injection well.

The construction and operation of these wells are conducted under a State permit, while NRC approves the fluids to be disposed by this method using the criteria under 10 CFR 20.2002. Important in the approval of this disposal method is a determination that (1) the aquifer into which the fluids are to be injected is unsuitable for use as an underground source of drinking water (USDW) under either Federal or State regulations, and (2) the injection aquifer poses no threat to other USDWs, for example through hydrologic connections. In addition, the associated doses must be ALARA and within the dose limits in 10 CFR 20.1301.

4.3 Solid Wastes

Sanitary wastes from the restrooms and lunchroom will be disposed in a State-approved septic system. Solid wastes generated at the site typically consist of spent resin, empty reagent containers, miscellaneous pipes and fittings, and domestic trash. These wastes will be classified as contaminated or non-contaminated waste, according to their radiological survey results.

Contaminated solid waste is separated into two categories. The first category is waste which has some salvage value or can be decontaminated to below unrestricted release limits. This type of waste may include piping, valves, instrumentation, equipment, and any other item that can be decontaminated. All decontaminated wastes are inspected and surveyed by the site radiation safety officer or health physics technician prior to release from the site to ensure that appropriate decontamination procedures have been observed. Licensees observe the release limits for decontaminated materials specified in NRC Branch Technical Position "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material" (NRC, 1987).

The second category of waste includes items that have no salvage value and have been contaminated during uranium recovery operations. Radium-contaminated filters are a common example of this type of waste. These types of materials are stored in a secure location within the restricted area until such time as they can be shipped to a site licensed to accept such waste for final disposal (Figure 10).

Figure 10. "Boner" building at Power Resources, Inc.'s Highland Uranium Project for storage of contaminated materials prior to disposal. (courtesy of Robert Evans, NRC)

Records of equipment and corresponding contamination levels are maintained for all items released from a site. Any item having contamination levels that exceed regulatory limits will be disposed at a site approved to receive byproduct waste materials, as discussed below. Transportation of all material to the byproduct disposal facility will be handled in accordance with the applicable U.S. Department of Transportation and NRC regulations (49 CFR 173.389 and 10 CFR Part 71, respectively) .

Licensees are required to dispose of 11e.(2) byproduct waste materials at any site authorized by NRC or an NRC Agreement State to accept such material for disposal. A copy of the licensee's agreement with the disposal site is required to maintain onsite for NRC inspection. In the event this agreement expires or is terminated, licensees are required to notify NRC within seven days of the expiration or termination date. A new agreement must be submitted to NRC for approval within 90 days of expiration or termination, or the licensee will be prohibited from further lixiviant injection.

Non-contaminated solid wastes will be collected at the site on a regular basis and disposed in the nearest sanitary landfill. The waste is surveyed prior to disposal to ensure that no contaminated waste is released from the site.

5.0 Final Site Reclamation and Decommissioning

5.1 Surface Reclamation

Reclamation activities in individual wellfields consist of returning disturbed lands to their pre-mining use. All injection, production, and monitor wells are plugged and abandoned prior to final closure of the site and after the groundwater restoration has been successfully completed. After the wells are plugged with an approved abandonment mud, a hole is dug around the well and, at a minimum, the top meter (3 ft) of casing is removed. Finally, the hole is backfilled and the surface is re-vegetated.

In decommissioning wellfields, the licensee first will remove surface equipment, such as injection and production feed lines, electrical conduits, well boxes, and wellhead equipment. Some wellhead equipment, such as valves, meters, or control fixtures, is salvaged. All buried wellfield piping is removed. Piping that is not reusable is considered contaminated and is disposed at a licensed byproduct material waste disposal site.

The plant site and solar evaporation pond areas will experience more disturbance than the wellfield areas. The plant and pond areas will be reclaimed in a fashion similar to the wellfield areas after groundwater restoration has been successfully completed. Treatment and disposal of pond water will depend on its chemical and radiological characteristics at the time of decommissioning. Pond sludges and sediments will be removed from the evaporation ponds and loaded into dump trucks or drums for disposal at the licensed byproduct material disposal site. The pond liners will then be cleaned to the degree possible. If, after cleaning, they are below the surface contamination limits, the liners will be released to an unrestricted area. If contamination limits are exceeded, pond liners will be cut into strips and transported to the byproduct disposal site. Materials in the leak detection system will be excavated and surveyed for contamination. If the leak detection system is not contaminated, it will be released for unrestricted use; otherwise, it will be disposed at the byproduct material disposal site.

Soil may be compacted in some areas from the drilling and maintenance traffic. Well closure will also involve some surface disturbance immediately surrounding each well. The non-vegetated or disturbed areas, including roads, will be either plowed or disced to aerate the soil. Soil from the wellfields and beneath the evaporation ponds will be surveyed for contamination, using an appropriately spaced grid with spot checks around likely areas of contamination. Any soils contaminated in excess of the limits defined in Appendix A to 10 CFR Part 40, will be removed and transported to a licensed byproduct material disposal site. Excess soil from the built-up plant base and pond embankments will be returned to the ponds as fill. Following this, land surface contours will be re-established. A final soil survey will be conducted on areas prepared for surface reclamation on a grid spacing adequate to confirm cleanup to applicable standards.

Following soil contouring and surface reclamation, topsoil will be replaced on all areas disturbed by the processing plant and the evaporation ponds. A grass seed mixture and fertilizer will then be spread. A period of one to two years will be required to establish a suitable grass cover. During this time, fences will be maintained to keep livestock off the area and away from new vegetation. After that time, disturbed land may be returned to their pre-mining use.

Reusable equipment will be segregated from worn-out or scrap items. Both categories of materials will be cleaned and temporarily stored onsite prior to final disposal. Cleaned refuse may be disposed in sanitary landfills, while contaminated materials will be disposed at a licensed byproduct material disposal facility.

5.2 <u>Plant Site Decommissioning</u>

After the equipment, building, piping, and associated support facilities have been removed from the wellfield area, a gamma survey will be conducted over the same wellfield grid that was surveyed prior to operation. The gamma survey results will be compared with those determined prior to operations. Soil samples will then be obtained from locations that display elevated gamma readings, and the samples will be analyzed for their natural uranium and Ra-226 content. Based upon the results, contaminated soil will be removed and shipped to a byproduct material disposal site. The gamma survey and soil sampling results will be used as a data base to assure that the site is radiologically safe for unrestricted use.

The plant area will be comprised of compacted earth, some surface covering material, a cement foundation, and the building. Once the building and cement pads have been removed, a gamma survey will be made of the compacted area. Any areas with elevated gamma readings will be sampled for radium and natural uranium to determine if contaminated soils must be removed. The compacted area will then be re-contoured, with excess soil placed in the pond pits, and the topsoil replaced. A final gamma survey will be performed and the results compared with the pre-operational survey results.

Reclamation and limited decommissioning will represent interim steps that are necessary prior to the final decommissioning of the site. To assure that final decommissioning is adequate to return the site to unrestricted use, licensees are required, by license condition, to submit a final detailed decommissioning plan for NRC review and approval at least 12 months prior to the planned final shutdown of mining operations.

Currently, in accordance with Criterion 9 of 10 CFR 40, Appendix A, licensees are required to maintain an NRC-approved financial surety arrangement adequate to cover the estimated costs, if accomplished by a third party, for completion of the NRC-approved site closure plan including: above-ground decommissioning and decontamination, the cost of offsite disposal of radioactive solid process or evaporation pond residues, and ground-water restoration. Licensees are required to update these costs on an annual basis and to provide the revised surety amount to NRC for approval. Along with each proposed revision or annual update, licensees also are required to submit supporting documentation showing a breakdown of the costs and the basis for the cost estimates with adjustments for inflation, maintenance of a minimum 15 percent contingency, changes in engineering plans, activities performed, and any other conditions affecting estimated costs for site closure. Any changes in the extent of NRC regulation of ISL facilities likely would require modifications to the extent of surety coverage for these facilities.

October 20, 1998

TO: Carl J. Paperiello, Director
Office of Nuclear Material Safety and Safeguards

SUBJECT: DIFFERING PROFESSIONAL VIEW CONCERNING NUCLEAR REGULATORY COMMISSION REGULATION OF LIQUID EFFLUENTS FROM *IN SITU* LEACH URANIUM EXTRACTION FACILITIES

Please find attached my professional view on Nuclear Regulatory Commission (NRC) regulation of liquid effluents from *in situ* leach uranium extraction facilities. Contrary to current and proposed staff practice, I believe that the liquid effluent from *in situ* leach uranium extraction facilities should be considered as 11e.(2) byproduct material. I am opposed to the current staff practice whereby some liquid effluent releases are regulated by the NRC while some are not. I am also opposed to a proposed staff alternative; whereby the NRC would relinquish all regulatory authority over liquid effluent releases. I am aware that the staff is preparing a Commission Paper on this subject which includes the staff's proposed alternative. Since this professional view also differs with current staff practice, I request that this professional view be considered by the agency, even if the staff withdraws or delays submittal of the Commission Paper.

I am also aware that the staff is preparing a Commission Paper recommending that NRC remove itself from the review of groundwater protection at *in situ* leach facilities by relying on the Environmental Protection Agency Underground Injection Control Program. My professional view on liquid effluents would be the same wether or not the NRC relied on the Environmental Protection Agency Underground Injection Control Program.

Should the agency so desire I hereby grant my permission to place in the public document file this differing professional view and to identify me as the author. If you have any questions, I can be reached at (301) 415-6630. As the staff member assigned with the task of preparing the Draft and Final "Standard Review Plans for *In Situ* Leach Uranium Extraction Facilities", I would like to thank you for this opportunity to express my viewpoint on this issue.

William H. Ford

William H. Ford
Hydrogeologist
Uranium Recovery Branch

cc: M. Knapp, NMSS; J. Greeves, DWM; M. Weber, DWM; J. Holonich, URB; J. Hickey, LLDP; J. Park, URB; M. Layton, URB

Attachment 2

DIFFERING PROFESSIONAL VIEW CONCERNING NRC REGULATION OF *IN SITU* LEACH URANIUM EXTRACTION IMPOUNDMENTS

SUBMITTED BY WILLIAM H. FORD
HYDROGEOLOGIST, URANIUM RECOVERY BRANCH
OCTOBER 20, 1998

SUMMARY OF EXISTING AND PROPOSED STAFF VIEWS AND PROFESSIONAL VIEW

Contrary to current and proposed staff practice, I believe that the liquid effluent from *in situ* leach uranium extraction facilities should be considered as 11e.(2) byproduct material. I am opposed to the current staff practice whereby some liquid effluent releases are regulated by the NRC while some are not. I am also opposed to a proposed staff alternative; whereby the NRC would relinquish all regulatory authority over liquid effluent releases.

Uranium *in situ* leach facilities produce uranium by using wells to circulate water containing chemicals which mobilize and transport uranium and other chemical constituents through an aquifer. When the water is pumped to the surface the uranium recovery plant removes the uranium prior to returning the water to the aquifer. When uranium extraction activities in a well field are no longer economically viable the groundwater quality in the aquifer is restored. At *in situ* leach facilities, liquid waste streams originate from (1) the uranium recovery plant, (2) aquifer restoration activities, and (3) the production bleed from the well field. The production bleed consists of groundwater extracted from the aquifer during the uranium recovery operations in excess of injected water and is used to maintain a net groundwater inflow into the uranium extraction zone. At *in situ* leach facilities, management of liquid waste has involved such disposal practices as release to surface waters, evaporation from lined impoundments, land application, and deep well injection.

DESCRIPTION OF PROFESSIONAL VIEW AND DIFFERENCES WITH STAFF VIEWS

Historically the NRC has held that all liquid effluents from *in situ* leach facilities are 11e.(2) byproduct material. The NRC followed this approach until 1995. The historic approach has several advantages:

1a. It assures that any health, safety, and environmental risks from the disposal of impoundment sludges and contaminated equipment will be at acceptable levels. The disposal of this material in an 11e.(2) disposal site means that, as required by 10 CFR 40, air, water, and solid releases will be kept to acceptable levels.

2a. It discourages onsite disposal and the creation of many small disposal sites of radioactive material, and encourages site operators to reduce the volume of radioactive waste requiring disposal.

3a. It provides a clear definition of NRC regulatory responsibility in the clean up of contaminated soil, equipment, impoundment sludge, and in the regulation of emissions from 11e.(2) facilities.

4a. It provides a strong guarantee that there will be a location to dispose of contaminated material from the uranium recovery process.

5a. It is internally consistent with previous Office of General Council written decisions about NRC regulatory responsibility over 11e.(2) byproduct material facilities.

6a. It is consistent with commitments made to the public in environmental assessments and environmental impact statements, that contaminated impoundment sludges and material will not be disposed of onsite.

7a. It is one of the recommended approaches identified on page 132 of the National Mining Association White Paper titled "Recommendations for a Coordinated Approach to Regulating the Uranium Recovery Industry" which was presented before the Commission on June 17, 1998 (Attachment A).

Effluent produced by the uranium recovery plant and by the production bleed is defined as the "process bleed". Since 1995, the NRC staff have considered the process bleed to be 11e.(2) byproduct material, while the liquid effluent produced by groundwater restoration activities is not. This effluent is defined as naturally occurring radioactive material or technologically enhanced radioactive material. Therefore, NRC does not license this material.

Current staff practice has several disadvantages.

1b. The justification for defining groundwater undergoing restoration as non 11e.(2) byproduct material is weak. This is because the groundwater was directly contaminated by an 11e.(2) process that was used to extract uranium and because in the early phases of groundwater restoration; uranium is extracted to supplement the production of uranium by the recovery plant.

2b. Defining groundwater undergoing restoration as non 11e.(2) byproduct material has the potential to weaken NRC regulatory authority over liquid, air, and solid emissions from 11e.(2) facilities and the decommissioning and cleanup of those facilities. For example, this approach sets the precedent that contamination caused by an 11e.(2) facility does not fall within the regulatory jurisdiction of the NRC (Attachment B). This means that other emissions or areas contaminated by 11e.(2) facilities will be increasingly vulnerable to challenges that such contamination is outside the NRCs authority. For example, the present approach defines groundwater undergoing restoration as non 11e.(2) byproduct material. This is in turn quite naturally calls into question NRCs regulatory authority to require restoration of the groundwater. Alternatively, if groundwater contaminated by 11e.(2) site activities is not considered to be under NRCs regulatory authority, then how can contaminated equipment, soil, and other materials contaminated by 11e.(2) facility activities fall within NRCs jurisdiction?

3b. Current staff practice is creating disagreements between licensees and the NRC over NRCs regulatory authority at *in situ* leach facilities. To comply with the current practice an accurate determination (supported by acceptable documentation) of the origin of the waste water placed in an impoundment is important because the origin of the water determines the regulatory responsibility for the impoundment and the final disposal of the impoundment material (Attachment B).

Solid waste from impoundments that held only processing water are 11e.(2) byproduct material. However, solid waste from impoundments that held only water from groundwater restoration activities are not under NRCs regulatory authority.

Solid waste from impoundments that held a mixture of process waste water and water from groundwater restoration activities is considered 11e.(2) byproduct material if process waste water was the predominant source of water in the impoundment. Whereas, if the predominant source of water in the impoundment was water from groundwater restoration activities, it will not be regulated by the NRC as 11e.(2) byproduct material. If a licensee wants to exercise this option, the current staff practice **requires the NRC staff to consult with the Commission**. Since, most of the solid waste sent to impoundments at *in situ* leach facilities is from groundwater restoration activities, use of this approach will probably classify most of the impoundment solid waste as non 11e.(2) byproduct material.

Impoundments containing only process waste water or a mixture of process waste water and water from groundwater restoration activities, must be designed, operated, and decommissioned in accordance with 10 CFR Part 40, Appendix A, whereas impoundments containing only water from groundwater restoration activities do not. The same logic of regulatory authority based on the pedigree of the waste water applies to land application of waste, deep well injection of waste, contaminated plant equipment, and soils contaminated from spills and leaks.

This will create disagreements between licensees, the NRC and the public, over what the NRC regulates. It may also force licensees to be burdened with increased paper work to justify the regulatory pedigree of an area of contaminated soil, a piece of contaminated equipment, or impoundment solid waste. Furthermore it may also encourage licensees to implement inefficient plant and well field designs solely to maintain the regulatory pedigree of plant equipment and processes (i.e. separate pipelines, land application facilities, impoundments, etc.).

4b. State governments may also be encouraged to regulate 11e.(2) disposal facilities. Commingled waste generated from or largely from groundwater restoration activities may have already been sent to 11e.(2) disposal sites. This means that States may view those sites to be a mixed waste site containing 11e.(2) byproduct material and naturally occurring radioactive material or technologically enhanced radioactive material and therefore subject to State regulation.

5b. Health, safety, and environmental risks will be increased by encouraging onsite disposal and the creation of many small disposal sites of radioactive material. Most of the radionuclide contamination (radium, uranium, thorium, and lead-210) will be generated by groundwater restoration liquid waste streams. Onsite disposal has the potential to create many small disposal sites, which could cause future health and safety issues similar to the vicinity properties associated with the Title I program (clean up of former Atomic Energy Commission uranium extraction sites).

6b. Alternatively, it is also possible that current staff practice will make it very difficult for some licensees to locate disposal sites that will accept contaminated material. Existing 11e.(2) disposal sites may demand detailed documentation of the regulatory pedigree of the material before they would accept contaminated equipment and material from an *in situ* leach facility. Alternatively, any sites that take only naturally occurring radioactive material or technologically enhanced radioactive material may demand the same documentation to prevent the introduction of 11e.(2) byproduct material into their operations. Finally, States have awarded permits and licenses on the understanding that *in situ* leach facilities will not dispose of contaminated equipment and material onsite. If States continue to enforce these commitments, licensees may not have a place to dispose of their contaminated material.

7b. The current staff practice was criticized as being illogical, inconsistent and unpredictable by the National Mining Association in their White Paper titled "Recommendations for a Coordinated Approach to Regulating the Uranium Recovery Industry" (on page 132 of Attachment A, presented before the Commission on June 17, 1998).

8b. It is likely that the original objective of the current staff practice will not be achieved and is unworthy of the manpower and cost that will be required of the NRC and the licensees to implement. It is my understanding that this approach was developed to provide licensees regulatory relief to discharge effluents to surface water (page A-1, and Tables A1 and A2 of the April, 1995, "Staff Technical Position on Effluent Disposal at Licensed Uranium Recovery Facilities" (Attachment C). However, licensees have reported (Attachment D) that the U.S. Environmental Protection Agency (EPA) considers all liquid effluents from in situ facilities to surface waters to be process waters and that EPA, in accordance with 40 CFR 440.34 (Attachment E) does not allow new *in situ* leach facilities to discharge process waste water to navigable waters. This same observation was made by the National Mining Association in their White Paper titled "Recommendations for a Coordinated Approach to Regulating the Uranium Recovery Industry" submitted before the Commission on June 17, 1998 (paragraph 1, page 129, Attachment A). To my knowledge no *in situ* leach operators licensed by the NRC presently discharge liquid effluents to surface waters.

NRC staff are considering another regulatory alternative to the regulation of liquid effluent at *in situ* leach facilities. At the time this professional view was written, the alternative was going through staff revisions. However, it is my understanding that the basis of this new alternative is that the process bleed would no longer be considered as 11e.(2) byproduct material. This means that the design, construction, and operation of the surface water impoundments would no longer be subject to NRC regulation. Since this alternative would also eliminate the issue of the comixing of process and water from groundwater restoration activities, it also implies that land application and deep well disposal activities should no longer be subject to NRC regulation.

This alternative has several disadvantages.

1c. The justification for defining the process bleed as non 11e.(2) byproduct material is even weaker. The process bleed at *in situ* facilities originates from the uranium recovery plant and from the production bleed. The production bleed is groundwater extracted from the aquifer during the uranium recovery operation to maintain a net groundwater inflow into the recovery zone. This bleed is used to control the 11e.(2) byproduct material process so that groundwater contamination does not leave the area of uranium extraction in the aquifer. Furthermore, before the bleed is pumped to impoundments or some other method of disposal, the uranium contained in the bleed is removed as part of the routine process of uranium extraction. Therefore, both bleeds are a direct result of uranium extraction activities.

It has also been argued among the staff that the production bleed makes up the major portion of the process bleed. However, depending of the facility the percentage of production bleed varies from a small to a significant amount. This difference may simply reflect how the particular facility chooses to classify it's bleeds. For example, in those facilities where the production bleed is reported to be a large, the facility pumps most of its plant discharge into the pipes that return the water to the well field. It then removes the production bleed from those same pipes so that on paper it appears that only a small part of the process bleed is from the plant. In any case, it seems very difficult to argue that both the plant and production bleeds do not originate from an 11e.(2) facility actively engaged in the processing of uranium.

2c Defining the process bleed as non 11e.(2) byproduct material has an even greater potential to weaken NRC regulatory authority over liquid, air, and solid emissions from 11e.(2) facilities and the decommissioning and cleanup of those facilities. With one exception, all the arguments apply to this alternative as previously discussed under paragraph "2b". The inclusion of the process bleed as non 11e.(2) byproduct material makes an even stronger case that the NRCs regulatory authority does not apply to discharges from 11e.(2) byproduct facilities.

3c. This alternative may create disagreements between licensees and the NRC over NRCs regulatory authority at *in situ* leach facilities. Using this alternative, the regulatory pedigree of the water would still be important in defining NRC regulatory authority over contaminated plant equipment, and soils contaminated from spills and leaks.

4c. State governments may be encouraged to regulate 11e.(2) disposal facilities. Non 11e.(2) byproduct material has already been sent to 11e.(2) disposal sites. This may mean that States may view the 11e.(2) disposal site as a mixed waste site containing 11e.(2) byproduct material and naturally occurring radioactive material or technologically enhanced radioactive material and therefore subject to State regulation.

5c. Health, safety, and environmental risks will be increased by onsite disposal and the creation of many small disposal sites of radioactive material (see discussion for paragraph "5b").

6c. It may be difficult for some licensees to locate disposal sites that will accept contaminated material (see discussion for paragraph "6b").

7c. The original motivation for this alternative is not worth the manpower and cost to implement that will be required of the NRC and licensees. It is my understanding that this alternative is being developed to eliminate the need to conduct "dam safety" inspections by NRC staff. However, it is also my understanding that there are only two *in situ* leach facilities with impoundments that require inspection and that these facilities would be inspected once every three years (each inspection is estimated to take one day).

8c. This alternative contains many of the criticisms made by the National Mining Association in their White Paper titled "Recommendations for a Coordinated Approach to Regulating the Uranium Recovery Industry (on pages 126 to 132, Attachment A, presented to the Commission on June 17, 1998). Some of these issues are identified in paragraphs "8b, 4c, and 6c" of this position paper.

Assessment of Consequences Should Position Not Be Adopted By Agency

Contrary to current and proposed staff practice, I believe that the liquid effluent from *in situ* leach uranium extraction facilities should be considered as 11e.(2) byproduct material. I am opposed to the current staff practice whereby some liquid effluent releases are regulated by the NRC while some are not. I am also opposed to a proposed staff alternative, whereby the NRC would relinquish all regulatory authority over liquid effluent releases. The current staff practice and the proposed alternative would require licensee's and the NRC to spend increased resources caused by disagreements over regulatory authority and locating acceptable waste disposal sites. They also (1) weaken NRC authority over the regulation of 11e.(2) byproduct material sites in general and (2) encourage State governments to extend their regulatory control to 11e.(2) byproduct disposal sites. Both approaches increase health, safety, and environmental risks by encouraging onsite disposal and the creation of many small disposal sites of radioactive material. In my view, the economic costs to the government and industry; as well as the long term risks to public health and safety, make the current staff practice and proposed alternative unsuitable.

Attachment A

Selected pages from

National Mining Association White Paper titled

"Recommendations for a Coordinated Approach to Regulating the Uranium Recovery Industry"

presented before the Commission on June 17, 1998

(Relevant Text Marked)

Recommendations for a Coordinated Approach to Regulating the Uranium Recovery Industry:

A White Paper Presented By

National Mining Association
Foundation For America's Future

Prepared by

Katie Sweeney
Associate General Counsel
National Mining Association

Anthony J. Thompson
Warren U. Lehrenbaum
Paul Gormley
David H. Kim
Shaw Pittman Potts & Trowbridge

an ISL facility, EPA's UIC program satisfies "NRC concerns about the safety of subsurface injection (i.e., well construction, geology, groundwater, etc.)."[252] NMA agrees fully with this view, but fails to see why it is not equally applicable to injection and production wells at ISL wellfields.

D. NRC's Liquid Effluent Guidance

As a practical matter, NRC staff's misapplication and misuse of the AEA jurisdictional definitions has put ISL licensees in an awkward position. This is particularly troublesome in the context of handling ISL liquid effluents.

1. Effluent at ISL Facilities

As described above, typically there are several types of liquid effluent produced at an ISL wellfield facility. For example, production bleed is the groundwater removed from the aquifer in excess of water injected to ensure that there is a "pressure sink" in the ore body, to prevent excursions outside of the mining zone, and to inhibit the build up of contaminants in the ore body and mining fluids. Additionally, elution and yellowcake precipitation activities generate wastewater, as do restoration activities once the wellfield ceases operation. For most of these effluents, licensees have a variety of disposal options available, including land application, solar evaporation, deep well disposal in appropriate cases or discharge to surface water. As a practical matter, certain of the liquid wastes including particularly the bleed and discarded restoration fluids often are commingled prior to treatment in radium/barium settlement ponds and, thus, any resulting sludges are commingled as well.

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[252] Slides provided at NRC meeting to discuss public comment on the Draft ISL Standard Review Plan (February 23, 1998) [hereinafter ISL SRP Slides].

2. NRC's Requirements for Effluent Disposal

In 1995, NRC staff drafted a guidance document that was intended to assist licensees with their liquid waste disposal. This document, the "Staff Technical Position on Effluent Disposal at Licensed Uranium Recovery Facilities" (Effluent Disposal STP),[253] provides that licensed UR facilities must submit to NRC a site-specific proposal for effluent disposal. This proposal will be approved by NRC if it complies with NRC and EPA requirements. For example, the Effluent Disposal STP provides that any release of liquid waste to surface water must comply with EPA NPDES regulations. However, because NRC staff misunderstands the EPA requirements, and because the Commission staff has applied its definitions inconsistently, the Effluent Disposal STP presents some difficulties for UR licensees. As described more fully in this section, these problems are most obvious in the context of an ISL UR facility. NRC staff recently has sought to address some of these concerns for ISL operators in its response to comments on its Draft ISL Standard Review Plan, however, this particular effort further shows the impracticality and unworkability of NRC's approach to regulating ISL facilities.

As a threshold matter, NRC acknowledges the distinction in EPA's NPDES regulations between *process/production wastewaters* and *mine (restoration) wastewaters*.[254] As explained in the Effluent Disposal STP, NRC defines as *process/production wastewater* any effluents that are created during actual UR operations, such as production bleed (groundwater extracted from the aquifer during recovery operators) and liquid waste from the mill. On the other hand, *mine (restoration) wastewater* includes any water from post operational groundwater sweep and

[253] Directive DWM 95-01 (Apr. 1995) [hereinafter Effluent Disposal STP].

[254] Effluent Disposal STP at 5.

groundwater extracted to restore water quality after production operations have ceased (i.e., restoration wastewaters).

As the Commission recognizes, NRC does not license mine restoration wastewater.[255] Rather, if they are to be discharged these mine restoration wastewaters must comply with EPA NPDES regulations. On the other hand, the Effluent Disposal STP provides that the disposal of byproduct material in effluents (e.g., process/production wastewaters) must comply with NRC regulations.[256] Recognizing that process/production waters and mine restoration wastewaters frequently are commingled in the same ponds, NRC's Effluent Disposal STP provided licensees with two options for the release of these liquids to surface waters. First, a licensee may categorize its wastewater streams flowing into the pond as either mine wastewater or process/production wastewater. In this situation, if both input streams are within applicable NRC and EPA NPDES limits, then the resulting mixture of wastewaters may be released to surface waters.[257] Alternatively, if a licensee decides not to categorize and monitor its commingled effluents by incoming wastewater stream, the licensee must show that the mixture in the ponds complies with the NRC standards in 10 C.F.R. Part 20 before releasing the effluents to surface water.[258]

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[255] ISL SRP Slides. However, the Commission still suggests that it can impose specific license conditions to remediate anticipated impacts from these mine wastes. *Id.* Presumably, NRC is relying on the "supplemental jurisdiction" provided by NEPA. As explained above, however, NEPA does not provide any such supplemental jurisdiction.

[256] Effluent Disposal STP at 2. The Effluent Disposal STP specifically referred to 10 C.F.R. Part 20, Subpart K.

[257] Effluent Disposal STP at 6.

[258] *Id.*

One problem with NRC's Effluent Disposal STP is that it conflicts with EPA regulations *expressly prohibiting* the release of process/production wastewaters from any ISL facility at which construction began after December 3, 1982.[259] Accordingly, a discharge to surface water of a mixture of mine/restoration and process production wastewaters, even if it complies with 10 C.F.R. Part 20 limits (which are more stringent than EPA NPDES limits), violates EPA NPDES regulations.

At a recent public meeting NRC staff stated that for ISL facilities the guidance contained in the Effluent Disposal STP will be modified.[260] At this meeting, NRC staff explained that, in response to comments on the Draft ISL Standard Review Plan, the final version of that document will be revised with regard to effluent disposal. Specifically, the final plan will address water that is stored in radium-barium treatment ponds which, as described above, frequently contain mixtures of process/production waters and mine/restoration waters. Responding to concerns of mine operators that these mixtures would raise disposal problems, NRC has developed a *"predominant source"* test. Under this standard, if the predominant source of effluent in a pond is process water, then all of the waste is 11e.(2) byproduct material. By contrast, if the predominant source is mine water, then all of the waste is subject to state mining standards.

The problem with NRC's "predominant source" test is that it will result in mine wastes (a type of NORM) being sent to tailings piles. Indeed, under this test, one could put *anything* in a tailings pile so long as 11e.(2) byproduct material "predominates." When one considers NRC's

[259] 40 C.F.R. § 440.34(b). For older ISL facilities, the prohibition does not apply.

[260] ISL SRP Slides.

rationale for the *non-11e.(2)* policy described in section IV, the "predominant source" test could present an obstacle to site closure if DOE or the states refuse to take title to a tailings pile containing *non-11e.(2) materials* because of the potential for overlapping jurisdiction over mixed wastes. Thus, the "predominant source" test is another example of a stop-gap measure designed to address a concern in the short term that fails to address the fundamental problems with NRC's UR program.

Finally, one concern about NRC's predominant source test may have been eliminated by a recent decision of the United States Court of Appeals for the Ninth Circuit. This concern involved EPA's NPDES regulations prohibiting ISL facilities where construction began after 1982 from discharging process/production water.[261] Because of the mixture of process/production water and mine/restoration water in the ponds, any releases to surface water would have included process/production waters and thus would have violated EPA's regulation. In *Dawn Mining*, however, the court held that the CWA does not apply to 11e.(2) byproduct materials.[262] Specifically, the court found that 11e.(2) byproduct materials do not fall within that statute's definition of "pollutant."[263] This being the case, process/production waters at ISL wellfields, which under NRC's current interpretation are 11e.(2) byproduct material, are not "pollutants" and are not within the scope of the CWA. Accordingly, EPA's prohibition on the discharge of process/production wastewaters may be irrelevant at ISL facilities.

[261] ISL SRP Slides.

[262] *Waste Action Project v. Dawn Mining Corp.*, No. 96-36055, 1998 US. App. Lexis 4115 at *15 (9th Cir. Mar. 10, 1998).

[263] *Dawn Mining* at *10.

E. Recommendations

NRC staff's jurisdictional approach at ISL wellfields turns a blind eye to longstanding statutory and regulatory interpretations regarding licensable source material. The logical disconnects in the staff's interpretation have produced confusion in the regulated community and result in other unforeseen problems. Despite the conflicts and contradictions arising from an assertion of jurisdiction over ISL wellfields described in this section, NRC staff have been reluctant to reevaluate its position. For example, the staff has stated that "[t]o continue the dialogue on these issues is diverting management and staff time."[264] However, NMA respectfully submits that it is an unsound regulatory approach for NRC to continue misapplying the fundamental jurisdictional definitions in the AEA: to make its ISL program credible, consistent, and legally supportable and to provide ISL licensees with greater certainly as to their regulatory obligations, the Commission must take a fresh look.

As explained above, the subsurface activities at ISL facilities do not involve source material within the scope of NRC's licensing jurisdiction. The entire UR operation below ground is a type of mining and therefore is beyond the jurisdiction of NRC. Moreover, because the ore in solution generally contains an average of less than 0.05% uranium at least until the IX unit, and most appropriately beyond at the elution stage, the solution is exempt from licensing requirements.

Even if NRC staff were able to overcome these obstacles by essentially ignoring AEA legislative history regarding mining and NRC's definitions of licensable source materials, it still

[264] NRC Staff Response to Concerns Raised by the National Mining Association.

must present a logical, consistent and predictable regulatory approach. Under one such an approach, if NRC continues to assert that ISL mining really is a type of processing, then the underground ore body is like the mill at a conventional facility. This means that like a conventional mill, the underground ore body is 11e.(2) byproduct material. Accordingly, *all wastewaters* from the ISL wellfields would be 11e.(2) byproduct material. Apart from being consistent with the approach to contamination and wastes from conventional milling, this approach would avoid the effluent disposal difficulties faced by ISL operators by ensuring that only 11e.(2) materials are sent to tailings piles. However, another approach, and the better reasoned one, is for NRC to agree that it does not have jurisdiction over ISL wellfields until the pregnant lixiviant at a minimum reaches the IX but more appropriately when it reaches the elution stage at the mill. This would mean that production bleed would be a mining waste, not a processing waste, and would allow this material to be disposed of pursuant to an NPDES permit. Any sludges resulting from these effluent streams would qualify for RCRA's Bevill exclusion. The only 11e.(2) byproduct material under this alternative would be discrete surface wastes from the production of yellowcake after the IX.

Attachment B

May 5, 1998 Letter to

Ms. Ruthe E. McBurney, CHP, Director
Division of Licensing, Registration, and Standards
Buureau of Radiation Control
Texas Department of Health

(Relevant Text Marked)

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

May 5, 1998

Ms. Ruth E. McBurney, CHP, Director
Division of Licensing, Registration,
and Standards
Bureau of Radiation Control
Texas Department of Health
1100 West 49th St.
Austin, TX 78756-3199

SUBJECT: RESPONSE TO MARCH 23, 1998, LETTER TO THE OFFICE OF STATE PROGRAMS

Dear Ms. McBurney:

I am responding to your March 23, 1998, letter to Richard L. Bangart, Director of the Office of State Programs, U.S. Nuclear Regulatory Commission (NRC). In that letter, you requested comments and recommendations from the NRC on whether the alternative procedures discussed in the letter are permissible under NRC regulations. The questions in your letter deal with either the mixing of soil contaminated with 11e.(2) byproduct material, or the disposal and release of materials generated by the operation of in situ leach facilities (ISLs).

In general, there is no statute or NRC rule that forbids mixing of contaminated and clean soils to comply with decommissioning cleanup standards. However, it has been a long-standing NRC staff practice to discourage compliance with environmental standards by dilution with uncontaminated material. Rather, the NRC staff encourages the cleanup of contamination to applicable standards. As such, in the past, NRC has found that removing soils contaminated with 11e.(2) byproduct to levels that met the applicable cleanup standards, and then disposing of the 11e.(2) byproduct material at a site licensed to receive such material was an acceptable way of complying with NRC regulations. If the NRC staff were presented with a proposal to use mixing as a method of complying with applicable cleanup standards, we would treat it as an alternative to the requirements in 10 CFR Part 40, Appendix A, and would require the applicant to show that the economic benefit and equivalent protection requirements specified in the "Introduction" to 10 CFR Part 40, Appendix A, have been met.

Several years ago, the NRC received a proposal to use disking of windblown contamination at the Wyoming American Nuclear Corporation mill tailings site to meet the radium standard in 10 CFR Part 40, Appendix A, criterion 6(6). Prior to completing its review of the proposal, the NRC requested that the licensee apply the method to a test plot to evaluate the effectiveness of this approach at the site. Because the applicant was unable to comply with the radium standard using this approach, the method was never used.

The answer to your questions concerning the disposal of Ra-226-contaminated soils under holding ponds is dependent on the origin of the water placed in the ponds during their operation. This is also related to your question about what criteria is appropriate for determining the classification of mining waste and 11e.(2) byproduct material. Essentially, any waste generated primarily as a result of the extraction of uranium from ore is defined as 11e.(2)

byproduct material, and subject to NRC regulation. This definition does not confer regulatory jurisdiction over waste generated from other ISL activities not being conducted primarily for the extraction of uranium.

At ISLs, waste streams originate from either the processes associated primarily with the extraction of uranium, or processes associated with other aspects of facility operation such as ground-water restoration or normal operational support not related to uranium extraction. For that waste generated primarily from the extraction of uranium from the ore, under the Atomic Energy Act, it is by definition 11e.(2) byproduct material, and thus subject to the requirements of Part 40, Appendix A, at NRC-licensed sites. Examples of processes that would fall within this definition include the equipment used in the operation of a well field or processing facility. On the other hand, wastes from ground-water restoration is not generated primarily from the extraction of uranium, and is considered a mine waste subject to state mining regulations at NRC-licensed sites. It is important to note that at the beginning of ground-water restoration, ISLs will still extract some uranium from the restoration water. However, the process itself is being done primarily to restore ground water, not extract uranium. Therefore, it does not meet the definition of 11e.(2) byproduct material.

For the particular issue concerning the cleanup of Ra-226-contaminated soil below holding ponds, the source of the effluent placed in the pond determines the regulatory responsibility. At ISL operations, liquid wastes can be generated from the uranium recovery plant, from the production bleed, and from ground-water restoration activities. Production bleed is ground water extracted from the aquifer during the uranium recovery operation in excess of injected water to maintain a net ground-water inflow into the recovery zone. Effluent produced by the uranium recovery plant and by production bleed is process wastewater, and because it is a waste stream generated as part of the uranium extraction activities it is defined as 11e.(2) byproduct material. Ground-water effluent is produced at the end of a uranium recovery operation, during restoration of ground-water quality in the recovery zone. Effluent produced during ground-water restoration activities is considered to be "mine wastewater," and is not considered to be 11e.(2) byproduct material. This effluent may be defined as naturally occurring radioactive material or as technologically enhanced naturally occurring radioactive material.

Any residual pond material or contaminated soils below a pond that contained all or some process wastewater would contain 11e.(2) byproduct material. For the case where the holding pond commingled process wastewater and mine wastewater, the NRC staff has taken the position that it will view all residual material as 11e.(2) byproduct material if the pond held predominantly process wastewater. By doing this, the NRC is working to eliminate a situation where there is a commingled waste with no option for disposal. A second option is for licensees to dispose of all commingled wastes on site under state mining regulations. This option would apply to any pond that held commingled wastewater regardless of how much was process wastewater. It would require ISL licensees to show that the alternatives provisions of economic benefit and equivalent protection found in Part 40, Appendix A, would be met, and the 11e.(2) byproduct material need not meet the requirements for long-term stabilization in Appendix A. Licensees would also have to address the cost-benefit provision in Criterion 2 of Part 40, Appendix A, concerning the proliferation of small 11e.(2) disposal cells. Finally, the NRC staff would have to consult with the Commission on the need for an exemption of this material from other licensing requirements in the Atomic Energy Act of 1954, as amended that become applicable when such an option is proposed. For a holding pond that held solely process wastewater, the residual and soil contamination is by definition solely 11e.(2) byproduct material, and needs to be reclaimed by cleanup and disposal in a mill licensed to take the material or an 11e.(2) disposal cell.

A third area of questioning from your letter raised the issue of disposal of contaminated materials from ISLs, such as concrete, piping, and pumps. As noted above, if this material was used in the uranium extraction process, it is by definition 11e.(2) byproduct material. Therefore, ISL licensees must comply with 10 CFR Part 40, Appendix A, criterion (2) which requires the disposal of this material at a mill licensed to dispose of the material or an 11e.(2) disposal site. Alternatively, the licensee could decontaminate the material to meet the NRC cleanup criteria for unrestricted release. In making the decision for unrestricted release, the NRC staff notes that the 15 pCi/g Ra-226 and 30 pCi/g natural uranium standard referenced in the question does not apply to this type of material. Those standards relate to the contamination of soil. Rather, the standards contained in Table 1 of NRC Regulatory Guide 8.30, titled "Health Physics Surveys in Uranium Mills," for uranium and associated decay products contamination and the standards contained in Table I of NRC Regulatory Guide 1.86, titled "Termination of Operating Licenses for Nuclear Reactors," for radium, thorium, or other radionuclides are applicable.

Finally, I want to address your question about the reclamation of contaminated well field soils. Soils contaminated from spills and leaks of process wastewater or a mixture of process and mine wastewater are by definition 11e.(2) byproduct material, and would be subject to the cleanup requirements of Part 40, Appendix A, at NRC-licensed sites. Soil contaminated by spills and leaks of only mine wastewater do not have to meet the requirements of Part 40, Appendix A, because this waste is viewed as a mine waste by NRC, and subject to state mining regulation. However, it is the opinion of NRC staff that well field soils are most likely to become contaminated from processing fluids as opposed to mine wastewater.

Similarly, contaminated plant equipment that was only used in the restoration of the well fields is not considered to be subject to NRC regulation. Plant equipment that was used as part of uranium extraction operations, or for both uranium extraction and ground-water restoration, is considered to be subject to NRC regulation because it is 11e.(2) byproduct material. These distinctions again flow from the definition of 11e.(2) byproduct material given in the Atomic Energy Act of 1954, as amended, and the fact that the Act excludes mining from regulation by NRC. As noted above, ground-water restoration is not being conducted primarily for the extraction of uranium, and, therefore, any wastes generated solely from that process is not defined as 11e.(2) byproduct material.

It is important to note that the National Mining Association recently submitted a white paper requesting a review by the Commission of these issues. The results of this review has the potential to change the information presented here.

Should you have any questions on this letter, please contact William Ford at (301) 415-6630, or for specific health physics and decommissioning questions, please contact Duane Schmidt at (301) 415-6919, or Elaine Brummett at (301) 415-6606.

Sincerely,

Joseph J. Holonich, Chief
Uranium Recovery Branch
Division of Waste Management
Office of Nuclear Material Safety
and Safeguards

determination hinges on the definition of processing and mine water. At *in situ* leach facilities, liquid waste streams originate from the uranium recovery plant, from the production bleed, and from ground water restoration activities. Production bleed is ground water extracted from the aquifer during the uranium recovery operation in excess of injected water to maintain a net ground water inflow into the recovery zone. Effluent produced by the uranium recovery plant and by production bleed is defined as "process waste water" and is considered to be 11e.(2) byproduct material. Ground water effluent is produced at the end of a uranium recovery operation, during restoration of ground water quality in the recovery zone. Effluent produced during ground water restoration activities is considered to be "mine wastewater," and as defined in 40 CFR Part 440, is not considered to be 11e.(2) byproduct material. This effluent is defined as naturally occurring radioactive material or technologically enhanced naturally occurring radioactive material. Therefore, while the NRC may evaluate the environmental impact associated mine waste water effluent disposal, it does not license this material.

Specific criteria applicable to effluent disposal of process waste water, mine waste water, and a mixture of the two waters is contained in Appendix D of the Draft Standard Review Plan for Uranium Extraction License Applications, NUREG-1569. A final version of Appendix D will be sent to you when the final review plan is published this spring or early summer. However, Appendix D does not directly address the issues raised in your letter of well-field soil and equipment disposal. For contaminated well-field soils, it is the opinion of NRC staff that this material is subject to NRC regulation, because while it is possible that the contamination could have occurred from mine (restoration) water, it is more likely to have occurred from processing water or a mixture of process and mine waters. Soils contaminated by the processing plant or by spills and leaks from ponds that held process water or a mixture of process and mine water are subject to NRC regulation. However, soil contaminated by spills and leaks from ponds that held only mine water are not subject to NRC regulation. Contaminated plant equipment that was only used in the restoration of the well fields is not considered to be subject to NRC regulation, but plant equipment that was used as part to the processing circuit, or for both processing and ground water, restoration is considered to be subject to NRC regulation.

Should you have any questions on this letter, please contact William Ford at (301) 415-6630, or for specific health physics and decommissioning questions, please contact Duane Schmidt at (301) 415-6919, or Elaine Brummett at (301) 415-6606.

Sincerely,

Joseph J. Holonich, Chief
Uranium Recovery Branch
Division of Waste Management
Office of Nuclear Material Safety
and Safeguards

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Sincerely,

[Original signed by]
Joseph J. Holonich, Chief
Uranium Recovery Branch
Division of Waste Management
Office of Nuclear Material Safety
and Safeguards

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/S/

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Attachment C

April, 1995

"Staff Technical Position
on
Effluent Disposal at Licensed Uranium Recovery Facilities"

(Relevant Text Marked)

Staff Technical Position

on

Effluent Disposal
at Licensed Uranium Recovery Facilities

Division of Waste Management
U. S. Nuclear Regulatory Commission

April, 1995

REVISION 0

Staff Technical Position
on
Effluent Disposal
at Licensed Uranium Recovery Facilities

Background

NRC-licensed uranium recovery facilities, including milling and in situ leach (ISL) facilities, generate liquid wastes (i.e., effluent) that require proper disposal. At uranium mills, effluent may include contaminated water recovered from ground-water corrective action programs and tailings dewatering activities, and tailings liquor that must be extracted and properly disposed of before surface site reclamation can proceed.

At ISL facilities, effluent is generated from four liquid waste streams: Two involving the host aquifer and the other two originating at the main uranium recovery plant. Liquid waste streams involving the host aquifer include production bleed and ground-water sweep. Production bleed is ground water extracted from the aquifer during the uranium recovery operation, in excess of injected water, in order to maintain a net ground-water inflow into the recovery zone and minimize or eliminate the migration of lixiviant and dissolved uranium outside the recovery zone. Ground-water sweep is ground water extracted at the end of a uranium recovery operation primarily to restore ground-water quality in the recovery zone. Liquid waste streams originating at the main uranium recovery plant include wastewater from yellowcake processing and reject brine from reverse osmosis treatment of contaminated water.

Evaporation has generally been used for management of liquid waste at licensed uranium mills and mill tailings disposal sites. This practice involves discharging liquid waste in one or more on-site lined evaporation ponds where the water is lost to the atmosphere by surface evaporation and other evaporation enhancement systems, and the remaining sludge is placed in a licensed tailings disposal facility. At ISL facilities, management of liquid waste has generally involved such disposal practices as release to surface waters, on-site land applications including on-site irrigation, and injection in deep wells.

Purpose and Applicability

This Staff Technical Position (STP) provides guidance and discusses the technical and regulatory basis for review and evaluation of proposals for disposal of liquid waste at licensed uranium recovery facilities. The STP is primarily intended to guide NRC staff reviews of site-specific proposals for disposal of liquid waste at uranium mills and ISL facilities. The STP can also be used for preparation of proposals for liquid waste disposal by uranium recovery licensees and applicants.

This STP is applicable to both licensed and new facilities. Previously approved limits at licensed sites that may not conform to the applicable regulations can be changed by a site-specific license amendment.

Applicable Regulation and Standards

In general, applications and proposals for disposal of liquid waste at licensed uranium recovery facilities must comply with the regulations in Appendix A to 10 CFR Part 40, and Subparts K and D, 10 CFR Part 20, as applicable depending on the proposed disposal procedure. All terms and characterizations in this STP are to be used consistent with their definitions in the applicable regulations.

Applicable regulations in Appendix A to 10 CFR Part 40 mainly include design standards for construction, maintenance, and operation of surface impoundments that are used for disposal of liquid waste or waste containing free liquids (Criteria 5A(1) through 5A(5)); installation of liners (Criterion 5E); and seepage control (Criterion 5F). Appendix A also includes other generally applicable provisions, including in particular site-specific ground-water protection standards for both radioactive and non-radioactive hazardous constituents (Criteria 5B and 5C); corrective action programs (Criterion 5D); ground-water monitoring requirements (Criterion 7); and closure requirements (Criterion 6).

Furthermore, Criterion 8 of Appendix A to 10 CFR Part 40 requires that byproduct materials must be managed so as to conform to the applicable EPA regulations in 40 CFR Part 440, "Ore Mining and Dressing Point Source Category: Effluent Limitations Guidelines and New Source Performance Standards, Subpart C, Uranium, Radium, and Vanadium Ores Subcategory," as codified on January 1, 1983. These regulations provide technology-based limitations for disposal of wastewater from uranium mining and milling facilities by release in surface waters.

Byproduct material disposal under Part 20 requires compliance with the applicable regulations in 10 CFR Part 20, Subpart K (§20.2001, §20.2002 and §20.2007), and Subpart D (§20.1301 and §20.1302). Subpart K offers provisions for byproduct material disposal by "release in effluents" (§20.2001), or other disposal methods proposed by the licensee (§20.2002). Among other requirements, the provisions in §20.2001 and §20.2002 require compliance with the radiation dose limits for individual members of the public in §20.1301, and a demonstration of compliance with these limits as provided in §20.1302.

The dose limits in §20.1301 include the total effective dose equivalent to individual members of the public (0.1 rem/year), as well as the dose in any unrestricted area from external sources in any one hour (0.002 rem in any one hour) (§20.1301 (a) and (b)). In addition, the regulations allow a licensee to apply for Commission authorization in advance to operate up to an annual dose limit for an individual member of the public (0.5 rem), which the Commission may generally authorize on a temporary basis or under special circumstances involving existing facilities (those designed prior to January, 1994), subject to the requirements in §20.1301 (c) (1), (2), and (3). The regulations also require (in §20.1301 (d)) that licensees who are subject to the provisions of U.S. Environmental Protection Agency's (EPA) generally applicable environmental standards in 40 CFR Part 190 shall comply with these standards. In some cases, the Commission may impose additional restrictions on radiation levels and on the total quantity of radionuclides that may be released in effluents in order to restrict the collective dose at a particular site (§20.1301 (e)).

In order to demonstrate compliance with the dose limits for individual members of the public in §20.1301, licensees and applicants must do so according to the provisions of §20.1302, which require that licensees:

> (a) demonstrate compliance with the dose limits for individual members of the public by conducting surveys of radiation levels in unrestricted and controlled areas and radioactive materials in effluents released to unrestricted and controlled areas; and,
>
> (b) show compliance with the annual dose limit by demonstrating, by measurement or calculation, that the total effective dose equivalent to the individual likely to receive the highest dose from the licensed operation does not exceed the annual dose limit; OR, by demonstrating that the annual average concentrations of released radioactive materials do not exceed the effluent concentration values (for water) provided in Table 2 of Appendix B to §20.1001-§20.2401 and that the dose from external sources to a continuously exposed individual would not exceed the established standard (0.002 rem/hour and 0.05 rem in a year).

The provisions of §20.1302 also allow licensees, upon approval by the Commission, to adjust the effluent concentration values in Table 2 of Appendix B to §20.1001-§20.2401 for members of the public to take account of the actual characteristics of effluent that will be released (§20.1302 (c)).

The provisions in §20.2007 require that licensees and applicants must also comply with other applicable federal, state, and local environmental and health protection regulations governing any other toxic or hazardous properties of licensed materials disposed of under Part 20, Subpart K.

In addition to the above requirements, licensees and applicants considering disposal of licensed materials under the provisions of either §20.2001 or §20.2002 are further required to comply with NRC's regulatory provisions for decommissioning of licensed facilities, prior to facility closure and license termination. These provisions include the interim cleanup criteria presently in use, and those specified in the final rule when the final rule is promulgated (the proposed radiological criteria for decommissioning are provided in the proposed rule in 10 CFR Part 20, Subpart E: §20.1401 through §20.1405, FR Vol 59, No. 161, page 43228, dated August 22, 1994).

Proposal Review and Evaluation Criteria

In general, licensees of uranium recovery facilities are required to submit proposals for disposal of liquid waste, and obtain NRC's approval of the proposed procedures. Proposals will be approved on a site-specific basis by NRC staff based on demonstrated compliance with all of the applicable regulations.

Proposal review and evaluation criteria that will be used by the staff are discussed in the following paragraphs for four disposal procedures that have been in practice or proposed at licensed uranium recovery facilities. These include: on-site evaporation; release in surface waters; on-site land applications; and injection in deep wells.

On-Site Evaporation

In accordance with Appendix A, 10 CFR Part 40, proposals for on-site evaporation systems must demonstrate that the proposed disposal facility is designed, operated, and closed in a manner that prevents migration of waste from the evaporation systems to a subsurface soil, ground water, or surface water. In addition, applicants must demonstrate that site-specific ground-water protection standards and monitoring requirements are adequately established to detect any migration of contaminants to the ground water and to implement corrective action to restore ground-water quality if and when necessary as required by the regulations.

Evaporation pond systems will be approved if they comply with the regulatory requirements in Appendix A, 10 CFR Part 40. These mainly include the design provisions for surface impoundments (Criteria 5A(1) through 5A(5)); installation of liners (Criterion 5E); and seepage control (Criterion 5F). In addition, evaporation ponds must also meet other generally applicable regulatory provisions in Appendix A, including in particular the site-specific ground-water protection standards (Criteria 5B and 5C); corrective action programs (Criterion 5D); ground-water monitoring requirements (Criterion 7); and closure requirements (Criterion 6).

Release in Surface Waters

Proposals for release of liquid waste in surface waters must demonstrate compliance with the provisions of §20.2001 and §20.2007, and the provisions of 40 CFR Part 440 as required by Criterion 8 of Appendix A to 10 CFR Part 40, as applicable based on site-specific conditions.

Specifically, release in surface waters must meet the regulatory provisions in §20.2001 (a)(3), which requires that licensees comply with the dose limits for individual members of the public in §20.1301. In order to demonstrate compliance with the dose limits for individual members of the public in §20.1301, licensees and applicants must do so according to the provisions of §20.1302 (The provisions of §20.1301 and §20.1302 have already been discussed under Applicable Regulations).

Licensees and applicants must also comply with other applicable federal, state, and local environmental and health protection regulations governing any other toxic or hazardous properties of licensed materials disposed of under Part 20, Subpart K, pursuant to the provisions in §20.2007.

Compliance with Criterion 8 of Appendix A to 10 CFR Part 40 requires conformance to the provisions in 40 CFR Part 440, as applicable. These regulations provide technology-based effluent limitations for existing point sources, in §440.32 and §440.33) and new source performance standards (NSPS), in §440.34, promulgated by EPA under the Clean Water Act. Licensees must demonstrate compliance with these EPA regulations and standards, as applicable, including the obtaining of a National Pollutant Discharge Elimination System (NPDES) permit issued or approved by the EPA.

The regulatory provisions and requirements for release of liquid waste under a NPDES permit are outside the scope of this technical position; however, specific effluent limitations and standards in 40 CFR Part 440 (§440.30 through §440.34) that are applicable to discharges from mills and ISL uranium recovery facilities are provided and briefly discussed in an appendix to this STP.

As indicated in the appendix, there is a distinction in 40 CFR Part 440 Subpart C (i.e., NPDES standards) between "process wastewater" and "mine wastewater" with respect to ISL facilities. "Process wastewater" is wastewater and liquid waste generated from uranium recovery operations; it includes production bleed or ground water extracted from the aquifer during the uranium recovery operation, and liquid waste generated at the main uranium recovery plant. "Mine wastewater" is wastewater from post-operation ground water sweep, or ground water extracted to restore water quality in the recovery zone after a uranium recovery operation is stopped.

NPDES effluent limitations in 40 CFR 440 that are applicable to NRC licensed facilities are provided in the appendix in Tables A1 and A2. The effluent limitations in Table A1 are applicable to mills, including "process wastewater" from ISL facilities. The effluent limitations in Table A2 are applicable to mines, including "mine wastewater" from ISL facilities.

Staff notes that NRC's ISL licensees must comply with the NPDES effluent limitations for uranium in Table A2, which applies to existing mines, including "mine wastewater" from ISL facilities; this is because mines and "mine wastewater" are not covered by NRC regulations in Part 20. However, there is no such standard for uranium in Table A1, which applies to existing mills, including "process wastewater" from ISL facilities; licensees must in this case comply with the provisions in 10 CFR Part 20, Subpart K (i.e., meet the dose limits for individual members of the public pursuant to §20.1301 and other requirements to satisfy the provisions in Subpart K). Moreover, the NPDES effluent limitations for certain non-radioactive constituents for release of "process wastewater" may be different from those for release of "mine wastewater" (e.g., the effluent limitations for the chemical oxygen demand or COD in Tables A1 and Table A2, for example).

Therefore, ISL licensees proposing to dispose of byproduct material by release in effluents may need to satisfy different standards, depending on whether the disposal involves releasing a "process wastewater" or a "mine wastewater." Consequently, licensed ISL facilities that involve commingling of "process wastewater" and "mine wastewater" in an interim common storage facility (i.e., storage reservoir) before the wastewater is released in surface waters have two alternative options to satisfy the regulations. Under the first option, a licensee would monitor the incoming wastewater by source and meet the corresponding effluent limitations separately for "process wastewater" and "mine wastewater" at their respective points of discharge into the interim storage facility. If both input streams were within the appropriate effluent release limits, the licensee would be free to release the wastewater from the storage facility. In the second option, a licensee would not monitor the input streams, and would need to meet the applicable standard in 10 CFR Part 20 before releasing the commingled wastewater in surface waters.

Licensees and applicants disposing effluent by release in surface waters are further required to comply with NRC's regulatory provisions for decommissioning, prior to facility closure and license termination (decommissioning requirements have already been discussed under Applicable Regulations and Standards).

Land Applications

Proposals for disposal of liquid waste by on-site land applications, including irrigation, will be approved under the provisions of §20.2002. Licensees must in this case provide a description of the waste, including its physical and chemical properties that are important to risk evaluation; the proposed manner and conditions of waste disposal; an analysis and evaluation of pertinent information on the nature of the environment; information on the nature and location of other potentially affected facilities; and analyses and procedures to ensure that doses are maintained As Low As Reasonably Achievable (ALARA) and within the dose limits in Part 20 (i.e., §20.1301).

Proposals must analyze and assess projected concentrations of radioactive contaminants in the soil; projected impacts on ground-water and surface water quality, and on land uses including particularly crops and vegetation; and projected exposures and health risks that may be associated with radioactive constituents reaching the food chain to verify that the projected doses and risks conforming to the risk levels permitted under Part 20. It is expected that proposals include provisions for periodic soil surveys that include contaminant monitoring to verify that the contaminant levels in the soil do not exceed those projected, and a remediation plan that can be implemented in the event that the projected levels are exceeded.

In addition to the radiation dose, it may also be necessary in some cases to conduct analyses to assess the chemical toxicity of radioactive and non-radioactive constituents in order to evaluate the health risks associated with land applications involving irrigation at particular sites, in compliance with other applicable Federal, State, and local environmental and health protection regulations that must also be satisfied pursuant to §20.2007. Staff will work with appropriate State and Federal agencies if necessary to review site-specific chemical toxicity evaluations, and to verify that any necessary permits for this purpose are secured as warranted by the applicable regulations.

In the absence of compliance monitoring wells in the uppermost aquifer in the area used for effluent disposal or for installation of land application systems including temporary surface storage facilities, proposals must demonstrate that contaminants will not be returned to the ground water and cause exceedence of any site-specific ground-water protection standards that are established pursuant to Appendix A of 10 CFR Part 40.

Licensees and applicants disposing effluent by on-site land applications are further required to comply with NRC's regulatory provisions for decommissioning, prior to facility closure and license termination (decommissioning requirements have already been discussed under Applicable Regulations and Standards).

Deep-Well Injection

Proposals for disposal of liquid waste by injection in deep wells must meet the regulatory provisions in §20.2002. Specifically, proposals must in this case include a description of the waste, including its physical and chemical properties that are important to risk evaluation; the proposed manner and conditions of waste disposal; an analysis and evaluation of pertinent information on the nature of the environment; information on the nature and location of other potentially affected facilities; and analyses and procedures to ensure that doses are ALARA, and within the dose limits in Part 20 (i.e., §20.1301).

Proposals must also demonstrate that the injection zone is confined, that it is not a drinking water source, and that the injected contaminants will not cause exceedence of any established site-specific ground-water protection standards in the uppermost aquifer or result in any cross contamination that would adversely impact another zone that is a source of drinking water. If necessary and warranted by site conditions, proposals may include provisions for periodic ground-water monitoring in the vicinity of the injection well to verify that drinking water zones are free from cross contamination, and a remediation plan that can be implemented in the event that unacceptable levels of contamination are detected.

In addition, pursuant to the provisions of §20.2007, proposals for disposal by injection in deep wells must also meet any other applicable Federal, State, and local government regulations pertaining to deep well injection, and obtain any necessary permits for this purpose. In particular, proposals must satisfy the EPA's regulatory provisions in 40 CFR Part 146: Underground Injection Control (UIC) Program: Criteria and Standards, and obtain necessary permits from the EPA and/or States authorized by EPA to enforce these provisions. In general, proposals that satisfy the EPA regulations under the UIC program will be approved by NRC staff.

Licensees and applicants disposing effluent by injection in deep wells are further required to comply with NRC's regulatory provisions for decommissioning, prior to facility closure and license termination (decommissioning requirements have already been discussed under Applicable Regulations and Standards).

Appendix

Summary
Effluent Limitations and Standards Applicable to NRC Licensed Facilities in 40 CFR Part 440: "Ore Mining and Dressing Point Source Category, Subpart C, Uranium, Radium and Vanadium Ores Subcategory"

Since the NRC does not regulate conventional mining, the effluent limitations in 40 CFR Part 440 pertaining exclusively to conventional mines are not applicable to NRC licensed facilities and will not be provided or discussed in this summary.

There is a distinction in 40 CFR Part 440 Subpart C between "process wastewater" and "mine wastewater" with respect to in situ leach (ISL) facilities (see 40 CFR Part 440, Subpart L, and 47 FR 54604). "Process wastewater" is wastewater and liquid waste generated from uranium recovery operations; it includes production bleed or ground water extracted from the aquifer during the uranium recovery operation, and liquid waste generated at the main uranium recovery plant. "Mine wastewater" is wastewater from post-operation ground water sweep, or ground water extracted to restore water quality in the recovery zone after a uranium recovery operation is stopped.

Effluent limitations in 40 CFR 440 that are applicable to NRC licensed facilities are provided in Tables A1 and A2. The effluent limitations in Table A1 are applicable to mills, including "process wastewater" from ISL facilities. Effluents from existing mills, including "process wastewater" from existing ISL facilities, applying the best practicable control technology currently available (BPT) shall not exceed the attainable effluent limitations provided in Table A1.

The effluent limitations in Table A2 are applicable to mines, including "mine wastewater" from ISL facilities. Existing mines, including "mine wastewater" from ISL facilities, applying the best available technology economically achievable (BAT) shall not exceed the attainable effluent limitations provided in Table A2.

In addition to the above, the new source[1] performance standards (40 CFR Part §440.34(b)) stipulate that for new sources there shall be no discharge of process wastewater to navigable waters from mills using the acid leach, alkaline leach or combined acid and alkaline leach process for the extraction of uranium or from mines and mills using ISL methods. These regulations further stipulate that in the event that the annual precipitation falling on

[1] Pursuant to the definition of "new sources" in 40 CFR 122.2, "new" uranium recovery facilities as they pertain to the regulations in 40 CFR Part 440 are those the construction of which commenced after December 3,1982, which is the date when the effluent standards relevant to uranium recovery were first issued. "Existing" facilities are those the construction of which commenced before December 3, 1982.

the treatment facility and the drainage area contributing surface runoff to the treatment facility exceeds the annual evaporation, a volume of water equivalent to the difference between these two values may be discharged subject to the limitations set forth above.

In that the effluent limitations and standards in 40 CFR Part 440 are based on technology-based treatment requirements, effluent limitations and standards at specific sites will be imposed based on approved treatment technology on a site-specific basis by the EPA. Treatment technology would be approved for specific sites based on the regulatory provisions in 40 CFR Part 125: Criteria and Standards for the National Pollutant Discharge Elimination System; Subpart A: Criteria and Standards for Imposing Technology Based Treatment Requirements Under Sections 301 (b) and 402 of the Act (i.e. Clean Water Act) (40 CFR Part 125, §125.1 through §125.3).

Table A1
Effluent Limitations Representing the Degree of Effluent Reduction Attainable by the Application of BPT Technology

(Applicable to existing mills, including "process wastewater" from in situ leach facilities)

(Source: 40 CFR Part 440, §440.32(b))

Effluent Characteristic	Effluent Limitations	
	Maximum for any One Day	Average of Daily Values for 30 Consecutive Days
TSS (mg/l)	30	20
COD (mg/l)	---	500
As (mg/l)	1.0	0.5
Zn (mg/l)	1.0	0.5
Ra226 (dissolved); pCi/l	10	3
Ra226 (total); pCi/l	30	10
NH^3 (mg/l)	---	100
pH	6.0-9.0	6.0-9.0

Table A2
Effluent Limitations Representing the Degree of Effluent Reduction Attainable by the Application of BAT Technology

(Applicable to existing mines, including "mine wastewater" from in situ leach facilities)

(Source: 40 CFR Part 440, §440.33(a))

Effluent Characteristic	Effluent Limitations	
	Maximum for any One Day	Average of Daily Values for 30 Consecutive Days
COD (mg/l)	200	100
Zn (mg/l)	1.0	0.5
Ra226 (dissolved); pCi/l	10	3
Ra226 (total); pCi/l	30	10
U (mg/l)	4	2

Attachment D

Selected Pages

From

Power Resources December 1, 1997 Letter

(Relevant Text Marked)

POWER RESOURCES

Operations Office
800 Werner Ct.
Suite 352
Casper, Wyoming USA 82601
Tel: 307-472-2035
Fax: 307-234-2147

December 1, 1997

Chief, Rules and Directives
U.S. Nuclear Regulatory Commission.
Washington, D.C.
20555

Dear Sir or Madam:

Subject: Comments On The Draft Standard Review Plan For *In Situ* Uranium Extraction Licence Applications, NUREG-1569

Please find attached Power Resources Inc., (PRI) comments on the draft Standard Review Plan for *In Situ* Uranium Extraction License Applications. PRI is a major ISL uranium producer, producing in excess of one million pounds U_3O_8 per year for domestic and foreign electrical utilities.

We are disappointed that a ninety day extension of the review period was not granted (Holonich to Wittrup, 11/20/97) as this prevented meaningful intra-industry consultation. In general, we feel that this document should be shelved and the process started from the beginning with adequate State and industry input. The document incorporates none of the previous input from the industry, and given the rush to get this document finalized, we feel doubtful that any of our comments will be addressed this time.

As an *in situ* uranium producer, we cannot stress enough the importance of an effective and thorough review of this document with input from state and federal agencies, and the ISL industry. This SRP has the potential to significantly impact our future expansion plans, and possibly our profitability and viability, if carried forward without the necessary review and input.

Sincerely,

Mark Wittrup, MSc., P.Eng.
Director, Environment and Safety

cc: M. Loomis, WMA
K. Sweeney, NMA
J. Holonich, NRC
C. Schmitt
M. Chalmers
P. Hildenbrand
W. Kearney

significant flaws and inconsistencies that should be addressed by NRC. The uranium industry was told at that time that the effluent disposal document was to be reevaluated in December 1996 and that industry's comments would be addressed at that time. Comparing the1995 guidance document with Appendix D of the draft SRP clearly shows that the document has not been reevaluated as promised nor have any of the uranium industry's concerns been addressed. Appendix D of the SRP should be revised to address industry's concerns. Comments provided to NRC by Power Resources, Inc. in October 1995 can be found as Attachment A to this document.

39. **Appendix E, Recommended Outline for Site-Specific In Situ Leach Facility Reclamation and Stabilization Cost Estimates, Pages E-1 through E-5:** Same as Comment 33 above.

Attachment A: Comments to the NRC Regarding Effluent Disposal at Licensed Uranium Recovery Facilities

BACKGROUND

1. The STP states that reverse osmosis (RO) reject brine is a liquid waste from the processing of yellowcake. This is not true. RO is used during ground water restoration as a tool to assist in returning the affected ground water to its pre-mining condition. The RO reject brine is a waste connected with ground water restoration rather than yellowcake processing.

2. The STP states that evaporation is used for management of liquid wastes at licensed uranium mills and tailings disposal sites. This is not true. Liquid wastes from conventional mills are sent to the tailings disposal facility along with the solid wastes. The only time evaporation may be used is during decommissioning when ground water from under the tailings disposal site may be pumped to evaporation ponds as part of a Corrective Action Plan to mitigate a ground water contaminant plume.

3. The STP states that management of liquid wastes at ISL sites includes release to surface waters. This is generally only true for ground water restoration fluids as the EPA, NPDES regulations prohibit surface discharge of process waste water from ISL facilities. However, PRI believes that the in situ mining fluids are indeed mine water, not process waste water, and should be eligible for NPDES surface discharge. This opinion is apparently inconsistent with EPA's interpretation, which considers

the mining fluids to be process fluids.

APPLICABLE RULES AND REGULATIONS

1. The first part of this section (page 2) states that disposal of liquid waste must comply with 10 CFR 40, Appendix A requirements including the closure (decommissioning) requirements of Criterion 6. The last paragraph of this section (page 3) states that, in addition, licensees will also be required to comply with NRC regulatory provisions for decommissioning and closure and references the proposed rule at 10 CFR 20.1401 through 20.1405. These two statements are contradictory since the unrestricted release criteria for soil radium concentration in Criterion 6 of 10 CFR 40, Appendix A is 5/15 pCi/gram while the proposed criteria in 10 CFR 20.1404 has a 15 mrem/year TEDE requirement which, for radium, is equivalent to 0.1 pCi/gram. The language of the STP indicates that Licensees will have to meet both criteria which is impossible to accomplish. Additional clarification should be provided.

2. Proposed 10 CFR 20.1401 states that as applied to uranium mills, the proposed decommissioning criteria would apply only to decommissioning of the facility and not to the disposal of tailings or soil cleanup which is to be performed in accordance with 10 CFR 40, Appendix A. Historically, the NRC has required ISL's to comply with the Appendix A requirements for soil cleanup. Does the term "uranium mills" of the proposed 10 CFR 20.1401 include ISL facilities in this sense as it does in Appendix A of Part 40?

ON-SITE EVAPORATION

1. This section appears to confuse tailings cells with evaporation ponds. The requirements of 10 CFR 40, Appendix A apply to impoundments that are designed to dispose of liquid and solid wastes resulting from uranium or thorium milling operations, or mill tailings. Evaporation ponds are designed to contain ground water or other liquid effluents with relatively small quantities of suspended and dissolved solids. Therefore, the design criteria in Appendix A are not appropriate for evaporation ponds.

2. This section also states that evaporation ponds must comply with the closure standards of Criterion 6 in 10 CFR 40, Appendix A. Criterion 6 specifies that the waste disposal area must be closed by placing an earthen cover over the waste material (ie., buried in place). Historically, the NRC has required that evaporation ponds be excavated and disposed at a tailings facility or other disposal facility licensed by the NRC to accept by-product material. Does the language in the STP represent a change of NRC policy regarding decommissioning of evaporation ponds?

Attachment E

40 CFR 440.34

(Relevant Text Marked)

mines using in-situ leach methods shall not exceed:

Effluent characteristic	Effluent limitations	
	Maximum for any 1 day	Average of daily values for 30 consecutive days
	Milligrams per liter	
TSS	30	20
COD	200	100
Zn	1.0	0.5
Ra226 [1] (dissolved)	10	3
Ra226 [1] (total)	30	10
U	4	2
pH	(2)	(2)

[1] Values in picocuries per liter (pCi/l).
[2] Within the range 6.0 to 9.0.

(b) The concentrations of pollutants discharged from mills using the acid leach, alkaline leach or combined acid and alkaline leach process for the extraction of uranium, radium and vanadium including mill-mine facilities and mines using in-situ leach methods shall not exceed:

Effluent characteristic	Effluent limitations	
	Maximum for any 1 day	Average of daily values for 30 consecutive days
	Milligrams per liter	
TSS	30	20
COD	----------	500
As	1.0	.5
Zn	1.00	.5
Ra226 [1] (dissolved)	10	3
Ra226 [1] (total)	30	10
NH_3	----------	100
pH	(2)	(2)

[1] Values in picocuries per liter (pCi/l).
[2] Within the range 6.0 to 9.0.

§440.33 Effluent limitations representing the degree of effluent reduction attainable by the application of the best available technology economically achievable (BAT).

Except as provided in Subpart L of this part and 40 CFR 125.30 through 125.32, any existing point source subject to this subpart must achieve the following limitations representing the degree of effluent reduction attainable by the application of the best available technology economically achievable (BAT):

(a) The concentration of pollutants discharged in mine drainage from mines, either open-pit or underground, that produce uranium ore, including mines using in-situ leach methods, shall not exceed:

Effluent characteristic	Effluent limitations	
	Maximum for any 1 day	Average of daily values for 30 consecutive days
	Milligrams per liter	
COD	200	100
Zn	1.00	.5
Ra226 [1] (dissolved)	10.0	3.0
Ra226 [1] (total)	30.0	10.0
U	4.0	2.0

[1] Values in picocuries per liter (pCi/l).

§440.34 New source performance standards (NSPS).

Except as provided in Subpart L of this part any new source subject to this subpart must achieve the following NSPS representing the degree of effluent reduction attainable by the application of the best available demonstrated technology (BADT):

(a) The concentration of pollutants discharged in mine drainage from mines, either open-pit or underground, that produce uranium ore, excluding mines using in situ leach methods, shall not exceed:

Effluent characteristic	Effluent limitations	
	Maximum for any 1 day	Average of daily values for 30 consecutive days
	Milligrams per liter	
COD	200	100
Zn	1.0	0.5
Ra [1] 226 (dissolved)	10.0	3.0
Ra [1] 226 (total)	30.0	10.0
U	4.0	2.0
pH	(2)	(2)
TSS	30.0	20.0

[1] Values in picocuries per liter (pCi/l).
[2] Within the range 6.0 to 9.0.

(b)(1) Except as provided in paragraph (b) of this section, there shall be no discharge of process wastewater to navigable waters from mills using the acid leach, alkaline leach or combined acid and alkaline leach process for the extraction of uranium or from mines and mills using in situ leach methods. The Agency recognizes that the elimination of the discharge of pollutants to navigable waters may result in an increase in discharges of some pollutants in the process to extract uranium from ore and wastes produced in this step therefore meet the definition of 11e.(2) byproduct material.

The argument that groundwater restoration waste water is not 11e.(2) byproduct material relies on separating the processes in an *in situ* facility into those that directly lead to production of uranium from ore and those for other purposes. Under this argument, groundwater restoration is a process that is independent of the extraction of uranium and therefore wastes produced during this process are not 11e.(2) byproduct material.

Both of the above arguments are reasonable and, as discussed in the Commission Paper, NRC has taken both positions. In the past, NRC considered groundwater restoration waste water as 11e.(2) byproduct material. In the 1995 staff guidance, "Staff Technical Position on Effluent Disposal at Licensed Uranium Recovery Facilities," groundwater restoration waste water is considered not to be 11e.(2) byproduct material.

Waste waters produced during uranium extraction

This waste water is also called process bleed water and consists primarily of production bleed. In order to maintain a net inward pressure in the aquifer that is being worked, more water is extracted than is reinjected back into the aquifer. The excess water that is not reinjected is waste water called production bleed. However, because the all the water that is pumped to the surface from the aquifer contains uranium, it is first processed to remove the uranium. Thus, the production bleed is a waste water stream that is diverted after the uranium is extracted. As such, it clearly meets the definition of 11e.(2) byproduct material. This is the position that NRC has always taken.

Option 3 in the Commission Paper proposes to treat production bleed as mine waste water and not 11e.(2) byproduct material without discussing how that would comport with the definition of 11e.(2) byproduct material. It draws a distinction for wastes resulting from the production of yellowcake but does not explain the basis for that distinction. However, the definition of 11e.(2) byproduct material specifically refers to "extraction" of uranium and the production bleed is diverted after the extraction of the uranium from the water. This can be seen in the figure on page 101 of April 1998 White Paper prepared by the National Mining Association. In that figure, it can be seen that the bleed is diverted after the water from production wells passes through the ion exchange column and the uranium is extracted by the resin.

<u>Alternative</u>

An option not considered in the Commission Paper is: 1) to continue to classify waste waters produced during uranium recovery as 11e.(2) byproduct material in conformance with past and current NRC practice, and 2) allow licensees to designate groundwater restoration waste water as either 11e.(2) byproduct material or mine wastes on a case by case basis. This would solve many of the problems identified in the other options. Licensees with separate ponds for the two waste water streams can designate the groundwater restoration waste water as mining waste. Licensees that mix the two waste water streams can designate the groundwater restoration waste water as 11e.(2) byproduct material. This will also remove concerns that evaporation pond sludges sent to tailings piles in the past may not have been 11e.(2) byproduct material.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

December 21, 1998

MEMORANDUM FOR: Carl J. Paperiello, Director
Office of Nuclear Material Safety
and Safeguards

FROM: John J. Surmeier, Chairman
Differing Professional View Panel

SUBJECT: DIFFERING PROFESSIONAL VIEW PANEL REPORT ON HANDLING OF LIQUID EFFLUENT RELEASES FROM *IN SITU* LEACH OPERATIONS AT LICENSED FACILITIES

Pursuant to the Management Directive 10.159 entitled "Differing Professional Views and Opinions," you established a Differing Professional View (DPV) Panel to review DPVs from two individuals on a related issue concerning the handling of liquid effluent releases from *in situ* leach (ISL) uranium extraction operations at licensed facilities. The two DPVs were submitted by Mr. William H. Ford on October 20, 1998 and Dr. Myron Fliegel on November 19, 1998. Initially, you established a DPV Panel, consisting of Stuart Treby, Duane Schmidt, and me, to review Mr. Ford's concerns. After receiving second DPV on the same subject, however, it appeared useful for our Panel to evaluate the concerns of both staff members. Dr. Fliegel agreed to use the existing Panel.

Both Mr. Ford's and Dr. Fliegel's DPVs raise a number of complex issues that they assert have been created by staff redefining what is or is not waste under section 11e.(2) of the Atomic Energy Act of 1954, as amended by the Uranium Mill Tailings Radiation Control Act of 1978.

The Panel finds that many of the concerns expressed in the DPVs are reasonable and that they should be addressed and considered by senior management in accordance with the Panel's recommendations in the attached Report.

The Panel would be pleased to discuss our Report at your convenience.

Attachment: As stated

cc: M. Fliegel
W. Ford
J. Greeves
J. Holonich
N. Stablein

Attachment 4

Differing Professional View Panel Report

Concerning Handling of

Liquid Effluent Releases From *in Situ* Leach

Operations at Licensed Uranium Recovery Facilities

12/21/98
John J. Surmeier, Chairman

12/21/98
Stuart A. Treby, Panel Member

12/21/98
Duane W. Schmidt, Panel Member

DIFFERING PROFESSIONAL VIEW PANEL REPORT CONCERNING HANDLING OF LIQUID EFFLUENT RELEASES FROM IN SITU LEACH OPERATIONS AT LICENSED URANIUM RECOVERY FACILITIES

I. INTRODUCTION

This report discusses the review of the Differing Professional Views (DPVs) from two individuals on a related issue concerning the handling of liquid effluent releases from *in situ* leach (ISL) uranium extraction operations at licensed facilities. The two DPVs were submitted by:

- **William H. Ford** to Carl J. Paperiello, Director, Office of Nuclear Material Safety and Safeguards (NMSS) on October 20, 1998 (Attachment A). Mr. Ford, in his DPV, objects not only to the current Division of Waste Management's (DWM's) policy towards regulating liquid effluent at ISL facilities but also to Option 3 in the proposed Commission Paper entitled "Recommendations on Ways to Improve the Efficiency of NRC Regulations at *In Situ* Leach Uranium Recovery Facilities" (hereafter referred as the proposed Commission Paper). Mr. Ford believes that all of the liquid effluent releases should be considered as "11e.(2) byproduct material," as practiced by NRC staff prior to 1995. Furthermore, his view would be the same whether or not the NRC relied on the Environmental Protection Agency (EPA) Underground Inject Control (UIC) Program.

  Mr. Ford submitted several supporting documents with his DPV: (1) Selected pages from the National Mining Association White Paper presented before the Commission on June 17, 1998; (2) a letter to Ms. Ruth E. McBurney, Director Division of Licensing, Registration, and Standards, Bureau of Radiation Control, Texas Department of Health from Joseph J. Holonich, dated May 5, 1998; (3) the April 1995, DWM "Staff Technical Position on Effluent Disposal at Licensed Uranium Recovery Facilities; and (4) Selected pages from Power Resources December 1, 1997 Letter. These documents are included as part of Attachment A. Mr. Ford later provided additional supporting documents for Panel consideration that will be referenced separately.

- **Myron Fliegel** to Joseph J. Holonich, Chief, Uranium Recovery Branch, DWM/NMSS on November 19, 1998 (Attachment B). Dr. Fliegel disagrees with some of the conclusions and recommendations in the addressed the proposed Commission Paper. He concluded that Option 3 of the proposed Commission Paper did not conform with a plain English reading of the definition of 11e.(2) byproduct material and should be rejected.

Following receipt of the first DPV from Mr. Ford, a Panel was established to review it in accordance with NRC Management Directive 10.159, "Differing Professional Views and Opinions." The Panel members were John J. Surmeier, Chairman; Stuart A. Treby; and Duane W. Schmidt. The second DPV was assigned to the existing Panel after agreement by Dr. Fliegel, and was confirmed in a memorandum from Carl J. Paperiello, Director, Office of Nuclear Material Safety and Safeguards, dated November 27, 1998. (Attachment C.)

II. BACKGROUND

Both Mr. Ford's and Dr. Fliegel's DPVs raise a number of complex issues that required considerable research. Attachment D contains a list of the documents reviewed by the Panel, with a synopsis of pertinent information. The following discussion provides the reader with background information relating to the DPVs discussion that follows.

A. In-Situ Leach Uranium Extraction — The Effluent Streams

At ISL facilities, we often think of two phases of activity -- the production phase and the restoration of groundwater. In the production phase, ISL facilities produce uranium by using injection and production wells to circulate lixiviant (water containing chemicals), which mobilizes and transports uranium and other chemical constituents, through an aquifer. When the water is pumped to the surface, the uranium recovery plant removes the uranium prior to returning the water to the aquifer. When uranium extraction activities in a well field are no longer economically viable, the groundwater quality in the aquifer is restored (restoration phase). The reason for this restoration is that in the process of extracting uranium, the lixiviant dissolves other constituents that remain in the groundwater such as radium, selenium and arsenic.

During the production phase, at ISL facilities, the liquid waste streams originate from (1) the production bleed from the well field, and (2) other aspects of uranium recovery in the plant. The production bleed consists of groundwater extracted from the aquifer during the uranium recovery operations in excess of injected water and is used to maintain a net groundwater inflow into the uranium extraction zone. The other liquid waste streams are from such aspects as elution of the uranium from the ion-exchange resins, washing and production of yellowcake, and other miscellaneous sources.

During the restoration phase, the ISL facility may continue to extract and concentrate uranium through the ion exchange process as long as it remains economical. As a result, some of the restoration phase effluent wastes may be very similar to those in the production phase. On the other hand, there are other waste streams unique to restoration techniques such as from groundwater sweep (in which no water is reinjected into the aquifer) and reverse osmosis.

At ISL facilities, management of liquid waste has involved such disposal practices as release to surface waters, evaporation from lined impoundments, land application, and deep well injection.

B. 11e.(2) Byproduct Material

The Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA) amended Section 11e. of the Atomic Energy Act (AEA) to include specifically as byproduct material ". . . . the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content." For purposes of this paper, these tailings or wastes, as defined in Section 11e.(2) of the AEA, will be designated as "11e.(2) byproduct material."

C. The Effluent Waste Stream Problem -- Where in the Process Is 11.e(2) Byproduct Material Created?

This question of where 11e.(2) byproduct material is created has been a highly controversial issue since at least 1980. This issue has been the concern of industry and the NRC staff. A root cause relates to differing interpretations of where in the ISL process extraction or concentration takes place and therefore 11e.(2) byproduct material is created. There has never been a "definitive" determination that has resolved the controversy. In trying to resolve this issue, NRC staff has modified its guidance practice over the past several years. In each case, industry has strenuously objected. Staff now is proposing another change in its guidance that is contained in a proposed Commission Paper. The two DPVs express concerns over the direction and recommendations in the Commission Paper. Additional details on this problem are presented in Section D and Attached D of this Report.

D. Historical Perspective

The groundwater and effluent release controversy over NRC licensed ISL facilities goes back to at least 1980 when the Governor of the State of Wyoming questioned NRC's regulatory authority over groundwater at ISL facilities. The concern by the Governor may have been as a result of: (1) UMTRCA not explicitly mentioning in situ operations; (2) the definition in 10 CFR 40.4 of "byproduct material" that excludes underground ore bodies depleted by solution extraction; and (3) the 1980 "Bevill Amendment" to EPA's Resource Conservation and Recovery Act (RCRA) in which high volume, low-level wastes from mining or mineral processing are excluded from the definition of hazardous waste (40 CFR 261.4(b)(7)).

In an April 28, 1980 memorandum to Chairman Ahearne from Howard K. Shapar, Executive Legal Director, the Office of the Executive Legal Director (OELD) concluded that under the licensing and regulatory authority found in the AEA, as amended by UMTRCA, the NRC had the authority to protect groundwater at ISL facilities through the imposition of groundwater protection conditions in ISL licenses. (See Attachment E-2.)

During the next eighteen years, the industry and the affected States—both Agreement and non-Agreements States—have raised concerns on this issue. NRC staff first provided policy guidance on effluent release at ISL facilities in 1987 which was reissued in 1993 in the Uranium Recovery Policy and Guidance Directive System, as LLWM-87-01. This NRC staff policy reaffirmed the conclusions reached in the 1980 OELD Legal Opinion and stated that the staff may elect, as a matter of regulatory policy, to discharge its responsibility by deferring to a State for regulatory control.

In 1994, Shaw, Pittman, Potts & Trowbridge, on behalf of six companies engaged in ISL uranium operations, requested a review and reversal of NRC's 1980 OELD Legal Opinion that provided the basis for NRC' legal authority to impose license conditions to protect groundwater from contaminants which result from licensed operations connected with ISL extraction of source material. NRC staff responded by stating that the "[p]otential contaminants of groundwater resulting from in situ operations are clearly within the scope of NRC's regulatory control under the Atomic Energy Act, as amended, by UMTRCA." While not included in the DWM response to Shaw, Pittman, Potts & Trowbridge, the OGC staff memorandum used as a basis for the above response made a very cogent observation by noting that "[i]f NRC has no jurisdiction it has no authority to exempt."[1] The OGC staff memorandum also indicated that the submitted legal arguments were not convincing enough to alter the conclusions reached in the 1980 OELD Legal opinion.

In 1995, DWM issued a Staff Technical Position (STP), "Effluent Disposal at Licensed Uranium Recovery Facilities." Among other things the STP differentiated for the first time between how process and restoration effluent wastes at ISL facilities were to be regulated. Process wastes were considered those wastes associated with the production phase of operations (with primary purpose being extraction of uranium) in a given wellfield and therefore 11e.(2) byproduct material, while restoration wastes were considered those associated with the restoration phase (with primary purpose being ground water quality restoration) and therefore implicitly not considered 11e.(2) byproduct material. Based on the material the Panel has reviewed, the industry response was that this change in staff position was not helpful. Specifically, it resulted in an increased uncertainty as to how to dispose of waste which now could be commingled process waste (11e.(2) byproduct material) and restoration waste (not 11e.(2) byproduct material).

In 1997, NRC published a Draft Standard Review Plan for In Situ Uranium Extraction License Applications, NUREG-1569, that incorporates an effluent release concept modified from the 1995 STP. Again, it appears as if the ISL industry comments were negative. Power Resources Inc. (PRI), an NRC ISL licensee, stressed in its response the need for an effective and thorough review of this document with input from state and federal agencies, and the ISL industry. PRI further stated that "[t]his SRP has the potential to significantly impact our future expansion plans, and possibly our profitability and viability, if carried forward without the necessary review and input."

In 1998, the National Mining Association (NMA) submitted a White Paper, prepared by Shaw, Pittman, Potts & Trowbridge and the Associate General Counsel of NMA, to the NRC in April 1998. Among other issues, the White Paper devoted over thirty pages to discussing NRC's jurisdiction over ISL facilities. The White Paper raised questions concerning NRC's current liquid effluent guidance policy (Option 1 in the proposed Commission Paper). The NMA stated that it believed "[a]s a practical matter, NRC staff's misapplication and misuse of the AEA jurisdictional definitions has put ISL licensees in an awkward position. This is particularly troublesome in the context of handling ISL liquid effluents." The White Paper suggested two other approaches:

(1) "Under one such approach, if NRC continues to assert that ISL mining really is a type of process, then the underground ore body is like the mill at a conventional facility. This means that like a conventional mill, the underground ore body is 11e.(2) byproduct material. Accordingly, *all wastewater* for the ISL wellfields would be 11e.(2) byproduct material." (Option 2 in the proposed Commission Paper.)

(2) "However, another approach, and the better reasoned one, is for NRC to agree that it does not have jurisdiction over ISL wellfields until the pregnant lixiviant at a minimum

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[1] Memorandum from Robert L. Fonner to Joseph J Holonich, "Jurisdiction Over Wellfields at In Situ Uranium Recovery Operations, dated March 30, 1994, p. 2. (Reproduced in Attachment E.)

reaches the IX but more appropriately when it reaches the elution stage at the mill. This would mean that production bleed would be a mining waste, not a processing waste, and would allow this material to be disposed of pursuant to an NPDES permit. Any sludges resulting from these effluent streams would qualify for RCRA's Bevill exclusion. The only 11e.(2) byproduct material under this alternative would be discrete surface wastes from the production of yellowcake after the IX." (Note: This approach may be considered similar to Option 3 in the proposed Commission Paper; however, the White Paper implies that the NRC agree that it does not have jurisdiction. The Commission Paper states that NRC can defer its authority to others (EPA or EPA's Primacy States), thus affirming that NRC does have jurisdiction over all groundwater at ISL sites.)

III. DPV SUMMARIES

A. William Ford's DPV (Attachment A)

Mr. Ford's DPV discussed the reasons why all liquid effluent from *in situ* leach uranium extraction facilities should be considered as 11e.(2) byproduct material as was done by the NRC staff from at least the early 1980's up until this policy was changed by the Division of Waste Management (DWM) in its April, 1995 "Staff Technical Position on Effluent Disposal at Licensed Uranium Recovery Facilities" (hereafter referred to as the 1995 STP). Second, Mr. Ford presents arguments to support the reasons he is opposed to the current staff practice (using the 1995 STP) whereby some liquid effluent releases are regulated by the NRC while some are not. Finally, the DPV argues against the proposed staff alternative policy (Option 3 in the proposed Commission Paper) in which NRC would relinquish all regulatory authority over liquid effluent releases including both "production bleed" and ground water restoration waste waters.

Mr. Ford believes that the current staff practice (1995 STP) and the proposed alternative (Option 3 in the proposed Commission Paper) create great uncertainty for all parties. These options open up potential litigation and would require licensees and the NRC to spend increased resources caused by disagreements over regulatory authority and locating acceptable waste disposal sites. He further argues that these two alternatives also (1) weaken NRC authority over the regulation of 11e.(2) byproduct material sites in general including conventional uranium mills and (2) encourage State governments to extend their regulatory control to 11e.(2) byproduct disposal sites.

Mr. Ford, in his cover memorandum to the DPV, indicated that he was aware that the staff was preparing a Commission Paper recommending that NRC remove itself from the review of groundwater protection at *in situ* leach facility by relying on the Environmental Protection Agency's Underground Injection Control (UIC) Program. He does not object to this proposed action; however, his professional view on liquid effluents would be the same whether or not the NRC relied on EPA's UIC Program.

B. Myron Fliegel's DPV (Attachment B)

Dr. Fliegel's DPV addresses Option 3 in the proposed Commission Paper entitled: "Recommendations on Ways to Improve the Efficiency of NRC Regulations at *In Situ* Leach Uranium Recovery Facilities". Among other things, Option 3 proposes to treat "production bleed" at *in situ* leach facilities as non 11e.2 byproduct material. (In order to maintain a net inward pressure in the aquifer that is being worked, more water is extracted than is reinjected back into the aquifer. The excess water that is not reinjected is waste water called "production bleed.") Dr. Fliegel believes that the third option is inconsistent with a plain English reading of the definition of 11e.(2) byproduct material. He believes that it is clear that there is concentration of uranium at the ion exchange stage and that the production bleed is, therefore, 11e.(2) byproduct material. He further believes that one cannot make a distinction between the waste stream resulting after the elution stage (washing and production of the yellowcake) and the waste stream consisting of the production bleed produced at the ion exchange stage.

IV. SUMMARY OF ISSUES REVIEWED BY THE DPV PANEL

The Panel reviewed the material discussed cited above as well as the documents listed in Attachment D. The Panel held discussions with Mr. Ford, Dr. Fliegel, and Mr. Joseph Holonich, Acting Deputy Director, NMSS/DWM. A summary of the key issues reviewed and the Panel's findings are presented below.

A. Definition of 11e.(2) Byproduct Materials

As noted above, section 11.e(2) of the AEA, defined "byproduct material" to include " . . . the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content." In developing the implementing regulations of 10 CFR 40, the Commission modified the definition slightly, to specifically include surface wastes from ISL facilities while excluding the depleted underground ore body: " . . . the tailings or wastes produced by the extraction of uranium or thorium from any ore processed primarily for its source material content, including discrete surface wastes resulting from uranium solution extraction processes. Underground ore bodies depleted by such solution extraction operations do not constitute 'byproduct material' within this definition." For uranium ISL facilities, important aspects of the definition of 11e.(2) byproduct material are that (1) the material must be a waste, (2) the waste is produced during the process of extraction *or* concentration of uranium, and (3) the extraction or concentration is from ore that is processed primarily for its source material (uranium) content.

In contrast to "source material," the Commission has not established through rulemaking any lower (bounding) limit or de minimis concentration for 11.e(2) byproduct material, below which the material would no longer be considered 11e.(2) byproduct material. Thus, the dilution of 11e.(2) byproduct material with water or other liquids would not in and by itself make it non-11e.(2) byproduct material.

B. Classification of the Waste Streams

Determination of where in the ISL process "extraction or concentration of uranium" occurs, and the resulting waste stream, is central to the issues raised in the DPVs.

Production Bleed Waste Stream

Both Mr. Ford and Dr. Fliegel argue in their DPV's that the "production bleed" waste stream is integral to the process for the extraction of uranium. In Options 1 and 2 of the proposed Commission Paper, the staff classifies the "production bleed" as 11e.(2) byproduct material. This is consistent with a determination that the production bleed is a waste water stream that is diverted after the ion exchange columns. Uranium is clearly concentrated (and could be considered extracted) in the ion exchange resin, so production bleed is a waste resulting from the concentration of uranium.

However, in the recommended Option 3, staff proposes the NRC should no longer classify the production bleed as 11.e(2) byproduct material

> ". . . since it is a waste that is generated as part of ensuring protection of ground water and not as a result of extracting uranium. Production bleed, instead, would be reclassified as a 'mine wastewater.'" (See page 6 of the 12/16/98.)

No information is provided in the proposed Commission Paper for concluding that the activity of "concentration or extraction of uranium" is moved from the ion exchange columns to the elution stage. In addition, industry information (not included in the proposed Commission Paper) indicates that the production bleed also serves a production purpose, and is useful toward the extraction of uranium. In the Power Resources, Inc. amendment application for its Gas Hill Project (Chapter 3, page 3-50, dated June 1998) the following statement is made concerning the production or "wellfield" bleed.

> "The ISL process is operated as a closed system, with the total injection rate to the wellfield maintained below the total production rate from the wellfield. The water which is removed is referred to as bleed or purge. The bleed performs **two functions** in the well field operation:
>
> "1. **Prevents an unwanted build-up of anions which compete with uranium for ion exchange sites and must be removed during ground water restoration;** and
>
> "2. Creates a hydrologic cone of depression within the mined zone which prevents the unwanted migration of lixiviant away from the mining area.
>
> "The bleed will be removed from the closed system after the lixiviant passes through the ion exchange system for uranium removal." **[Bold face added for emphasis.]**

The NMA in its White Paper also indicates that this bleed "brings fresh water into the mining zone to inhibit the build up of contaminants that could reduce the efficiency of the mining operation."[2]

[2] "Recommendations for a Coordinated Approach to Regulating the Uranium Recovery Industry: A White Paper" presented by the National Mining Association, dated April 22, 1988, p. 102.

While Mr. Ford in his DPV did not address Dr. Fliegel's concerns, he raised a number of issues concerning the potential adverse impact that excluding the production bleed from NRC regulation (Option 3 of the proposed Commission Paper) could have on NRC, the industry and States.

FINDING: In the proposed Commission Paper, the staff asserts that the production bleed only serves the purpose of protecting groundwater and therefore can be classified as mine waste water. Contrary to this view, the additional industry information indicates that the production bleed also aids in the concentration of the uranium at the ion exchange columns. Dr. Fliegel shares this view that concentration of uranium occurs at the ion exchange columns. Since these points are not directly addressed, additional justification for classifying this waste stream as non-11e.(2) byproduct material appears to be warranted in the Commission Paper.

In addition, Mr. Ford has raised arguments pointing out the disadvantages of the staff's recommended approach in Option 3. His DPV raises reasonable arguments for consideration by senior management and should be addressed in any rulemaking to clarify regulation of ISL uranium extraction activities.

<u>Groundwater Restoration Waste Stream</u>

The DPVs (particularly Mr. Ford) raise arguments that the groundwater restoration waste streams should be 11e(2) byproduct materials contrary to the DWM Staff Technical Position. One argument, discussed by Dr. Fliegel as reasonable, is that ground water restoration wastes are 11e.(2) byproduct material if one considers the ISL facility as an entity with the sole purpose of producing uranium from ore. As such, any waste produced from that facility, at any time in the life cycle of the facility, can be viewed as waste produced by the extraction or concentration of uranium, since there was no other purpose for the facility. Using this argument, ground water restoration is a necessary step in the process to extract uranium from ore and wastes produced in this step therefore meet the definition of 11e.(2) byproduct material.

The ISL operation is almost a closed-loop process. After leaching with the lixiviant the underground ore body is processed ore. The pregnant lixiviant (containing uranium) is brought to the surface, where it is passed through an ion-exchange system to remove the uranium; then the barren lixiviant is reinjected (possibly with additional fresh lixiviant) into the ore body where the uranium is again dissolved. It can be argued that the lixiviant reinjected last contains wastes produced from the extraction in the ion-exchange system and thus would be by definition 11e.(2) byproduct material. As result, after the process circuit ceases operation, the contaminated ground water would be 11e.(2) byproduct material. It could then be argued that all wastes from ground water restoration from that point on would also be 11e.(2) byproduct material, and would be under the jurisdiction of UMTRCA, EPA standards, and NRC regulations.

Another argument that ground water restoration wastes are 11e.(2) byproduct material is that running lixiviant through an ore body is processing which extracts uranium from the ore body into the process water (lixiviant). Thus, any waste produced, including the contaminated ground water, would be considered 11e.(2) byproduct material.

A fourth argument, that ground water restoration wastes are 11e.(2) byproduct material, is that only the depleted ore body is specifically excluded from the definition of byproduct material in the regulation (10 CFR 40.4). The contaminated ground water is not excluded from the definition of byproduct material, and so should be considered to be included as byproduct material.

Mr. Ford in his DPV identifies a series of arguments against the current DWM Technical Position (Option 1 in the proposed Commission Paper). Some of the principal ones are: 1)Defining groundwater undergoing restoration as non-11e(2) byproduct material has the potential to weaken NRC regulatory authority over liquid, air, and solid emissions from 11e.(2) facilities and the decommissioning and cleanup of those facilities; 2) Current staff practice will create disagreements between licensees, the NRC, and the public, over what the NRC regulates; 3) State governments may be encouraged to regulate 11e.(2) disposal facility since the material would be commingled radioactive and chemical waste; 4) Health, safety, and environmental risks will be increased by encouraging onsite disposal and the creation of many small disposal sites of radioactive material; and 5) Current staff practice will make it very difficult for some licensees to locate disposal sites that will accept contaminated material. In his DPV, Mr. Ford identifies a series of arguments in favor of returning to the pre-1995 NRC staff policy of treating all waste streams as 11e.(2) byproduct material (Option 2 of the proposed Commission Paper).

FINDING: The DPVs raise reasonable arguments for consideration by senior management and should be addressed in any future rulemaking to clarify regulation of ISL uranium extraction activities.

V. PANEL RECOMMENDATIONS

Pursuant to Management Directive 10.159, the Panel has restricted its recommendations to only those concerns raised either in the DPVs or follow up discussions with Mr. Ford and Dr. Fliegel.[3]

1. The proposed Commission Paper needs to be reviewed and potentially revised to address the findings made above.

2. Senior management needs to give consideration to the arguments made in the DPVs in any future rulemaking to clarify NRC's regulation of ISL uranium extraction activities.

3. Senior management needs to reevaluate whether the current practice (Option 1 in the Commission Paper) should be continued upon consideration of the arguments in Mr. Ford's DPV.

[3] Given the 18-year history and the Panel's review of this complex issue, the Panel suggests that consideration be given to developing legislation to clarify how ISL uranium extraction activities and the resulting waste should be regulated.

January 20, 1999

TO: Carl J. Paperiello, Director
Office of Nuclear Material Safety and Safeguards

SUBJECT: COMMENTS ON COMMISSION PAPER TITLED "RECOMMENDATIONS ON WAYS TO IMPROVE THE EFFICIENCY OF NRC REGULATION AT IN SITU LEACH URANIUM RECOVERY FACILITIES"

William Ford filed a Differing Professional Opinion on October 20, 1998, titled, "*Differing Professional View Concerning Nuclear Regulatory Commission Regulation of Liquid Effluents From In Situ Leach Uranium Extraction Facilities*" and Myron Fliegel filed a Differing Professional Opinion on November 19, 1998, titled "*Differing Professional View On Commission Paper Titled: "Recommendations on Ways to Improve the Efficiency of NRC Regulation at in Situ Leach Uranium Recovery Facilities"*. At this time, the Differing Professional View Panel has completed it's recommendation to the Office Director and we are presently awaiting your decision. Meanwhile, we have recently received a draft of the Commission Paper that was sent to the Executive Director for Operations in January 1999. This paper has our Differing Professional Opinions attached to it. In our opinion, the Commission paper does not address the concerns of the Differing Professional Views or the recommendations of the Differing Professional View Panel.

After reading this draft of the Commission Paper we wish to high-light two observations, in addition to the comments in our Differing Professional Views.

1. The commission paper does not provide any support for the statement that the current staff practice is more consistent with the definition of 11e.(2) byproduct material in the Atomic Energy Act.

On page 5 the statement is made with respect to the current staff approach (Option 1) that "*The principal advantages of this option are that defining post-extraction liquid effluents in this manner is more consistent with the definition of 11e.(2) byproduct material in the AEA, and that this approach also is more consistent with how EPA views such waste under 40 CFR Part 440, which addresses, in part, effluent discharges from uranium mining operations.*"

Until 1995, NRC held that all liquid effluents from *in situ* leach facilities are 11e.(2) byproduct material. This was confirmed most recently in a March 30, 1994, memorandum to Joseph J.

Attachment 5

Holonich, Acting Branch Chief Uranium Recovery Branch from Robert L. Fonner Office of General Council which stated that *"only the ore body is excluded from byproduct material. All other waste is byproduct material."* One year later the staff changed this position when it published it's April, 1995, *"Staff Technical Position on Effluent Disposal at Licensed Uranium Recovery Facilities"*. However, we have been unable to find any Office of General Council concurrences in this document or any written communications from the Office of General Council explaining the basis for the change in the interpretation of 11e.(2) byproduct material. This same observation is also true for the proposed option (Option 3).

During solution mining, the groundwater is pumped out of the ground, sent through the processing plant, and reinjected into the well field from 100 to 200 times. Therefore, the groundwater has come in contact with the processing plant many times and should be considered 11e.(2) byproduct material.

The statement that *"that this approach also is more consistent with how EPA views such waste under 40 CFR Part 440, which addresses, in part, effluent discharges from uranium mining operations"*, is in our view incorrect. As pointed out in paragraph 8b of William Ford's Differing Professional View, the U.S. Environmental Protection Agency considers all liquid effluents from *in situ* facilities to surface waters to be process waters and in accordance with 40 CFR 440.34 does not allow new *in situ* leach facilities to discharge process waste water to navigable waters.

2. The recommended option (Option 3) has not recognized that this option may unilaterally remove NRC regulatory authority over the well fields and some of the surface facilities at uranium *in situ* extraction facilities.

Option 3 of the Commission Paper (page 6) would classify only post ion-exchange wastes as 11e.(2) byproduct material. All other wastes would not be subject to NRC regulation.

This also means that all wastes streams from the well fields would not be subject to NRC regulation. Identifying all waste streams from the well field as not being 11e.(2) byproduct material, raises the question of whether NRC has regulatory authority over the well field. In other words if the waste streams from the well field are not 11e.(2) byproduct material, the well fields must not be a 11e.(2) byproduct material activity. Such a conclusion would render mute the discussion in the Commission Paper of Dual Regulation of Ground Water and reliance on the Environmental Protection Agency Underground Injection Program. It would also mean that contaminated well field pipes and equipment would not be subject to NRC regulation.

The Commission Paper (page 7) states that this option would limit NRC regulatory authority to radiation protection in the processing facilities. However, using the same argument as above, if only post ion-exchange wastes are 11e.(2) byproduct material, the front-end of the plant may not be subject to NRC regulatory authority of any kind. Ion exchange columns can be a significant source of radon gas emissions within the plant if the columns are open to the atmosphere by design or leaks. We do not see any indication that the Commission Paper has considered this consequence.

We have both provided information and expressed opinions in our Differing Professional Views that explain why we think this interpretation of 11e.(2) byproduct material should be reconsidered. We request that these comments be added to the Commission Paper package.

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