PROGRAM

Submitted to
U.S. NUCLEAR REGULATORY COMMISSION

in Compliance with
APPENDIX A to PART 40
TITLE 10 CODE of FEDERAL REGULATIONS

COLLINS DRAW PROJECT
CAMPBELL COUNTY, WYOMING

SOURCE MATERIAL LICENSE NO. SUA-1352
DOCKET NO. 040-08714

October 1, 1981

LICENSEE

THE CLEVELAND-CLIFFS IRON COMPANY
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PROJECT MANAGER for the

THUNDERBIRD JOINT VENTURE
Getty Oil Company
Texas Eastern Nuclear, Inc.
Pioneer Nuclear, Inc.
The Cleveland-Cliffs Iron Company

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INTRODUCTION

The purpose of this document is to submit a detailed program in compliance with Appendix A to 10 CFR 40 as published in the Federal Register, v.45, p.65533, October 3, 1980, for the disposition of byproduct material produced during the in situ extraction and processing of uranium source material at the Collins Draw Research and Development In Situ Uranium Mine and Process Plant. The Cleveland-Cliffs Iron Company (Cleveland-Cliffs) is the manager and operator of the Collins Draw Project for the Thunderbird Joint Venture. The research project is authorized by the U.S. Nuclear Regulatory Commission (NRC) Source Material License No. SUA-1352, by Wyoming Department of Environmental Quality (DEQ) In Situ Research and Development License No. 3RD, Wyoming DEQ Wastewater Facility Permit No. 79-682, and other permits and licenses, with Cleveland-Cliffs as the licensee and permittee. The Collins Draw Project site is located in southwest Campbell County, Wyoming, which is sparsely populated by livestock ranchers. The nearest community is located approximately 35 miles southwest of the project in Natrona County.

OPERATIONS SUMMARY

A brief summary of the research in situ mine and process plant operation follows to assist in evaluation of byproduct material generation and disposition. The Collins Draw R&D Project is a pilot uranium in situ leach mining and solution processing test designed to evaluate the technical viability and the economic feasibility of extracting uranium from a mineralized water-saturated sandstone zone 450 feet below ground level with minimal surface disturbance, groundwater impact, and byproduct material generation.

The in situ mine is composed of two well fields. The A-1 Well Field is approximately 1/4 acre in surface area, and the B Well Field is approximately 1 acre in surface area. Preconditioning start-up of the A-1 Well Field pattern area with water injection and circulation began on March 10, 1980, and lixiviant solution mining chemical injection started in A-1 on April 2, 1980. The solution mining of the A-1 Well Field was conducted until November 4, 1980, at which time groundwater restoration was initiated. Presently, the groundwater quality is nearly restored in the A-1 Well Field mine zone.

Injection of lixiviant into the B Well Field began on November 4, 1980, with the transfer of mine chemicals from the A-1 Well Field. Mining was conducted in the B Well Field until July 23, 1981, when the B Well Field was also placed in the restoration mode. Restoration of the B Well Field is estimated to be completed in 1982.

A dilute ammonium carbonate and hydrogen peroxide and/or oxygen lixiviant has been used to dissolve the uranium from the mineralized sandstone. The lixiviant was injected into the mineralized zone via wells at a maximum rate of

100 gallons per minute, circuited through the mineralized zone and pumped out of wells at the rate of injection. An essential test of the proposed well field operation was to attempt to balance injection and production. Therefore, no surplus water was intentionally injected or produced to require byproduct wastewater treatment and disposal. From the well fields, the pregnant (uranium loaded) mining solution was pumped to the process plant for uranium extraction.

On entering the process plant, the pregnant mining solution is passed through the production surge tank, is filtered to remove suspended solids, and then the solution is circuited through anion exchange resin columns (hereafter, uranium extraction IX columns) which adsorb the uranium from solution. The barren mining solution is filtered and recycled back to the well field for reinjection.

A strong ammonium carbonate solution is used to strip the uranium from the uranium extraction IX columns. The uranium is precipitated from the eluant with heat, producing a pure uranyl oxide as well as gaseous ammonia and carbon dioxide. The gases are recovered, condensed, and recycled to produce fresh strip solution. The uranyl oxide is pumped from the precipitator to a settling tank to increase liquid-solid separation prior to drying. The uranium is dried in a rotary vacuum dryer heated by steam. The dried yellow cake product is then drummed for storage and shipment. All water vapor and other gases from the dryer are collected, recondensed, and used as process makeup water.

The unit operations in the plant have been batch-type operations which process continuous feed from the well field. The above-described batch uranium recovery process is continuing during the groundwater restoration phase, however, at a greatly decreased rate due to the decreasing concentrations of uranium in the water from the mine zone.

During the restoration phase, various water treatment techniques and alternatives have been tested to restore the groundwater quality in the A-1 and B Well Fields. At termination of solution mining in the A-1 Well Field, the ammonium carbonate mining solutions were circuited through the uranium removal IX columns and then injected into the B Well Field. When the restoration solutions from the A Well Field became too dilute, for utilization in the B Well Field, the restoration solution was circuited to a reverse osmosis (RO) unit which produced a treated-restored water product which was returned to the A-1 Well Field, and a reject stream composed of a more concentrated ammonium carbonate mining solution which was injected into the B Well Field. Later, the reject stream was pumped to byproduct wastewater treatment.

Another restoration method tested has involved circuiting well field water through the uranium removal IX columns, and then through another set of ion exchange resin columns which contain a resin that adsorbs ammonium. The ammonium removal IX columns are then stripped by a dilute hydrochloric acid solution; the eluant is neutralized, and then the eluant is pumped to the byproduct wastewater treatment process.

Currently, water from the well fields being restored is pumped through the uranium removal IX columns and then ammonia is air stripped from the water by ammonia stripping tubes, and the stripped water is returned to the well fields. The ammonia stripping tubes have been the most successful and efficient process for removing ammonia from the groundwater in the mine zone.

Applications have been submitted to the NRC for a license amendment to surface discharge water during restoration and to the Wyoming DEQ to receive a surface discharge permit in compliance with NPDES (National Pollutant Discharge Elimination System) criteria.

NONBYPRODUCT WASTE GENERATION and DISPOSAL

As defined in Part 40.4, Title 10, Code of Federal Regulations (10 CFR 40.4),

> "Byproduct Material" means the tailings or wastes produced by the extraction or concentration 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.

At the Collins Draw Project, not all of the wastes produced are "discrete surface wastes resulting from solution extraction processes." This section of the program briefly discusses the generation and disposal of the nonbyproduct waste materials.

The uranium solution process plant has two restrooms which contain a total of three washbasins, three toilets, and one shower. The lunchroom used by the operating crew contains one kitchen sink. The domestic-type wastewater produced by the restrooms and the lunchroom is discharged to a septic tank and then to a sanitary leach field which are permitted by the Wyoming DEQ.

Nonbyproduct solid waste material produced at Collins Draw is composed of empty shipping containers for equipment, instruments and other supplies; broken and disposable laboratory glass and plastic ware; used rubber tires; wastepaper, and plastic and glass bottles; and domestic-type solid waste materials. These solid waste materials are disposed of in a solid waste disposal landfill also permitted by the Wyoming DEQ. Radioactive and hazardous wastes are not disposed of in the solid waste landfill.

LIQUID BYPRODUCT MATERIAL GENERATION, TREATMENT and DISPOSAL

Since project inception, Cleveland-Cliffs has sought an environmentally and radiologically safe, independent, permanent and complete byproduct wastewater disposal alternative that would not create a large surface disturbance and would not require removal and transport of large volumes of byproduct materials at project termination.

Evaporation ponds are the common byproduct material accumulation method in the in situ mining industry. Evaporation ponds can be designed and build to meet existing regulations without further research and development. However, it was not believed that this was the optimal disposal method for byproduct wastewaters produced at Collins Draw. Evaporation ponds require large areas of level land for maximum evaporative surface area. The Collins Draw Project is located in relatively rough topography and, consequently, construction of evaporation ponds would create significant surface disturbance. Evaporation is minimal during extended periods of cold weather which are prevalent in central Wyoming;

the ponds are difficult to adequately seal to prevent leakage; the ponds during use and later during final evaporation prior to removal of byproduct materials would emit uncontrolled radon gas; and the evaporative residues could be widely distributed by surface winds.

Evaporation ponds are not an independent, permanent and final method of disposal. At project termination, the evaporative residues remaining in the ponds would require removal and transport to an existing large mill tailings disposal site. This would create several additional factors beyond the control of Cleveland-Cliffs. Wind-blown soil entering the evaporation ponds would significantly increase the quantity of material that would have to be removed. The volume of byproduct material, the distance and accident potential of waste transport and the hazard to personnel are difficult to estimate. It is not known which mills and tailings ponds would be in operation at the time a disposal area would be required; if those operations would be licensed to dispose of the wastes; if those operations would have the capacity for the in situ wastes in addition to their own waste production; if they would be willing to accept the wastes; and what disposal fees would be charged. Therefore, evaporation pond byproduct material disposal plans and costs could not be estimated for a research and development in situ project such as Collins Draw and cost projections could not be based on research and development projects for planning of commercial facilities. Evaporation ponds may be the common in situ industry disposal method for byproduct materials, however, Cleveland-Cliffs has believed that there are alternatives that should be tested that may create less environmental and radiological impact.

Therefore, during project design and later operation, Cleveland-Cliffs has intensively evaluated alternatives that would reduce byproduct material generation; that would remove byproduct materials from the process wastewater with generation of a solid byproduct material that is safer to handle, control and dispose of; and that would provide a final treatment mechanism with permanent, safe disposal of any unreclaimed byproduct materials in the waste stream.

Numerous research technologies have been incorporated in the uranium mining, uranium recovery and groundwater restoration processes to substantially reduce liquid byproduct material waste generation. A nonchemical means of uranium precipitation in conjunction with collection and recycling off of gases; a high pH leachate system which suppresses the solubilization and mobilization of calcium, and other byproduct constituents; balanced injection-production well field operation; restoration techniques that use the sewage industry's wastewater treatment technology of air stripping ammonia; and the use of ion exchange, reverse osmosis, and other water treatment technologies have greatly decreased the volume and the concentration of byproduct wastewater produced by the Collins Draw Project. As one of the research objectives, all well field and plant operations are conducted to conserve water and to maximize water recycling.

As a result of the above-described efforts, since March 25, 1981 there has been no wastewater containing byproduct materials produced by the Collins Draw Project. Prior to March 25, the only systems in the solution mining and process circuits that produced liquid byproduct material were the reverse osmosis unit which has produced a wastewater reject stream, and certain ion exchange resin columns which have produced waste eluant during stripping. The

RO unit was used to treat natural groundwater for injection as a purified conditioned water into the A-1 Well Field mine zone prior to solution mining, the unit was used during restoration testing, and has been used during other research testing. Ion exchange columns were used to test removal of dissolved calcium from the pregnant mining solution, in order that the calcium would not interfere with the uranium removal ion exchange resins; were used to remove ammonia from the mining solutions during testing of restoration alternatives; and were used for other limited testing and research of ion exchange resins.

Other sources of wastewater have been solution spills in the process plant, plant washdown, boiler blowdown and laboratory wastewater. Spills, plant washdown, boiler blowdown, and lab wastewater are collected in a sump via piping, floor drains, and launders. Prior to March 25, 1981, byproduct solutions collected in the sump were pumped to the byproduct wastewater treatment system. Since March 25, these solutions collected in the sump have been classified as recoverable materials and have been returned back into the solution and process circuits for uranium recovery.

When wastewater containing byproduct materials has been produced, it is stored in tanks inside of the plant building, in an open top 8,500 gallon fiberglass tank outside of the plant building, or in two rubber storage bladders each with 25,000 gallons of capacity. After a batch quantity of byproduct wastewater is obtained, it is circulated through a series of ion exchange resin columns to reclaim any unrecovered uranium, and then the water is circulated through an ion exchange resin column to remove radium. The wastewater can be cycled through the resin columns more than once as required to remove byproduct materials from the waste stream.

The uranium is stripped from the resin, and the eluant solution is pumped into the process circuit for uranium extraction. To date, the radium removal resin has not reached saturation (the state of no longer efficiently loading radium), however, the resin is approaching saturation. When loaded to capacity, the saturated resin will be removed and disposed of as described in the next section and the columns will be loaded with new resin.

The wastewater that has had a significant quantity of radium and uranium removed is then discharged to the process wastewater drain field for final treatment and disposal of any residual byproduct materials.

The research process wastewater drain field was designed to operate much like a sanitary drain field using natural processes of water purification. To protect the environment, there would be minimal radon flux; the discharge would be below root zone and meteoric water penetration; wind dispersion of byproduct materials would be avoided; and at Collins Draw, there would be an impermeable siltstone layer between the discharge and the first groundwater aquifer.

The process wastewater drain field was licensed by the NRC to receive reverse osmosis byproduct discharge on June 29, 1979 as part of the Source Material License. The license was later amended for the drain field to receive all byproduct wastewater. Prior to operation, the drain field was also licensed by the Land Quality Division and the Water Quality Division of the Wyoming DEQ.

The attached Figure 1 contains the construction details for the process wastewater drain field. As shown on the drawing, the drain field consists of one discharge unit approximately 100 feet long and 30 feet wide. The second unit was excavated and constructed; however, the Wyoming DEQ has limited operation and access piping to only one unit. Currently, it is not anticipated that the second unit will be required.

During construction, all topsoil was removed from the drain field area and stockpiled for later use during reclamation. The subsoil was totally excavated to a depth of five feet below the surface and perforated drainage pipe was placed in one foot depth of gravel as shown in the drawing. An air vent was placed in the far end of each drain field unit to aid bacterial action in converting ammonia to nitrogen. The drain field was then covered with four feet of subsoil.

The following Table 1 shows the volume and the quality of the wastewater that has been discharged from the process plant to the research process wastewater drain field. During the first 9 months of operation approximately 305,500 gallons of wastewater were discharged to the drain field. No byproduct wastewater has been discharged to the drain field since March 11, 1981. The nonbyproduct wastewater discharges shown in Table 1 have consisted of water of potable quality that was emptied from tanks and piping prior to their utilization in the process circuit. There has been minimal discharge to the drain field during the past 6 months; however, stable groundwater restoration has not at this time been adequately demonstrated to the regulatory agencies, and alternative restoration technologies and methods could be tested and used that produce byproduct wastewater. Also, additional wastewater will be produced during decontamination of facilities and equipment. A maximum of 950,000 gallons of wastewater may be produced by the process plant and discharged to the drain field in approximately 2 1/2 years of operation. The average discharge rate would be approximately 1,000 gallons per day or 380,000 gallons per year.

In the Final Generic Environmental Impact Statement on Uranium Milling, 1980, U.S. Nuclear Regulatory Commission, NUREG-0706 (hereafter referred to as FGEIS), the environmental impacts that would result from a representative mill or "model mill" were intensively evaluated. To put the Collins Draw Project in perspective, the byproduct materials produced at Collins Draw will be compared with the byproduct materials produced by the model mill.

The daily net quantity of wastewater (not including recycled water or tailings) generated by the model mill and discharged to the tailings pond is 1,400 ST which is approximately 330 times the average daily discharge to the Collins Draw Project process wastewater drain field. The total wastewater production by the model mill during the 20-year mill operation will be 8,680,000 ST which is approximately 2,200 times the maximum volume of the treated wastewater discharge of the Collins Draw Project during its lifetime. The above discussion does not consider tailings or solid byproduct materials.

Appendix E-1, FGEIS, contains a method used to calculate seepage discharge from an unlined tailings pond. This same method can be used to calculate seepage from the process wastewater drain field as follows:

$$Q_{ppt} + Q_{mill\ (drain\ field)} = Q_{entr} + Q_{evap} + Q_{seep}$$

Table 1
Volume and Water Quality of Discharge to Process Drain Field
Collins Draw Project

	Discharge Volume		Mean Disc			
	Gallons	Liters	TDS mg/l	Na mg/l	NH_3 mg/l	As mg/
Wyoming DEQ Discharge Limits	950,000	3,595,750	None	None	None	5.0
USNRC Discharge Limits	None	None	None	None	None	Non
USPHS-EPA Max. Perm. Concentration	--		500	200	None	0.0
Treated Byproduct Discharge 6/19/80 to 3/11/81	305,530	1,1[illegible]31	3,799	246	569	0.1
Non-Byproduct Discharge 3/12/81 to 9/25/81	2,169	8,210	--	--	--	-
Estimated Future Discharge 9/26/81 to 12/19/82	642,301	2,431,109	1,000	200	20	0.0
Estimated Total Project Discharge 6/19/80 to 12/19/82	950,000	3,595,750	1,898	214	197	0.0

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...arge Concentration			Discharge Inventory						
Se mg/1	U mg/1	Ra226 pCi/1	TDS Kg	Na Kg	NH_3 Kg	As Kg	Se Kg	U Kg	Ra226 pCi
5.0	20.0	50.0	None	None	None	2.0	2.0	3.5	$8.0x10^7$
None	None	None	None	None	None	None	None	None	None
0.01	550 pCi/1	5	--	--	--	--	--	--	--
0.20	1.96	32.9	4,393	285	658	0.21	0.23	2.27	$3.8x10^7$
--	--		--	--	--	--	--	--	--
0.20	0.51	17.3	2,431	486	49	0.10	0.49	2.43	$2.4x10^7$
0.20	0.97	22.2	6,824	771	707	0.31	0.72	3.50	$8.0x10^7$

Since precipitation (Qppt) does not infiltrate to the point of drain field discharge, and wastewater is not entrained in tailings material (Qentr), and the quantity of water loss by evaporation (Qevap) is unknown, these factors are considered to be zero (0). It is known some evaporation occurs; however, for a conservative estimate, evaporation is not considered. The inflow to the drain field from the process plant equals the seepage discharge.

$$Qmill = Qseep = 380{,}000 \text{ gal/year} = 1438.3 \text{ m}^3\text{/yr}$$

Based on data and soil samples from the drilling of monitor wells around the drain field, it is thought that between the bottom of the drain field (5 feet) and 48 feet below surface, the geological material is an unconsolidated sandy loam, from approximately 48 feet to 54 feet there is an impermeable siltstone-shale layer, and from approximately 54 feet to 88 feet the material is consolidated sandstone. The water table is at approximately 88 feet and the confined aquifer is approximately 70 feet thick.

Based on computer modeling, it was determined that the velocity of the seepage water beneath the drain field would be approximately 9×10^{-6} cm/s or 2.8 m/yr. This rate is approximately the same as the velocity in Appendix 3-2, FGEIS, for the seepage from the model mill tailings pond. Assuming 83 feet (25.3m) from the bottom of the drain field to the water table, it would take approximately 9 years for the discharge water to seep to the water table. It should be noted, that in comparison to the model mill tailings pond, the drain field will only have an intermittent head on the discharge for 2.5 years until the discharge is terminated. Since there is an impermeable siltstone-shale layer at approximately 48 feet to 54 feet beneath the drain field, then there could be lateral movement of seepage water, and it would take considerably longer time for the seepage water to penetrate to the water table. Any seepage that does reach the siltstone-shale layer, is expected to be of acceptable water quality due to the quality of the discharge and the purification properties of the subsoil beneath the drain field.

Table 1, also characterizes the water quality of the discharge from the process plant to the drain field, and subsequently, from the drain field distribution pipes to the subsoil. The discharge from the drain field has not exeeded the Wyoming DEQ licensed discharge limitations. An anomalous arsenic analysis of 0.48 mg/l for one of the composite discharge samples was received, but thought to be in error. Discounting this assay, the range of arsenic concentrations in the 18 biweekly composite drain field discharge samples is 0.001 mg/l to 0.12 mg/l with a mean of 0.04 mg/l. The 0.04 mg/l arsenic is thought to be a more valid indication of the average arsenic concentration in the discharge, and this concentration is below the USPHS-USEPA maximum permissible concentration in drinking water.

For comparison, the tailings pond seepage of the model mill (FGEIS) would contain approximately 30 times the concentration of TDS, 4 times the concentration of sodium, 4 times the concentration of ammonia and ammonium, 3 to 8 times the concentration of arsenic, 160 times the concentration of selenium, and 18 times the concentration of radium in the seepage that is estimated to be released by the drain field. The total estimated quantity of radium to seep from the drain field is 8×10^7 pCi. The total quantity of radium estimated to seep from the tailings pond can be calculated as follows:

$$(2.2 \times 10^5 \text{ m}^3/\text{yr})(20 \text{ yr})(10^3 \text{ l/m}^3)(400 \text{ pCi/l}) =$$
$$1.76 \times 10^{12} \text{ pCi} = 1.76 \text{ Curies of radium}$$

This quantity of radium is approximately 22,000 times the maximum quantity of radium in wastewater released by the Collins Draw Project drain field. The comparison does not consider the quantity of radium retained in the entrained liquids and in the solids in the tailings pond.

There are several natural processes of water treatment and purification and these processes are being used as a final treatment technique for the process wastewater released by the drain field. Bacteria are capable of breaking down ammonia to nitrogen gas. By ion exchange, clay particles in the soil can absorb undesirable radioactive or toxic ions, such as radium, arsenic and uranium, in the seepage water and, in exchange, release nontoxic nonradioactive ions such as potassium, sodium, etc., which will be either reabsorbed or precipitated. The process drain field utilizes this natural ion exchange water treatment process for final treatment and purification of wastewater produced by the project. These natural water treatment and purification processes are also discussed in Appendix E-3, FGEIS.

As discussed in Appendix E-3, FGEIS, the distance that the radium discharged by the drain field is expected to travel is 0.39 meters and thorium, which has not been analyzed in the discharge, should be fixed within a few centimeters of the drain field bottom. Arsenic is expected to be removed from the water in 0.17 meters. It is expected that at least 95% of the uranium in the discharge would be adsorbed onto the soils beneath the drain field. Due to the low concentration of selenium in the discharge, the prevalence of natural selenium in the topsoil and the subsoil at Collins Draw, and the impermeable layer of siltstone thought to be betwe - the drain field discharge and the water table, this element is not expecte to contaminate or impact the groundwater.

The low volume of wastewater seepage from the drain field purified by the natural water treatment processes should not impact the water quality of any groundwater aquifers.

As stated above, the radium should be adsorbed within the first 0.39 meters of subsoil beneath the drain field. The radium would be the most concentrated in the first 0.1 meters of soil. If all of the radium were adsorbed within the 0.2 meters, the concentration of radium in the soil can be calculated as follows:

$$\frac{8\times10^{7}\ \text{pCi}}{(0.2\text{m depth})(9.1\text{ m width})(30.5\text{ m length})(1.6\text{ g/cm}^{3})(10^{6}\text{ cm}^{3}/\text{m}^{3})} =$$

0.90 pCi/g of soil.

It is difficult to accurately calculate the radon emanating from the lifetime drain field discharge. Assuming that the 0.97 pCi/g radium distribution is homogenous, and that instead of a covered drain field assuming a tailings pond open to the atmosphere and the tailings pond was of infinite thickness (greater than 3-4 meters in depth), the radon flux could be calculated as follows:

$$J_{\infty} = (Ra)\,\varepsilon\rho(\lambda D/P)^{\frac{1}{2}} \times 10^{4} \qquad = 0.93\ \text{pCi/m}^{2}\text{-S}$$

However, the radon flux would be much less than $0.93 pCi/m^2$-S because the radium in the drain field is only 0.1 meter in depth and not of infinite thickness and the drain field is covered by an additional 1.2 meters of soil.

Per Table 0.2, Appendix O, FGEIS, the average background radium concentration in soils from uranium milling areas in Wyoming is 1.0 pCi/g. This is more than the concentration estimated for the soils beneath the drain field. The drain field should not endanger the health and safety of the public or the environment.

After groundwater restoration of the mine zone is completed, the facilities and equipment will be decontaminated for unrestricted use, and the project area, except for possibly the process plant, will be reclaimed. During reclamation the area will be recontoured at which time additional soil will be placed over the drain field. After recontouring, the stockpiled topsoil will be redistributed over the disturbed areas, and then the site, including the drain field area will be revegetated by seeding with grass. After grass has been established, the project area will be reopened for livestock grazing land use by the rancher-owner.

Cleveland-Cliffs has recently applied to the Wyoming DEQ for an NPDES surface wastewater discharge permit, and has applied to the NRC for an amendment to the Source Material License to authorize surface water discarge.

As a restoration alternative, Cleveland-Cliffs seeks to remove approximately 20,000,000 gallons of water from the mine zone in an attempt to further improve the groundwater quality. This alternative will contribute to a timely, orderly, and economic termination of all research activities.

The water would be pumped from the mine zone at approximately 100 gallons per minute, circuited through the uranium recovery plant to remove uranium, radium and other constituents to be in compliance with NPDES discharge limitations, and then the water would be discharged on the surface. A discharge of 20,000,000 gallons, at the rate of 100 gallons per minute, would require approximately 140 days of continuous discharge or nearly 5 months.

It is not anticipated that the current restoration research would be completed and the surface discharge would begin before November 1, 1981. There is a possibility that the water discharge would not begin until the spring of 1982. However, Cleveland-Cliffs requests the flexibility to discharge as soon as authorization is obtained. All discharge should be completed during 1982, with a discharge volume of approximately 20,000,000 gallons.

Per NPDES discharge limitations, the radium concentration is limited to 3 pCi/l dissolved radium and 10 pCi/l total radium, and the uranium concentration is limited to 2 mg/l in the discharge. At these concentrations, the 20,000,000-gallon discharge would release a maximum of 75.7×10^7 pCi of radium and 151.4 kilograms of uranium. The attached Figure 2 shows the location of the proposed surface discharge point. The discharge will flow approximately 250 feet (76 meters) westerly in an unnamed dry gulch before reaching the ephemeral Collins Draw stream channel, which is a tributary of the ephemeral Cottonwood Creek, which is a tributary of the Dry Fork of the Powder River.

The discharge is expected to dissipate into the soils of the Collins Draw and Cottonwood Creek stream beds before reaching the Dry Fork of the Powder River. The stream beds are wide and flat and heavily vegetated with native grasses. The water should spread out to cover a wide area and the grasses should prevent channelization and erosion. The discharge is expected to cover in excess of 100 surface acres.

Assuming even distribution of the maximum allowable quantity of radium in the discharge dissipating into 100 acres of soil, and the radium traveling only 1 centimeter deep, the radium concentrations in the soil can be calculated as follows:

$$\frac{757\times10^{6}\ \text{pCi}}{(100\ \text{acres})(4047\ \text{m}^2/\text{acre})(1\ \text{cm, depth})10^4\ \text{cm}^2/\text{m}^2)(1.6\text{g/cm}^3)}$$
$$= 0.117\ \text{pCi/g}.$$

If the radium was only dissipated over 20 acres the radium concentration in the soil would be five times as concentrated or 0.585 pCi/g.

The surface discharge should not create adverse environmental impact. The surface water discharge with trace quantities of ammonia will irrigate and fertilize the stream beds and should substantially increase vegetation production for the rancher-landowner, and, therefore, be a beneficial impact.

Baseline surface topsoil samples have been taken at six locations in the Collins Draw stream bed near the proposed surface discharge point, as shown on Figure 2. These samples have been analyzed for uranium, radium and thorium and the results of these analyses are attached as Table 2. After termination of surface discharge, postdischarge topsoil samples will be collected in approximately the same six locations, unless the discharge has not flowed over or seeped into these locations and then substitute locations will be used. The postdischarge samples will also be analyzed for uranium, radium and thorium.

If the postdischarge samples indicate uranium contamination of 20 mg per kilogram of soil in excess of baseline, radium contamination of 5 pCi per gram of soil in excess of baseline or thorium contamination in excess or 5 pCi per gram of soil in excess of baseline, the contaminated areas will be mapped, and communications will be conducted with the NRC and the Wyoming DEQ to establish procedures to mitigate the impact.

SOLID BYPRODUCT MATERIAL GENERATION and DISPOSAL

Solid byproduct materials generated by the Collins Draw Project include used ion exchange resin; spent filter media; worn-out gloves, coveralls, etc., from yellow cake drying and packaging; salt precipitates in equipment and storage vessels; and process systems and equipment that cannot be decontaminated or transferred to another licensed facility.

Sources of byproduct ion exchange resins are the uranium removal IX columns, the byproduct wastewater treatment ion exchange columns, resins used during testing for calcium and ammonia, and other processing and research that have used ion exchange resins during the project. Spent filter media is generated during the filtration of mining, uranium recovery, and restoration liquids to remove suspended solids. Gloves, coveralls, etc., from the operation of the yellow cake dryer and the drumming of yellow cake product are also considered byproduct materials.

During decontamination of the facilities and equipment for termination of the Source Material License, additional byproduct materials will be generated. Calcium and other salts that have precipitated in the equipment and storage tanks will be removed as solids where possible. Remaining residues will be washed out and pumped to byproduct wastewater treatment and disposal as discussed above. Used plant facilities and equipment will be decontaminated per Annex C (NRC, November 1976) and released for unrestricted use. Process systems and equipment that cannot be adequately decontaminated will be transferred to another licensed facility or will be classified as solid byproduct material.

The two rubber storage bladders will be emptied and disposed of with the solid byproduct material.

All byproduct solid waste material generated by the Collins Draw Project except for oversize conta[illegible] process systems and equipment and the rubber bladders will be placed in [illegible] Type-17H steel drums with lids. It is currently estimated that there will be 30 drums of byproduct ion exchange resin, 20 drums of byproduct filter media and waste clothing, 20 drums of salt precipitate byproduct material, and less than 10 drums of other solid byproduct materials generated during project decommissioning.

All offsite shipments of solid byproduct materials will be conducted in exclusive use vehicles per DOT and NRC regulations.

Cleveland-Cliffs will attempt to contract with an owner of an existing large mill tailings disposal site to accept and dispose of the solid byproduct material. The NRC and Cleveland-Cliffs cannot legally require the owner of such a site to accept wastes from the Collins Draw Project, or to limit disposal fees to a reasonable and equitable amount.

If after a comprehensive and sincere effort, a disposal agreement cannot be achieved, this effort will be demonstrated to the NRC and a final on-site disposal plan that will ensure the health and safety of the public and the environment will be submitted to the NRC.

COMPLIANCE with APPENDIX A to PART 40

Appendix A to 10 CFR 40, "establishes technical, financial, ownership, and long-term site surveillance criteria relating to the siting, operation, decontamination, decommissioning and reclamation of mills and tailings or waste systems and sites at which such mills and systems are located."

Criterion 2 states:

> To avoid proliferation of small waste disposal sites and thereby reduce perpetual surveillance obligations, byproduct material from in situ extraction operations, such as residues from solution evaporation or contaminated control processes, and wastes from small remote above ground extraction operations shall be disposed of at existing large mill tailings disposal sites; unless, considering the nature of the wastes, such as their volume and specific activity, and the costs and environmental impacts of transporting the wastes to a large disposal site, such offsite disposal is demonstrated to be impracticable or the advantages of onsite burial clearly outweigh the benefits of reducing the perpetual surveillance obligations.

Attempts will be made to dispose of all solid byproduct materials generated by the Collins Project at an existing large mill tailings disposal site in compliance with Criterion 2.

Trace quantities of byproduct material that are dissolved in wastewater discharged to the process drain field and discharged on the surface will not contaminate the groundwater or potential sources of drinking water. Residues from the process drain field discharge and the proposed surface discharge will be of such low quantity and low specific activity that the recovery and offsite disposal of these residues would be impractical. It would be very difficult to trace and define the extent of diffusion of the radioactive residues due to their low volume and specific activity. The radium concentrations in the soils and the radon emanations from the soils receiving the discharges should approximate and not be discernable from background or baseline levels.

As contained in the Final Generic Environmental Impact Statement on Uranium Milling, a representative conventional uranium mill, the "model mill," would produce 2,000 ST per day dry tailings and 1,400 ST per day net wastewater, which is a 20-year project total of 21,080,000 ST of waste. The Collins Draw Project could discharge 3,964 ST of wastewater to the drain field and 83,453 ST of wastewater on the surface for a project total of 87,417 ST. The surface discharge, which is approximately 98% of the Collins Draw Project total discharge, would meet state and EPA-NPDES water quality criteria.

As previously calculated and discussed, the liquid fraction of the tailings produced by the model mill during the lifetime mill operation would contain approximately 2 Curies of radium. The solid tailings would contain 2.59×10^{3} Curies of radium. Therefore, approximately 2.6×10^{3} Curies of radium would be generated by the model mill and disposed of in the tailings pond during the project. It has been previously estimated that the drain field discharge and surface discharge would release a maximum of 8.4×10^{-4} Curies of radium during the lifetime of the Collins Draw Project. In comparison, a representative conventional mill would generate and dispose of approximately 3,100,000 times more radium in the mill tailings pond than would be contained in the process drain field discharge and the surface discharge from the Collins Draw Project.

Byproduct material accounting and inventory at the model mill would have to be maintained in excess of 99.9999% accuracy to discern the maximum total quantity of radium discharged at Collins Draw. This is similar to comparing 1 minute to 5.9 years or 1 inch to 49 miles.

Similar comparisons with similar ratios could be made for other radioactive and hazardous constituents in the byproduct materials generated by the model mill and by the Collins Draw Project.

The comparisons very definitely demonstrate the low volume and the very low specific activity of the wastewater discharged by the drain field and the wastewater proposed to be discharged on the surface. As demonstrated by comparison to the model mill, the low volume and the very low specific activity should not require the removal and disposal of the discharge residues at an existing large mill tailings disposal site and should negate any perpetual surveillance obligations.

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TABLE 2

WAMCO LAB

P.O. BOX 3632 • CASPER, WYOMING 82602

ANALYSIS REPORT

COMPANY: Cleveland-Cliffs DATE: August 28, 1981

WAMCO NO.	SAMPLE DESCRIPTION	Radium 226 pCi/g	Thorium 230 pCi/g	U_3O_8 ppm			
2689	Topsoil						
1	#1	2.3±0.7	3.1±0.8	8.0			
2	#2	1.5±0.6	2.2±0.7	7.3			
3	#3	1.8±0.6	1.9±0.6	4.5			
4	#4	2.3±0.7	1.8±0.6	4.0			
5	#5	2.1±0.7	2.8±0.8	5.0			
6	#6	1.4±0.6	1.8±0.6	10.8			

REMARKS:

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