GE Nuclear Energy

General Electric Company
Castle Hayne Road, Wilmington, NC 28402

November 9, 1989

Director
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attention: Mr. L. C. Rouse, Chief
Fuel Cycle Safety Branch
OWFN, Room 6D23, Mail 6H3

Dear Sir:

Subject: License Amendment Request (Revision # 26)

References:
(1) NRC License SNM-1097, Docket # 70-1113
(2) Letter, CM Vaughan to WT Crow, 9/22/83
(3) Letter, RG Page to CM Vaughan, 12/21/83
(4) Letter, CM Vaughan to WT Crow, 7/1/85
(5) Letter, CM Vaughan to WT Crow, 7/10/85
(6) Letter, WT Crow to CM Vaughan, 8/9/85

With reference to activities authorized by NRC License SNM-1097 at the General Electric Company Nuclear Fuel and Components Manufacturing facility, GE hereby requests permission to utilize the Uranium Recovery from Lagoon Sludge (URLS) project facility for the purpose of conducting uranium recovery development and processing as described in Attachment 1 to this letter.

Attachment 2 contains a description of the requested revisions and Attachment 3 is the revised pages.

Pursuant to 10 CFR 170.31, a GE check for $150 for processing this amendment request is enclosed.

General Electric personnel would be pleased to discuss this matter further with you and your staff as you may deem necessary.

Sincerely,

GE NUCLEAR ENERGY

[signature]

T. Preston Winslow, Manager
Licensing & Nuclear Materials Management

Attachment

cc: SD Ebneter - Region II

ATTACHMENT 1

URANIUM RECOVERY FROM LAGOON SLUDGE

BACKGROUND

On 9/22/83, GE requested NRC permission to allow construction of a facility that would be used to recover uranium from the calcium fluoride on-site lagoon sludges. On 12/21/83, the NRC granted this request.

On 7/1/85, GE notified the NRC that, although construction of the structure was essentially complete and equipment was partially installed, the project was being deferred until a later date. In the same correspondence we stated that concurrent with the deferral, we were evaluating a desludging project and anticipated pilot testing in the future.

On 7/10/85, we requested permission to develop techniques and to recover the uranium from nitrate sludges and to perform testing for filter media selection and associated ongoing operations based on the results of these tests. This request was approved on 8/9/85. Due to business considerations, the URLS facility has never begun the planned activity.

We have now finalized our plans to utilize the URLS facility to dispose of the resulting liquid and solid wastes as described below.

1.0 OBJECTIVE

The current objective of the Uranium Recovery from Lagoon Sludge (URLS) project is to recover uranium from wet and dry sludges stored in lagoons and pits at the GE-Wilmington, NC, facility. The sludges are byproducts of existing and past treatment of liquid waste discharges from the uranium conversion process. There are two (2) types of sludges involved, nitrate base and fluoride base. The URLS project will develop and operate processes for the efficient removal of uranium from the sludge in a form that may be returned to our chemical conversion process through the existing UPMP uranium recovery system. Solid wastes generated during the process are planned to be disposed of off-site as non-hazardous chemical waste. The liquid wastes will be discharged into and be compatible with the existing waste streams.

2.0 PURPOSE

The purpose of this document is to describe the facility and the processes that will be used to recover the uranium from the nitrate and fluoride sludges and request NRC approval to utilize the URLS facility. This document describes the radiological and criticality controls, environmental controls, chemical and plant safety requirements to safely operate the facility.

3.0 FACILITY DESCRIPTION

As shown in Figure 1, the facility is located on the east side of the existing boiler building at the site's waste treatment area. This single-level structural extension (Figure 2) has a roofed area of about 1,800 square feet. The entire poured concrete area is curbed for containment of spills. The building has a self-contained HVAC system, including stack sampling. The outside tanks for chemical and sludge storage are curbed or diked to contain spills. All major utilities and support services are supplied by the existing waste treatment facility.

4.0 PROCESS DESCRIPTION (FIGURE 3)

4.1 Sludge Transfer

The sludge in the lagoons is currently covered with two or more feet of water. This sludge will be dredged out of the lagoon and transferred to a settling tank(s) that is located in a diked area northeast of the URLS facility. The sludge will be drawn out of the cone bottom of this settler and transferred to one of two sludge storage tanks. The supernate liquid will be returned to the lagoons. Basin or pit material will be excavated, reslurried, and transferred to the settling tank(s) for processing.

4.2 Leaching

The leaching operation removes the uranium from the solids of the sludge. This is accomplished by using a multi-stage, counter-current acid leaching process, a standard operation used for recovery of minerals from ores. The critically safe batch type operation will use two or more agitated leaching tanks with a filtration step between each stage. (A two stage system is described.)

A known volume of sludge will be transferred from a storage tank to the first stage leach tank. This sludge is mixed, by continuous agitation, with the filtrate from the second stage leach. It may be necessary to heat this system by a heat exchanger or direct injection of steam to enhance the leaching efficiency.

Following the completion of the leach cycle, the slurry is pumped to a filter for solid-liquid separation. This filtrate (which contains the extracted uranium) is sent to storage tanks and becomes the solvent extraction aqueous feed to recover the uranium. Most of the uranium will be removed during this first filtration step. The cake (solids) from this leaching step is rinsed, discharged to a repulper and pumped to a holding tank.

The slurry is then transferred to the second stage leaching tank where it is mixed, by continuous agitation, with fresh dilute acid. The leach system may be heated by a heat exchanger or direct steam injection to enhance the leaching efficiency.

After the completion of the leach cycle, the second stage slurry is pumped to the filter for solid-liquid separation. The second stage filtrate is pumped to the storage tank to be used as the liquid feed to the first stage leach. The second stage cake is washed and air-purged to reduce the excess liquid. The characteristics of the final cake ($CaSO_4$ or CaF_2) is checked for pH, percent solids/water, and residual uranium content. If acceptable, it is transferred to a container for eventual off-site disposal.

4.3 Solvent Extraction

The uranium in the liquid effluent from the first stage leach is recovered by processing through a standard two-column type solvent extraction system. The two phases, aqueous and organic, flow counter-current through both columns.

The uranium-bearing aqueous phase is filtered before it is fed into the upper section of the first column. It then flows down through the column, out the bottom. Most of the uranium is removed in the first column. The liquid is then pumped into the top section of the second column, where the remaining uranium is removed. This aqueous discharge, raffinate, is pumped to a storage tank for further treatment.

The organic phase is introduced into the bottom section of the second column flowing up through the column and out the top. It is then pumped into the lower section of the first column, up through the aqueous phase and out the top of the column as pregnant organic.

The uranium is transferred from the aqueous phase into the organic phase by intimate contact as the two phases flow counter-current through a series of sieve plates and pulsing liquid columns to obtain the maximum contact and uranium transfer efficiency.

The raffinate is treated by filtering after adjusting the pH with lime slurry. The filtrate and wash water can be used as recycle water within the process.

The uranium is removed from the pregnant organic phase by contacting it with a stripping solution, such as a carbonate, in a stripping column. The phase flow through the column is counter-current. The barren organic exits the top of the column into a storage tank to be reused as organic feed to the extraction columns. The aqueous phase containing the uranium exits the bottom of the column into the precipitation tank. The solution is decarbonated by adjusting the pH with acid. The uranium is precipitated from this solution. The uranium solids are filtered out, washed, air purged and placed in 3 or 5-gallon containers. The material is analyzed, temporarily placed on a storage pad and eventually returned to the fuel processing facility.

5.0 SAFETY

5.1 Criticality Safety

Criticality safety of the URLS project will be assured using a combination of safe batches, safe concentrations and safe geometries. The project is divided into three main sections for criticality safety. The first section is the sludge queue operation followed by the leach and filtration section and finally the solvent extraction and precipitation operation.

5.1.1 Sludge Queue

In this phase of the operation, sludge concentrations will be used as the criticality control.

.1 The concentration of uranium in the lagoons has been measured and found to be less than the minimum critical concentration by at least a factor of four according to ARH-600, Section III.B. 2-7. This phase of the operation will consist only of pumping the material to a queuing tank for decanting and settling. No operation will take place that could increase the concentration of the uranium above the values found in the lagoon. This operation will be viewed as an extension of the lagoon. This system will qualify as a concentration control under the provision of Section 4.2.1.3 of SNM-1097.

.2 After the contents of the queue tank have settled, the content of the tank will be representatively sampled to determine the percent solids and uranium content. This information will be used to establish safe batches for succeeding operations. A predetermined volume of material will be pumped to the leach feed tanks. The contents of each leach tank will constitute a safe batch of material per the requirements of Section 4.2.1.2 of SNM-1097.

5.1.2 Leach and Filtration

These processes will also be controlled by a combination of safe concentrations and safe mass.

.1 The leach and filtration processes cannot increase the concentration above that in the incoming sludge because no precipitation of the uranium is possible. Acids are added to the sludge volume to leach out the uranium. The addition of chemicals during the leaching operation will dilute the uranium concentration. Therefore, the previously defined concentrations will constitute an acceptable control under the requirements of Section 4.2.1.3 of SNM-1097.

.2 The safe batch, as defined in the sludge queue operation, will be processed through the leach and filtration operations as a unit separated from other uranium to be processed by the inspection of equipment prior to the introduction of the next safe batch and cleaning as necessary. The batch will be separated from the material in the geometry controlled solvent extraction and precipitation operations by the filtrate accumulation and SX feed tanks that are equipped with backflow prevention devices.

5.1.3 Solvent Extraction

The solvent extraction system must be in continuous operation in order to operate efficiently. Therefore, operation in compliance with the double contingency principle will be accomplished by a combination of geometry, concentration, and mass controls.

.1 The solvent extraction columns will be safe geometries under the provisions of Table 4.1 and 4.2 of SNM-1097 or under the provisions of Section 4.2.4 of SNM-1097.

.2 Concentrations will be held at a value acceptable under the provisions of Section 4.2.1.3 of SNM-1097. These concentrations will be limited by the characteristics of the chemicals used in the organic and aqueous solutions. The maximum theoretical uranium loading for the various chemicals proposed in the URLS project is less than 240 g U/L which corresponds to Kinf < 1 for UO_2 and water.

.3 Aqueous strip liquids will be sampled prior to transfer to unsafe geometries. Raffinate and organic solutions will be sampled at a frequency such that loss of the uranium throughput to either of these streams will be detected prior to reaching an unsafe condition.

5.1.4 Precipitation

The precipitation system will operate in a batch mode in compliance with the double contingency principle. This will be accomplished by a combination of geometry and concentration controls.

.1 All process vessels, product filters and the product fill station will be safe geometries under the provisions of Table 4.1 and 4.2 of SNM-1097 or under the provisions of Section 4.2.4 of SNM-1097.

.2 The contents of each piece of equipment will be limited to a safe mass. This mass limit will be maintained by a combination of the volume of the equipment and the maximum concentration of uranium which can occur in the strip solution.

5.1.4 Interaction

There are three areas for which interaction must be considered. These are the geometry controlled solvent extraction and precipitation process, the safe batch controlled leach and filtration process, and the safe batch controlled sludge queue process.

.1 Within the geometry controlled solvent extraction operation the interaction will be evaluated by the techniques of Section 4.2.10 of SNM-1097.

.2 The batch controlled operations of leach/filtration and sludge queuing will either be isolated from each other and from the solvent extraction/precipitation process in accord with the provisions of Section 4.2.10 of SNM-1097 or the interaction will be evaluated by the provisions of that section.

5.2 Radiological Safety

The facility will be operated according to the radiological control plan which exists for the current fuel manufacturing building. This includes exposure controls, personnel monitoring techniques, bioassay programs, area posting and radiation surveys.

Process areas of the facility are designated as controlled areas similar to the controlled process areas of the existing fuel manufacturing building.

Radiation workers will access the controlled areas through a designated change room(s), where they will don standard controlled area protective clothing i.e., coveralls, head covering, shoe covers or controlled area shoes, rubber gloves). Persons exiting the controlled area will monitor for contamination following removal of protective clothing.

The facility processes have been designed to offer complete containment to the work areas, thus minimizing the potential for surface and airborne contamination. Process tanks are vented to a scrubber exhaust system. This exhaust system is water scrubbed then filtered through HEPA filters before discharge to the atmosphere.

All process areas are curbed to contain any spills or leaks. The curbed areas have collecting sumps and automatic pumping systems to return the spills to the proper vessel. The recovered uranium-bearing product is transferred out of the process areas in closed three and five-gallon pails which are not opened outside of approved hoods.

The existing fuel manufacturing building contamination control plan and action guides will be used for the facility. If contamination in excess of the guideline limits occurs, the necessary decontamination action is taken per existing procedures, based upon knowledge of the particular circumstances and the behavior of the material involved.

The operation of the facility will be conducted according to written instructions prepared by process engineers with inputs from nuclear safety engineering personnel. These documents provide on-the-floor instructions to operations personnel and contain criticality and radiological safety provisions. Each equipment operator is provided adequate training to follow these operating documents.

5.3 Plant Safety

.1 Fire Protection

The fire protection provided meets or exceeds the plant requirements and the recommendation of the Factory Mutual Insurers.

The organic liquid in the solvent extraction system has a flash point > 160°F which is classified by NFPA as a combustible liquid Class III A, liquids with a flash point > 140°F and < 200°F. Fire safety devices designed into the system include:

- Smoke detectors in the exhaust system
- Sprinkler system in the organic liquid processing areas.
- Secondary liquid containment with API fusible link fire safe valves at tank discharges and containment penetrations.
- Strategically located fire extinguishers designed for specific fire control utilization.

.2 Chemical Safety

Personnel working in the process area containing hot acid are required to wear full face shields in addition to the standard protective clothing required for the controlled area.

Process vessels are vented to a central system which maintains a slight negative pressure in the tanks.

Any spills or overflows are contained within a curbed or diked area.

.3 Process Control

The facility is controlled from a central control system located in the URLS building. The control system controls and monitors the uranium recovery operation. An operator in the control room is responsible for monitoring and controlling the process along with the operators on the floor.

Instrumentation is installed, operated, and maintained according to plant standards and requirements. All critical systems fail safe if there is an electrical or air failure.

5.4 Environmental

All effluents, whether gaseous, liquid or solids, are monitored to ensure release criteria are met. The release of radiological and non-radiological particulates, aerosols, fumes, and vapors is controlled to as low a level as practical by filtration through low, medium, and high efficiency filters and by scrubbing the air with deionized water. Liquids are returned to the lagoons. Solids are analyzed and if within discharge limits, are released for off-site disposal. The uranium product is recycled to the existing fuel processing facility.

The process areas are maintained at a negative pressure with respect to atmosphere and adjacent areas. All exhaust air from the facility will be discharged through one new exhaust stack. Effluent constituents of concern will be continuously sampled or monitored as described in the current facility license information.

Favorable environmental impacts are expected from these activities by the elimination of uranium inventory from fluoride and nitrate waste treatment lagoons. An anticipated longer range benefit of the process, if successful, will be the uranium recovery and decommissioning of all uranium-bearing lagoons on site.

5.4 <u>Safeguard Material Control and Accounting</u>

Material control and accounting (MC&A) requirements will be applied in accordance with the NRC-approved GE-Wilmington Fundamental Nuclear Material Control Plan (FNMCP) and the IAEA Facility Attachment issued for the GE-Wilmington Design Information Questionnaire (DIQ).

Appropriate agency approvals will be obtained for the FNMCP and DIQ addressing the URLS uranium MC&A requirements prior to the reprocessing of any uranium materials outside of the URLS facility.

FIGURE 1

GENERAL PLANT LAYOUT

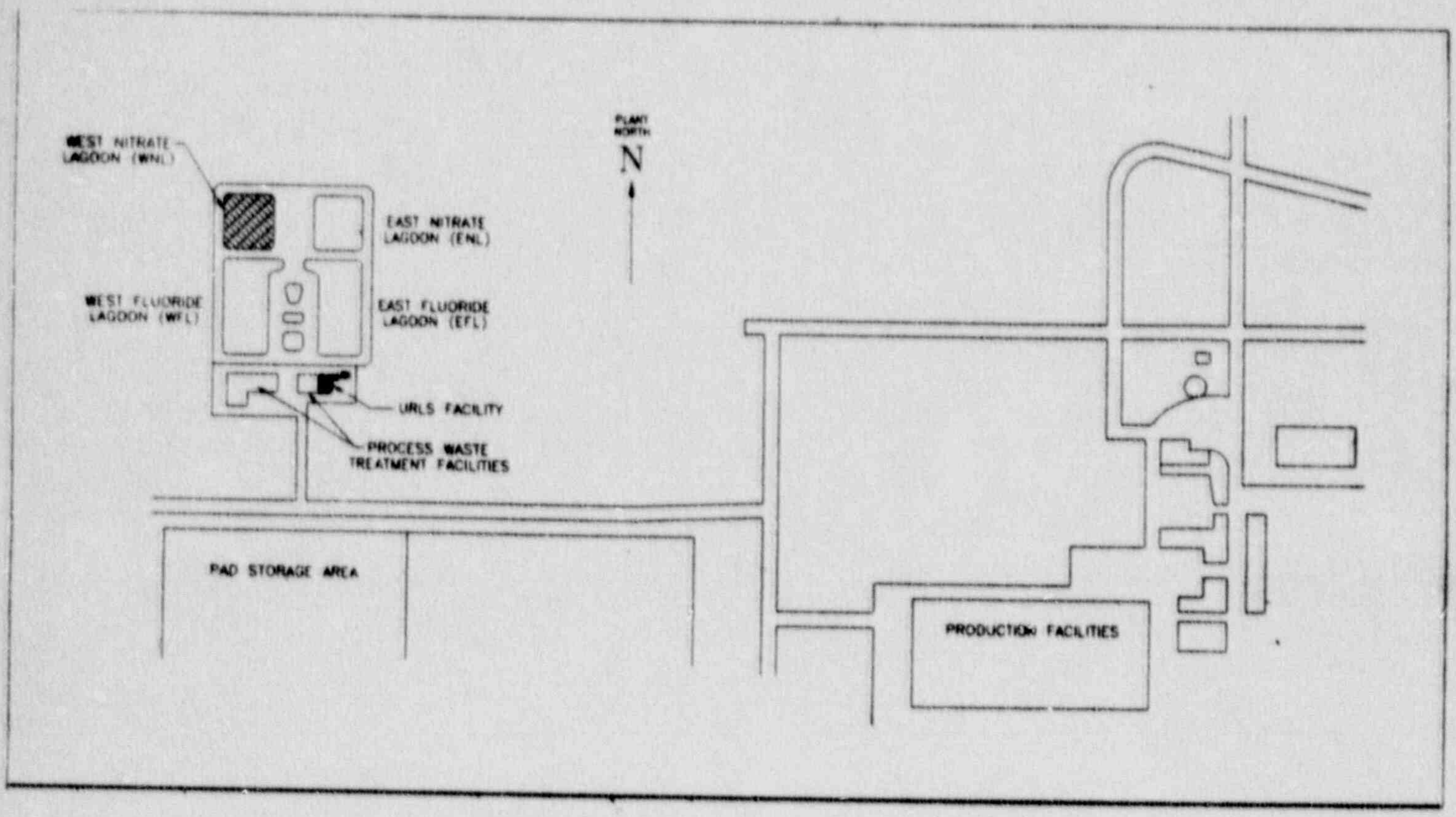


FIGURE 2

PLANNED LAYOUT OF URLS PLANT AND TANKS

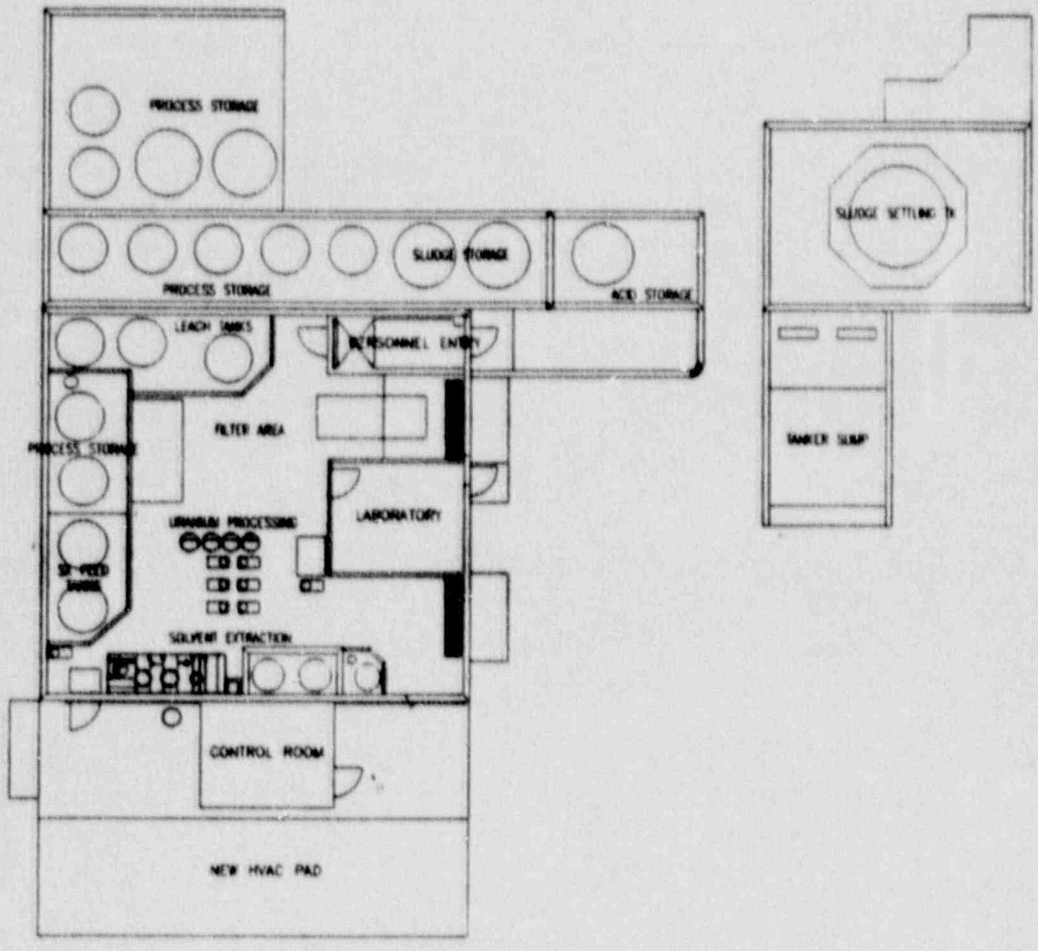
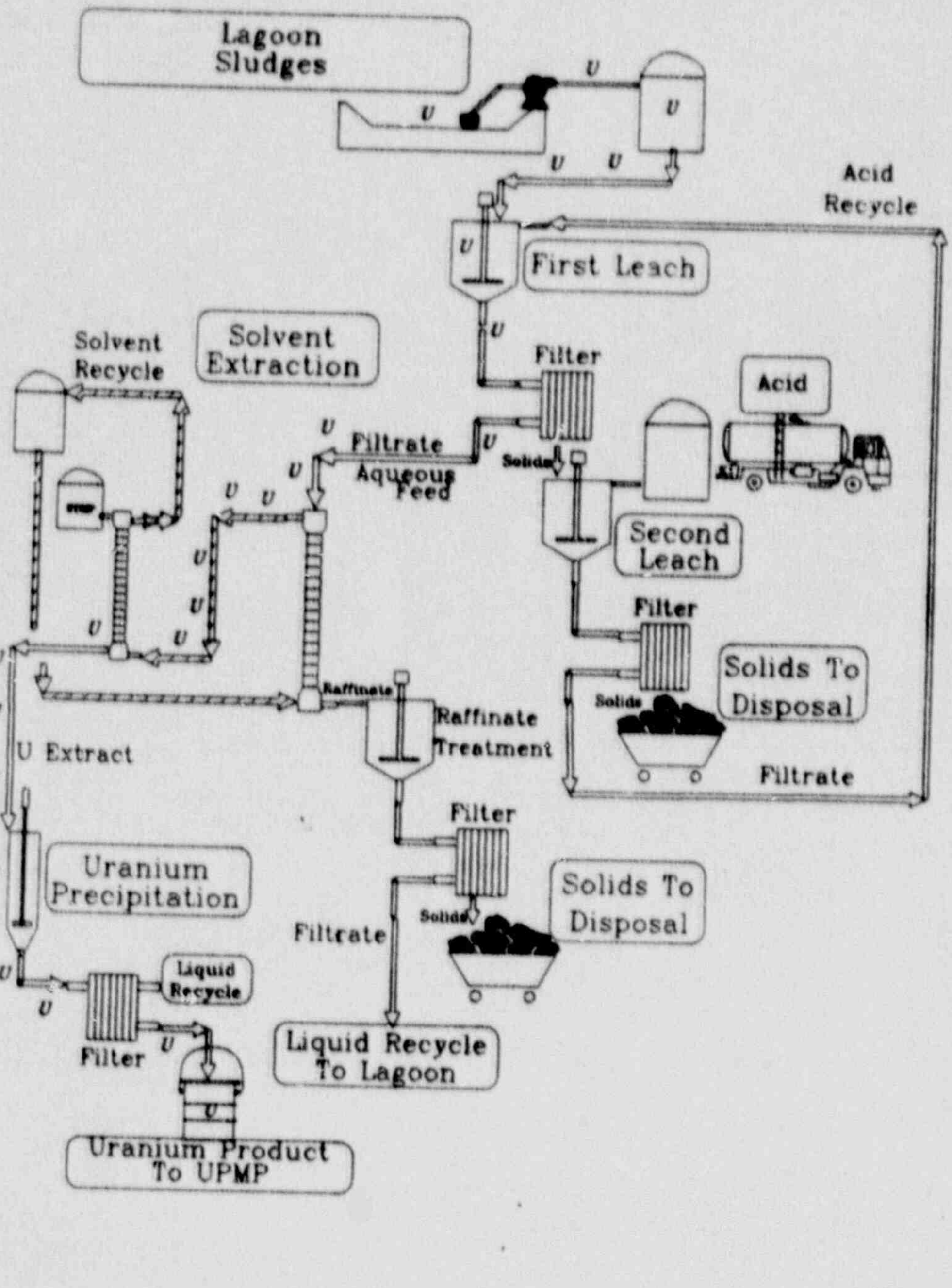


FIGURE 3

GENERALIZED URLS PROCESSING SYSTEM



ATTACHMENT 2

DESCRIPTION OF REQUESTED REVISIONS

Page(s)	Description
8	Revised to reflect the addition of Section 1.8.13 on pages I-1.20 and 21, and to change the subsequent page numbers in this chapter that changed due to the addition.
I-1.21	Revised to include new Section 1.8.13 for the Uranium Recovery from Lagoon Sludges (URLS) project.
I-1.22-25	These pages have been renumbered with no change to the content.

NOTE: All changes are noted with an asterisk on the right side of the page corresponding with the line changed.

ATTACHMENT 3

REVISED PAGES OF GE-SNM LICENSE 1097, DOCKET 70-1113

REVISIONS BY PAGE

Page	Application Date
TABLE OF CONTENTS	
1	10/23/87
2	"
3	"
4	"
5	"
6	"
7	"
8	11/09/89 *
9	2/06/89
10	7/28/89
11	2/06/89
12	"

PART I

CHAPTER 1

Page	Application Date
I-1.1	5/16/88
I-1.2	"
I-1.3	"
I-1.4	2/16/89
I-1.5	5/16/88
I-1.6	"
I-1.7	"
I-1.8	"
I-1.9	"
I-1.10	"
I-1.11	"
I-1.12	"
I-1.13	"
I-1.14	"
I-1.15	"
I-1.16	"
I-1.17	"
I-1.18	"
I-1.19	"
I-1.20	10/27/89
I-1.21	11/09/89 *
I-1.22	" *
I-1.23	" *
I-1.24	" *
I-1.25	" *

CHAPTER 2

Page	Application Date
I-2.1	2/06/89
I-2.2	"
I-2.3	"
I-2.4	"
I-2.5	"
I-2.6	"
I-2.7	"
I-2.8	"
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CHAPTER 3

Page	Application Date
I-3.1	10/23/87
I-3.2	"
I-3.3	10/23/87
I-3.4	"
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CHAPTER 4

Page	Application Date
I-4.1	10/23/87
I-4.2	"
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I-4.8	"
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I-4.10	"
I-4.11	"

1.8.13 Uranium Recovery from Lagoon Sludges (URLS) *

*

Authorization to install, test, and operate a facility for the efficient removal of uranium from wet and dry sludges stored in on-site lagoons and pits. *

There are two types of sludges involved - nitrate and fluoride base sludges. *

The material containing the recovered uranium will be returned to the fuel processing facility. *

Liquid waste from the URLS process will be transferred to the lagoons. Solid waste will be appropriately disposed of based on chemical and radionuclide composition. *

GUIDELINES FOR DECONTAMINATION OF FACILITIES AND EQUIPMENT

PRIOR TO RELEASE FOR UNRESTRICTED USE

OR TERMINATION OF LICENSES FOR BYPRODUCT, SOURCE,

OR SPECIAL NUCLEAR MATERIAL

U.S. Nuclear Regulatory Commission
Division of Industrial and
Medical Nuclear Safety
Washington, DC 20555

August 1987

~~87 0806 0434~~ 4pp.

The instructions in this guide, in conjunction with Table 1, specify the radionuclides and radiation exposure rate limits which should be used in decontamination and survey of surfaces or premises and equipment prior to abandonment or release for unrestricted use. The limits in Table 1 do not apply to premises, equipment, or scrap containing induced radioactivity for which the radiological considerations pertinent to their use may be different. The release of such facilities or items from regulatory control is considered on a case-by-case basis.

1. The licensee shall make a reasonable effort to eliminate residual contamination.

2. Radioactivity on equipment or surfaces shall not be covered by paint, plating, or other covering material unless contamination levels, as determined by a survey and documented, are below the limits specified in Table 1 prior to the application of the covering. A reasonable effort must be made to minimize the contamination prior to use of any covering.

3. The radioactivity on the interior surfaces of pipes, drain lines, or ductwork shall be determined by making measurements at all traps, and other appropriate access points, provided that contamination at these locations is likely to be representative of contamination on the interior of the pipes, drain lines, or ductwork. Surfaces of premises, equipment, or scrap which are likely to be contaminated but are of such size, construction, or location as to make the surface inaccessible for purposes of measurement shall be presumed to be contaminated in excess of the limits.

4. Upon request, the Commission may authorize a licensee to relinquish possession or control of premises, equipment, or scrap having surfaces contaminated with materials in excess of the limits specified. This may include, but would not be limited to, special circumstances such as razing of buildings, transfer of premises to another organization continuing work with radioactive materials, or conversion of facilities to a long-term storage or standby status. Such requests must:

   a. Provide detailed, specific information describing the premises, equipment or scrap, radioactive contaminants, and the nature, extent, and degree of residual surface contamination.

   b. Provide a detailed health and safety analysis which reflects that the residual amounts of materials on surface areas, together with other considerations such as prospective use of the premises, equipment, or scrap, are unlikely to result in an unreasonable risk to the health and safety of the public.

5. Prior to release of premises for unrestricted use, the licensee shall make a comprehensive radiation survey which establishes that contamination is within the limits specified in Table 1. A copy of the survey report shall be filed with the Division of Industrial and Medical Nuclear Safety, U. S. Nuclear Regulatory Commission, Washington, DC 20555, and also the Administrator of the NRC Regional Office having jurisdiction. The report should be filed at least 30 days prior to the planned date of abandonment. The survey report shall:

   a. Identify the premises.

   b. Show that reasonable effort has been made to eliminate residual contamination.

   c. Describe the scope of the survey and general procedures followed.

   d. State the findings of the survey in units specified in the instruction.

   Following review of the report, the NRC will consider visiting the facilities to confirm the survey.

TABLE 1

ACCEPTABLE SURFACE CONTAMINATION LEVELS

NUCLIDES[a]	AVERAGE[b c f]	MAXIMUM[b d f]	REMOVABLE[b e f]
U-nat, U-235, U-238, and associated decay products	5,000 dpm α/100 cm²	15,000 dpm α/100 cm²	1,000 dpm α/100 cm²
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	100 dpm/100 cm²	300 dpm/100 cm²	20 dpm/100 cm²
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1000 dpm/100 cm²	3000 dpm/100 cm²	200 dpm/100 cm²
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above.	5000 dpm βγ/100 cm²	15,000 dpm βγ/100 cm²	1000 dpm βγ/100 cm²

[a] Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides should apply independently.

[b] As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

[c] Measurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each such object.

[d] The maximum contamination level applies to an area of not more than 100 cm².

[e] The amount of removable radioactive material per 100 cm² of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.

[f] The average and maximum radiation levels associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/hr at 1 cm and 1.0 mrad/hr at 1 cm, respectively, measured through not more than 7 milligrams per square centimeter of total absorber.

DOCKET NO. 70-1113

CONTROL NO. 26078

DATE OF DOC. November 9, 1989

DATE RCVD. November 15, 1989

FCUF ✓ PDR ✓

FCAF LPDR

I & E REF. ✓

SAFEGUARDS ✓

FCTC OTHER

DATE 11/15/89 INITIAL SAC