Ms. Holahan, - NMSS 10/5/99

Attached is the SER and amendment request for the unrestricted release of a solution containing 1 ppm Uranium. We in licensing would like to discuss this amendment as it pertains to the clearance/release of solid material rule. Please contact me at 415-6317 or Dan Martin, 415-7254 to set up a meeting time.

Paul Lain NMSS

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

DOCKET NO: 70-1257

LICENSEE: Siemens Power Corporation (SPC)
Richland, WA

SUBJECT: SAFETY EVALUATION REPORT: SUBMITTAL DATED MAY 19, 1999, LICENSE AMENDMENT REQUEST FOR THE AUTHORIZED RELEASE OF AMMONIUM HYDROXIDE/AMMONIUM NITRATE SOLUTION FOR UNRESTRICTED COMMERCIAL USE

BACKGROUND

On September 1, 1998, the NRC amended Materials License SNM-1227 to include the authorized release of ammonium hydroxide solution for unrestricted commercial release. This solution is the effluent from the Ammonium Recovery Facility (ARF). On May 19, 1999, SPC requested the authorization for unrestricted commercial release of ammonium hydroxide/ammonium nitrate solution. This solution is the effluent from the Ammonium Diuranate (ADU) process and the Miscellaneous Uranium Recovery System (MURS). On August 10, 1999, the NRC and SPC had a telephone conference to discuss the amendment and supplemental information was provided by SPC on August 31 and September 21, 1999.

DISCUSSION

Since SPC started their dry conversion process, the ADU process and MURS are only used for scrap recovery. The need to recycle ammonium hydroxide has been drastically reduced. To further this reduction, SPC is requesting the authorization to release the effluent from the ADU process and MURS without processing them through the ARF. SPC proposes a release limit of 1 ppm uranium which is equivalent to 3 pCi/mL activity. SPC expects that this ammonium hydroxide/ammonium nitrate solution would be used in the manufacture of ammonia fertilizer and they plan to sell approximately 480,000 gallons per year.

The risk to human health was evaluated for the use of this mixture as fertilizer. By prior licensing action, the NRC authorized SPC to sell ammonium hydroxide containing 0.05 ppm uranium. In its analysis, SPC showed that its recovered ammonium hydroxide, if applied as a fertilizer, would add an extremely small fraction of activity over the naturally occurring uranium already in the soil. The current amendment would increase the uranium concentration to 1 ppm and include ammonium nitrate in the solution. The increase in uranium concentration is the result of the effluent no longer being processed through the ARF. SPC says the use of the ammonium hydroxide/ammonium nitrate solution would be similar to the use of recycled ammonium hydroxide when used as a fertilizer. The solution would be injected below the top three inches of soil. Using the soil application rates previously obtained from Walla Walla Farmers Co-op in Kennewick, Washington of 30 to 40 pounds of nitrogen per year, if the solution were applied every year for 10 years, and if none were removed via leaching, erosion, or other natural processes, it would result in an activity of 7.8×10^{-3} pCi/g in the top 3 inches of

soil. Uranium concentrations in Franklin County soil, as reported in the Hanford Site 1997 Environmental Report, Table 4.6.1 for all isotopes of uranium, averaged 0.50 pCi/g for 1997. The increase in uranium concentration caused by application of fertilizer containing 1 ppm of uranium is insignificant when compared to the background concentration. In addition, the contribution to the dose from other pathways, such as inhalation and external exposure to a worker standing next to a vat of ammonium hydroxide/ammonium nitrate solution prior to application would also be insignificant.

As part of this review, the staff considered the environmental consequences of the release of ammonium hydroxide/ammonium nitrate and determined that the release of this material will have no significant effect on public health and safety or the environment. The approval of this request is based upon the conditions specified in the amended license application:

1. A representative sample of each batch of ammonium hydroxide/ammonium nitrate solution shall be analyzed for uranium;

2. A batch shall be no larger than 100,000 liters; and

3. The uranium concentration in the ammonium hydroxide/ammonium nitrate solution shall not exceed 1 ppm or 3 pCi/ml.

These conditions are consistent with the conditions governing the authorized release of other uranium-bearing materials from the SPC facility. Therefore, the staff has determined that the release of ammonium hydroxide/ammonium nitrate solution for unrestricted commercial use is acceptable.

CATEGORICAL EXCLUSION

The staff has determined that the proposed changes do not adversely affect public health and safety or the environment and are categorically excluded from the requirement to prepare a site-specific environmental assessment. Therefore, in accordance with 10 CFR 51.22(c)(11), neither an environmental assessment nor an environmental impact statement is warranted for this action.

CONCLUSION

Based on the above discussion, the staff concludes that the release of ammonium hydroxide/ammonium nitrate solution containing not more than 1 ppm uranium will have no significant effect on public health and safety or the environment. Therefore, the staff recommends approval of this amendment request.

The Region IV inspection staff has no objection to this proposed licensing action.

PRINCIPAL CONTRIBUTORS
Julie Olivier
Heather Astwood
Paul Lain

SIEMENS

May 19, 1999
JBE:99:030

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

Gentlemen :

Subject: License Amendment Application - SNM-1227, Docket 70-1257; Sale of Ammonium Nitrate/Ammonium Hydroxide

Siemens Power Corporation (SPC) requests an amendment to its materials license to include, as an authorized activity, the sale of ammonium nitrate/ammonium hydroxide solution for use as fertilizer.

Background

SPC currently recovers ammonium hydroxide from its ammonium diuranate (ADU) process effluent and surface impoundment (lagoon) treatment effluent for internal recycle or sale as fertilizer. This recovery is accomplished by its Ammonia Recovery Facility (ARF). Because uranium hexafluoride (UF_6) is no longer converted to UO_2 by the ADU process (all UF_6 is now processed by dry conversion), the ADU effluent no longer contains significant quantities of fluoride. This current ADU effluent is an aqueous solution of ammonium hydroxide and ammonium nitrate, which makes it possible to use the ADU effluent itself directly (i.e., without processing by ARF) for fertilizer. Sale of the ADU effluent solution would (1) lower the amount of nitrate discharged to the City of Richland wastewater treatment plant and (2), by decreasing the processing load on ARF, allow quicker emptying and phase-out of SPC's surface impoundments under its State of Washington consent decree.

Process Description

Following the installation of its dry conversion facility, in 1998 SPC shut down one of its two major ADU conversion lines and now uses the second line (Line 2 in the UO_2 Building) for uranium scrap recovery. In the ADU scrap recovery process, uranium is dissolved in nitric acid and precipitated as ADU using ammonium hydroxide. The ADU is then converted into uranium dioxide and used in the fabrication of nuclear fuel. The effluent from the ADU process is a solution containing about 5% ammonium nitrate and

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10% ammonium hydroxide. Besides the Line 2 ADU process, a smaller but very similar ADU process, the Miscellaneous Uranium Recovery System (MURS) in the UO_2 Building, is also in use. The liquid effluent streams from both processes are currently treated by ion exchange for recovery of uranium and then combined and sent to ARF for recovery of ammonia before final ion exchange polishing to remove trace amounts of uranium and discharge to the sewer. Because these streams now contain very low fluorides, rather than processing them through ARF followed by discharge to the sewer, SPC proposes to collect and sell the combined ADU/MURS effluent solutions for use as fertilizer. In order to sell the effluent solution directly, SPC plans to add polishing ion exchange columns to reduce the uranium concentration of the ADU/MURS effluent to less than 1 ppm and a facility that will provide short-term storage and truck loadout capability.

Description of ADU/MURS Effluents

Samples of the Line 2 ADU and MURS liquid effluents were collected and analyzed over several weeks to determine their composition and suitability for use as fertilizer. Table 1 shows the nominal composition and flowrates of both streams, including data on heavy metals. It should be noted that the composition and flowrates of the streams are consistent and that the concentrations of constituents other than ammonium hydroxide and ammonium nitrate are very low.

Table 1. Line 2 ADU and MURS Liquid Effluent Compositions

Constituent	Line 2 ADU Effluent				MURS Effluent			
	8/20/98	8/28/98	9/3/98	9/9/98	8/20/98	8/28/98	9/3/98	9/9/98
NH_4OH (%)	10.6	11.8	11.0	7.9	3.6	4.0	4.2	2.1
NH_4NO_3 (%)	5.5	5.3	4.8	5.2	2.1	1.6	2.1	1.2
F (µg/ml)	<1.5	<30	<30	<3	302	<6	173	128
Ag (µg/ml)	<1	<1	<1	<1	<1	<1	<1	<1
As (µg/ml)	<1	<1	<1	<1	<1	<1	<1	<1
Ba (µg/ml)	<1	<1	<1	<1	<1	<1	<1	<1
Cd (µg/ml)	<1	<1	<1	<1	<1	<1	<1	<1
Co (µg/ml)	<1	<1	<1	<1	<1	<1	<1	<1
Cr (µg/ml)	<1	<1	<1	<1	<1	<1	<1	<1
Mo (µg/ml)	<1	<1	<1	<1	<1	<1	<1	<1
Ni (µg/ml)	<1	<1	<1	<1	<1	<1	<1	<1
Pb (µg/ml)	<1	<1	<1	<1	<1	<1	<1	<1
Se (µg/ml)	<1	<1	<1	<1	<1	<1	<1	<1
Zn (µg/ml)	<1	8.8	<1	<1	1.4	<1	52.3	<1
Hg (µg/ml)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

As previously noted, additional ion exchange will be used to reduce the uranium concentration in the combined liquid effluent to less than 1 ppm U. This will yield a maximum activity of 3 pCi/ml for the combined effluent with up to 5% enriched uranium.

Use of ADU/MURS Effluent for Fertilizer

SPC proposes a release limit of 1 ppm U, equivalent to 3 pCi/ml activity, for the ADU/MURS liquid effluent solution. The release limit for the ADU/MURS liquid effluent solution is consistent with the capability of the uranium clean-up process described above and is sufficiently low to result in an insignificant impact from the uranium to people or the environment from its final use as fertilizer. The calculated activity level for final treated ADU/MURS liquid effluent containing 5% enriched uranium is shown in Table 2.

Table 2. Calculated Activity for Line 2 ADU/MURS Effluent Containing 1 ppm Uranium, 5% Enrichment

Isotope	Isotope (%)	Isotope Activity (Ci/g)	Contributed Activity (Ci/ml)	ADU Effluent Total Activity (pCi/ml)
U-232	0	2.09E+01	0	2.99
U-234	0.035	6.19E-03	2.49E-12	
U-235	5	2.14E-06	1.23E-13	
U-236	0.028	6.34E-05	2.04E-14	
U-238	94.937	3.33E-07	2.64E-13	

By prior licensing action, the NRC authorized SPC to sell ammonium hydroxide for use as fertilizer. In its analysis, SPC showed that its recovered ammonium hydroxide when applied as a fertilizer would add an extremely small fraction of activity to the soil over the naturally occurring uranium already in the soil. The use of the ADU/MURS effluent solution will be identical to the use of recycled ammonium hydroxide. Because the ADU/MURS effluent contains ammonium hydroxide, it will be injected below the surface into the top three inches of soil. Using the soil application rates previously obtained from Walla Walla Farmers Co-op in Kennewick, Washington of 30 to 40 pounds of nitrogen per year, if the SPC ADU/MURS effluent solution were applied every year for 10 years, and if none were removed via leaching, erosion, or other natural processes, it would result in an activity of 7.8×10^{-3} pCi/g in the top 3 inches of soil. Uranium concentrations in Franklin County soil, as reported in the Hanford Site 1997

Environmental Report[1], Table 4.6.1 for all isotopes of uranium, averaged 0.50 pCi/g for 1997. The increase in uranium concentration caused by application of fertilizer containing 1 ppm of uranium is insignificant compared to the background uranium concentration.

A dose calculation performed with the RESRAD dose simulation software showed that the dose received by a resident farmer from soil which had been fertilized with ADU effluent solution would be about 0.5 X 10^{-3} mrem per year. This dose is a very small fraction (0.002%) of the EPA limit of 25 mrem/year (the allowable dose to the whole body from all fuel cycle activities, 40 CFR 190.10). The analysis was done using default RESRAD parameters with the depth of uranium set at 8 cm and the uranium isotope fractions shown in Table 2. The peak dose rate for each radionuclide was assumed for the entire period of the calculation, even though the peak dose for each radionuclide occurred at different times. These results show that the dose received by a resident farmer using the ADU liquid effluent solution as fertilizer (i.e., 0.5×10^{-3} mrem/yr) would be insignificant when compared to that from natural sources of radiation.

Conclusion

The use of SPC ADU/MURS liquid effluent solution as fertilizer would provide the opportunity for SPC to reduce the amount of nitrate discharged to the City of Richland wastewater treatment plant. It would also decrease the load on SPC's Ammonia Recovery Facility and thereby allow a quicker phase-out of its surface impoundments. Further, the amount of uranium added to the soil from the use of this solution as fertilizer is insignificant with respect to the naturally occurring uranium already present in area soils. A dose calculation using the RESRAD dose model shows that after 10 years of using the ADU/MURS effluent solution as fertilizer, the residual uranium will cause a dose rate of 0.002% of the EPA dose limit of 25 mrem per year to any affected individual from all possible fuel cycle related pathways.

This material will be handled in accordance with the radiation protection, criticality safety and environmental protection programs described in chapters 3,4 and 5, respectively, in SPC's license application. From a fire protection standpoint, the UO_2 building is rated as noncombustible. Fire loading is kept to a minimum through monthly inspections. Fire extinguishers (dry chemical or CO_2), alarm pull boxes, and heat detectors are strategically placed throughout the building. Where moderation control is in place, high expansion foam, dry chemical or CO_2 are required to be used to combat a fire. All flammable and combustible liquids of greater than one pint in volume are stored in fire rated containers.

In addition, SPC requests two other minor amendments. The first is to correct reference 25 on page 4-15 of its license application from Regulatory Guide 3.14, which is incorrect, to 3.41 which is the proper number. The second involves a change to the recently issued Amendment 16 to SNM-1227. SPC requests unmoderated, as well as moderated, uranium oxide be

[1] Dirkes, R.L. and R.W. Hanf, Hanford Site Environmental Report for Calendar Year 1997, PNNL-11795 UC-602, Pacific Northwest National Laboratory, Richland Washington 99352, September 1998.

authorized to be stored in sea-land containers. The unmoderated material will be stored under the rules that apply to moderated material.

Enclosed in support of this application, in addition to the information presented above, are six copies of pages 1-5, 1-6, 1-11 and 4-15 of SPC's license application.

If you have any questions or require more information, please contact me at 509-375-8663.

Very truly yours,

James B. Edgar
Staff Engineer, Licensing

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Enclosures

EMF-12(P), "Nuclear Material Safeguards Procedures Description for the Fuels Fabrication Plants." This document shall be maintained in a current and approved status and shall be properly implemented.

1.6.6 Authorization at Reactor Sites

SPC is authorized to possess fuel assemblies or fuel rods at reactor sites for the purpose of loading them into shipping containers and delivering them to a carrier for transport.

1.6.7 Authorized Release Guidelines

SPC is authorized to release equipment, scrap or facilities for unrestricted use, or for termination of license according to the "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material" as published by the U.S. Nuclear Regulatory Commission dated April 1993.

1.6.8 Authorized Criticality Alarm System Outage

SPC is granted an exemption from 10 CFR 70.24(a) for the purpose of performing maintenance on the criticality alarm system. Sections of the criticality alarm system may be taken out-of-service provided that all movement or processing of fissile material in affected areas is halted for the duration of the outage. Health and Safety Technicians shall conduct continuous surveys of the areas during the criticality alarm system outage.

1.6.9 Notification

Notifications to the NRC shall be made as required by regulations with the exception of 10 CFR 20.2202(a)(2) and (b)(2) as they apply to restricted areas. Reports to the NRC shall be made as required by regulations with the exception of those paragraphs in 10 CFR 20.2203 which refer to 10 CFR 20.2202(a)(2) and (b)(2) as they apply to restricted areas.

1.6.10 Authorized Workplace Air Sampling Adjustments

SPC is authorized to adjust Derived Air Concentration (DAC) limits and Annual Limit of Intake (ALI) values in process areas to reflect actual physical characteristics of the airborne uranium.

1.6.11 Authorized Release Guidelines for Hydrofluoric Acid

SPC is authorized to release hydrofluoric acid manufactured by the dry conversion process for unrestricted commercial use providing the following conditions are met:

1. A representative sample of each batch of hydrofluoric acid product shall be obtained and analyzed for uranium;

2. A batch shall be no larger than 46,000 liters;

3. The specific activity of any batch released for unrestricted use shall be ≤ 3 pCi/ml.

1.6.12 Authorized Release Guidelines for Ammonium Hydroxide from ARF

SPC is authorized to release ammonium hydroxide produced at the Ammonia Recovery Facility (ARF) for unrestricted commercial use provided the following conditions are met:

1. A representative sample of each batch of ammonium hydroxide product shall be obtained an analyzed for uranium;

2. A batch shall be no larger than 40,000 liters;

3. The uranium concentration in the ammonium hydroxide shall not exceed 0.05 ppm.

1.6.13 Authorized Release Guidelines for Ammonium Hydroxide/Ammonium Nitrate from ADU Effluent

SPC is authorized to release ammonium hydroxide/ammonium nitrate solution from the ADU processes used for uranium recovery for unrestricted commercial use provided the following conditions are met:

1. A representative sample of each batch of ammonium hydroxide/ammonium nitrate solution shall be obtained an analyzed for uranium;

2. A batch shall be no larger than 100,000 liters;

3. The uranium concentration in the ammonium hydroxide/ammonium nitrate solution shall not exceed 1 ppm.

18. H. F. Henry, "Studies in Nuclear Safety," K-1380, (1957).

19. C. L. Brown, "Nuclear Criticality Safety Analysis, Uranium Fuels Plant," Jersey Nuclear Company, BNW/JN-29, (1971).

20. "Determination of H/U Ratios in UO_2 Water and ADU-Water Mixtures," JN-71-2, (1971).

21. C. L. Brown, et. al., "Validation of Boundary Conditions for Assuming Nominal Reflection in Solid Angle Interaction Method (As Applied in Exxon Fuel Fabrication Plants)," BNW/XN-184, (1975).

22. "SCALE: A Modular Code System for Performing Standardized Computer Analyses for Licensing Evaluation," NUREG/CR-0200.

23. ANS Transactions, Vol.35, W. Marshall, et.al., "Criticality Safety Criteria".

24. American Nuclear Society, "Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors," ANSI/ANS 8.1-1983.

25. US Nuclear Regulatory Commission Regulatory Guide 3.41, "Validation of Calculational Methods for Nuclear Criticality Safety."

TABLE I-4.1

Table I-4.1

This table lists the major system components used at SPC and the type of Criticality Safety Control for each component. The individual control types may be used in conjunction with each other or individually provided multiple failures are required before the control type could fail.

Definitions:
GEO- Geometry (1 - favorable geometry; 2 - geometry control).
VOL - Volume control.
FNA Fixed neutron absorber.
NAA Neutron absorbing additives.
CCU Concentration control of uranium.
CCM- Concentration control of moderators.
MCU Mass control of uranium.
MCM Mass control of moderators.
PPC Process Parameter Control.
ARA- Control of array size i.e. total number or dimensions such as planar or 3-D arrays.
SPA Control of Spacing from other fissile units.

Table I-4.1 (Cont'd.)

COMPONENT	CONTROL TYPE: GEO 1	GEO 2	VOL	FNA	NAA	CCU	CCM	MCU	MCM	PPC	ARA	SPA	DISCUSSION OF ANY SPECIAL CONTROLS USED / ADDITIONAL EXPLANATION OF CONTROL TYPE
UF_6 Cylinder Storage (30" cylinder diameter or less)							X				X	X	Criticality is not possible unless moderators are present inside cylinders. Array size for full cylinders is limited to a single tier to prevent damage to cylinders.
UF_6 Cylinders on line (30" diameter or less)							X					X	Independently activated redundant devices prevent moderators from entering UF_6 cylinders.