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Docket No. 030-20934 License No. 37-23341-01

MEMORANDUM FOR: Stewart D. Ebneter, Director
Division of Radiation Safety and Safeguards

THRU: James H. Joyner, Chief
Nuclear Materials Safety Branch

FROM: John D. Kinneman, Chief
Nuclear Materials Safety Section B

SUBJECT: INTERSTATE NUCLEAR SERVICES (INS) CORPORATION, ROYERSFORD, PA

1. Background

The site at North Third Avenue in Royersford, Pennsylvania was first purchased for use as a nuclear laundry by Tri-State Industrial Laundries, the parent company of Environmental Laundries, on April 27, 1982. The home office of Tri-State Environmental Laundries was in Utica, New York, and the laundry operated under NRC License No. 31-21168-01 beginning April 1983. On February 17, 1984, Environmental Laundries was purchased by Interstate Nuclear Services Corporation (INS Corporation), a subsidiary of Interstate Uniform Services, Incorporated (now Unifirst Corporation). The facility continued to operate under License No. 31-21168-01 until September 13, 1984 when License No. 37-23341-01 was issued to the INS Corporation. The current license expires on January 31, 1989. The licensee operates similar facilities in Springfield, Massachusetts; Vicksburg, Mississippi; Columbia, South Carolina; Pleasanton, California; Macon, Georgia; Bremerton, Washington; Santa Fe, New Mexico; Portsmouth, Virginia; Charleston, South Carolina; and Honolulu, Hawaii.

The Royersford facility is located on twelve acres of ground. The building occupies approximately 40,000 square feet and is 1 1/2 stories high. An addition to the building was completed in spring 1987 to house a new waste water filtration system.

License No. 37-23341-01 authorizes the collection, laundering and decontamination of contaminated clothing and other launderable items, and the possession of contaminated equipment stored in a mobile facility. INS Corporation employs 25-40 individuals, most of whom handle contaminated items on a daily basis. The majority of the work is done during the day, although a second shift is used when necessary. Four industrial washers and dryers are used to decontaminate launderable items from users of licensed materials. Incoming shipments, primarily from nuclear power plants, are monitored to verify agreement with shipping documents. Each item is monitored for alpha and beta/gamma activity after laundering, according to the customer's contract specifications, either by hand or with an automated system.

Enclosure

2. INS Discharges to Sanitary Sewer

The INS Royersford facility discharges approximately 51,000 liters (13,000 gallons) per day into the Royersford sanitary sewer system. Prior to April 1987, all waste water discharged from the washers flowed to an 180-gallon hold-up tank. It then passed through a SWECO filter system into one of three 5000-gallon tanks. A sample from the tank was periodically taken and analyzed for compliance with NRC release limits. Water from the 5000-gallon tanks would be either discharged to the sewer or recirculated through a secondary bag filter system. Total activity concentrations of the wastewater discharged typically were between 1.5 and 2.5 E-5 microcuries per milliliter. Attachments 1 shows the radioactive constituents of the INS discharges to the sanitary sewer as determined by Oak Ridge Associated Universities (ORAU) analyses. These measurements were performed by ORAU on grab samples which were taken in June, 1986. The ORAU analysis indicates that these releases were less than 5% of the 10 CFR 20 limits for discharges to the sanitary sewer (Appendix B, Table I, Column II).

During April, 1987, a new filtration system was installed in an effort to reduce the activity concentration of the discharge to the sewer system. The new filtration system utilizes a series of mixers and polyelectrolytes to encourage agglomeration of particulates into larger, more easily filtered flakes. The mixture passes through a lamella phase separator where most particulate matter settles and is removed to drying beds. The supernatant liquid passes through a multi-media granular filter into a holding tank for sampling and analysis prior to release. This system is designed to be capable of removing solids to concentrations of less than 5 milligrams per liter. Since this system has been in use, the average activity concentration of radioactivity in the wastewater discharged has been reduced to less than 6 E-6 microcuries per milliliter.

Sampling of the wastewater is performed by removing a representative one-liter sample from the holding tank. An aliquot of this sample is evaporated until dry on a planchet, then counted. Gross alpha activity of this aliquot is measured with a scintillation alpha counter, and gross beta/gamma activity is determined using a GM counting system. The sum of the two measurements is used to determine the total activity concentration in the wastewater. Analysis of split samples by Oak Ridge Associated Universities indicates that INS Corporation may be overestimating the total activity by a factor of three. If so, the recent releases to the sewer may be less than 2% of the 10 CFR 20 limit.

3. Concentration of Radionuclides at Royersford Wastewater Treatment Facility

Wastewater released to the sewer system flows to the Royersford Wastewater Treatment Facility (WWTF). This facility is relatively small, designed to handle approximately 2 million liters per day. Discharge from INS Corporation comprises about 2.5% of the daily WWTF volume. (Other INS Corporation facilities typically contribute less than 0.04% of the local sewage treatment plants' volume.) Sludge resulting from the primary digester has a solids content of 3-5%. Approximately 9500 liters of this sludge is transferred to the secondary digester each week. Sludge accumulates in the secondary digester from October to May of each year. Clear water from the plant is chlorinated and discharged to the Schuykill River.

Exposure rate measurements performed by NRC Region I inspectors at several locations around the wastewater treatment facility were comparable with background levels, except at the openings of the secondary digester. Radiation levels of 900-1100 microrem per hour were measured at the secondary digester by the inspectors in 1986. They have since reduced to about 200-300 microrem per hour.

Analyses by ORAU of sludge from the secondary digester indicate measurable concentrations of most radionuclides being discharged by INS Corporation. However, concentrations of these nuclides in the liquid effluents released by the WWTF to the river are much lower. No gamma emitters were identified by ORAU in a sample of water released by the WWTF to the river. The tritium concentration in this sample was measured to be 2.5 E-6 microcuries per milliliter and the strontium-90 concentration in the sample was measured to be 2.4 E-8 microcuries per milliliter. These concentrations are each less than 10% of the limit for discharges to unrestricted areas. Considering the levels released from INS Corporation, and the dilution available prior to the wastewater treatment plant, it appears that the wastewater treatment process is concentrating the radionuclides in the sludge.

4. Previous Disposal of Contaminated Sludge from Royersford Wastewater Treatment Plant

Since prior to operation of the Tri-State laundry, sludge from the WWTF secondary digester has been withdrawn and spread on agricultural land by a commercial sludge spreader, beginning in May of each year. Approximately 12,000 gallons (4.5 E4 liters) were distributed per acre. Soil was tilled to a depth of 7-10 centimeters immediately following sludge treatment, and to a depth of 30 centimeters prior to planting animal-feed crops. The sludge was being spread only on agricultural lands growing crops for animal consumption. Attachment 2 shows the results of ORAU analyses of the radioactive constituents of the sludge released from the sewage treatment plant. The results are the average of a series of measurements made by ORAU in 1986 and 1987.

ORAU has performed surveys on farms where the sludge was spread. Radiation levels were measured by ORAU in 1986 at one meter above the surface of the treated areas. Those levels increased from about 14 microrems per hour before the sludge was spread to a maximum of 20 microrems per hour after the sludge was spread. These levels subsequently decreased over the summer.

Activity in the soil prior to sludge treatment was comparable with background soil samples. After application, levels of some isotopes increased. The major radionuclide identified was cobalt-60, with a concentration of 27 picocuries per gram in the top 2.5 centimeters of soil at one site. Concentrations of radionuclides decreased to baseline levels below a depth of 7.5 centimeters.

Air sampling performed by ORAU indicates no levels of airborne radioactivity exceeding the NRC limits for unrestricted areas during spreading operations. Radionuclide concentrations from sediment samples taken from runoff areas did not differ from baseline soil samples.

5. Pathway Analyses for Previous Agricultural Application of Contaminated Sludge

Pathway analyses and dose estimates were performed by ORAU to evaluate the effect of the disposal of the sludge on agricultural lands. The maximally exposed individual was determined to be a farmer who works on the land treated with the sludge, and consumes some vegetables grown on this land, as well as meat and milk from livestock fed crops from the treated land. For the maximally exposed farmer, this is estimated to be four millirems per year. The population dose equivalent commitment was estimated to be 1.2 personrem. This study is continuing.

6. Current Trends

Recent measurements by INS indicate that the releases from INS have been decreasing since the new water filtration system was installed in April 1987. Attachment 3 indicates the running annual average of the total gross beta activity released, based on INS measurement data.

In January 1988, the Royersford WWTF was informed by the Commonwealth of Pennsylvania Department of Environmental Resources that agricultural spreading of sludge would no longer be permitted because of concerns regarding the level of non-radioactive copper measured in the sludge. The Royersford WWTF is currently considering two substitute options for disposal of its sludge. One option is to dewater the sludge and dispose of it in a local landfill. This method would be expected to increase the solids content from approximately 4% to 20%. However, in a letter dated August 5, 1988, the Pennsylvania Department of Environmental Resources rescinded approval for disposal of Royersford sewage sludge at a local landfill, due to the radioactive constituent in the sludge.

A second option is to ash the sludge. The facility which ashed the sludge would then be responsible for disposing of the ash. Based on estimates by the Royersford WWTF, this method would be expected to increase the solids content to approximately 50%. Attachment 4 shows the expected concentration of radionuclides in sludge for the current method, the dewatered method, and (again, based on analysis by ORAU) the ash method of disposal, along with the 10 CFR 20 limits for unrestricted area discharges.

A grab sample was taken in March 1988 from the secondary digester at the Royersford WWTF and aliquots of the sample were dewatered and ashed by the operator of the facility. These samples were sent to ORAU for analysis. Attachment 5 shows the measured concentrations of radioisotopes in the sludge, dewatered sludge and ashed sludge. The ashing method used by the Royerford WWTF in this test reduced the moisture content to approximately one percent. These values are lower than expected and may indicate that the grab example was not representative of the contents of the digester.

The data available indicate that strontium-90 is the limiting isotope with regard to the disposal of the sludge. The data further indicate that a dilution of approximately one to two orders of magnitude is required to reduce the concentration of strontium-90 in ash to the 10 CFR 20, Appendix B, Table 2, Column 2 limit. Discussions with the manager of the Royersford Wastewater Treatment Facility indicate that this dilution is unlikely for any of the incinerators under consideration.

In August 1988, the licensee submitted a license amendment request to permit the direct discharge of its effluent to the Schuylkill River. This amendment request is currently under review.

7. Plan of Action

We plan to take no enforcement action at this time because the licensee's releases are within the regulatory limits. However, we are taking the following actions to ensure that the licensee's releases are ALARA and that the potential dose pathways are fully understood.

- Continue to evaluate the licensee's quarterly report of its discharges to the sewer.
- Continue the contract with ORAU to monitor concentration of radioactive material in sludge, however it is dispersed, and to continue dose pathway analyses of past agricultural disposal of sludge.
- Review the licensee's progress in its plans to make significant improvements in its monitoring capabilities and continue to encourage improvements in reducing the amount of activity discharged to the sewer.

- Prepare a technical assistance request for NMSS requesting advice on whether there is adequate justification for conditioning the license to reduce the limits on the discharge to the sanitary sewer when the license expires in January 1989. Request that NMSS suggest appropriate limits if they believe the limits can/should be reduced.

- Carefully review the license amendment request submitted by the licensee to discharge directly to the river.

John D. Kinneman, Chief
Nuclear Materials Safety Section B

Attachments:
1. ORAU Analysis of INS Discharges to Sanitary Sewer
2. ORAU Analysis of Sludge at Royersford Wastewater Treatment Facility
3. Gross Activity Measured by INS in Releases to Sewer
4. Radioisotope Concentrations in Current Sludge and Expected Concentration in Dewatered Sludge and Ashed Sludge
5. Measured Grab Sample Radioisotope Concentrations in Current Sludge, Dewatered Sludge, and Ashed Sludge in March 1988

cc:
E. Ullrich, RI
J. Hickey, NMSS
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ATTACHMENT 1

ORAU Analysis of INS Discharges to Sanitary Sewer

June 1986 ORAU Analysis of INS Discharges to Sanitary Sewer

Isotope	Average Concentration (pCi/ml)	Percentage of 10 CFR 20 Discharge Limits	
		Sanitary Sewer	Unrestricted Area
Co-60	0.50	0.05	1.6
Sr-90	0.36	3.60	119
Cs-134	0.42	0.10	4.6
Cs-137	2.59	0.70	12.9
All isotopes except H-3	5.82	4.50	142

NOTE: The gross beta measurement by the licensee for June 1986 was 11.5 pCi/ml.

ATTACHMENT 2

ORAU Analysis of Sludge at Royersford
Wastewater Treatment Facility

ORAU Analysis of Sludge at Royersford Wastewater Treatment Facility

Isotope	Average Concentration (pCi/ml)	Percentage of 10 CFR 20 Discharge Limits	
		Sanitary Sewer	Unrestricted Area
Co-60	55	5.5	183
Sr-90	2.7	26.8	892
Cs-134	1.6	0.5	18
Cs-137	15	3.7	74
All isotopes except H-3	101	3.8	1279

ATTACHMENT 3

Gross Activity Measured by INS in Releases to Sewer

Gross Activity Measured by INS in Releases to Sewer

Year	Average Concentration (pCi/ml)	Total Activity (Curies)
1986	15.0	0.24
1987	9.3	0.17
1988 (through June)	5.5	0.07

NOTES:
1. ORAU analysis of INS sewer releases in June 1986 indicated that 11.5 pCi/l measured by INS was equivalent to 4.5% of the sewer discharge limit and 142% of the unrestricted area discharge limit. ORAU measurements have indicated that the gross activity measurements by INS overestimate the concentration released to the sewer.
2. Regulatory limit for total activity discharged to sewer is one curie.
3. INS installed new filtration system in April 1987.

ATTACHMENT 4

Radionuclide Concentrations in Current Sludge and
Expected Concentrations in Dewatered Sludge and Ashed Sludge

Radionuclide Concentrations

Isotope	Average 1986-1987 Sludge pCi/ml	Expected Dewatered Sludge pCi/g	Expected Ashed Sludge pCi/g	10 CFR 20 Limits Unrestricted Area pCi/ml
Co-60	55	1,200	2,900	30
Sr-90	2.7	56	140	0.3
Cs-134	1.6	34	84	9
Cs-137	15	310	780	20
All isotopes except H-3	101	2,087	5,252	--

Unrestricted Area Limit: 10 CFR 20, Appendix B, Table 2, Column 2

Assumptions:

All activity remains in the solids. (This is conservative, but not correct, for ashing because approximately 25% of the radioactivity is expected to be released in the incineration process.)
Current Sludge: 5% Solids
Dewatered Sludge: 20% Solids
Ashed Sludge: 50% Solids

250,000 gallons of current sludge produces 50 tons of dewatered sludge and 25 tons of ash.

ATTACHMENT 5

Measured Grab Sample Radionuclide Concentrations
in Current Sludge, Dewatered Sludge, and Ashed Sludge in March 1988

March, 1988 Grab Sample
Measured Radionuclide Concentrations

Isotope	March 1988 Sludge pCi/ml	Dewatered Sludge pCi/g	Ashed Sludge pCi/g	10 CFR 20 Limits Unrestricted Area pCi/ml
Co-60	7.2	93	1100	30
Sr-90	0.6	20	76	0.3
Cs-134	0.3	3	36	9
Cs-137	2.5	30	340	20

Unrestricted Area Limit: 10 CFR 20, Appendix B, Table 2, Column 2

Note: 1. Ashed sludge sample was not actually ashed but was dried to less than 1% moisture content.

2. The grab sample may not be representative of the contents of the secondary digester.