

U. S. ATOMIC ENERGY COMMISSION
DIRECTORATE OF REGULATORY OPERATIONS
REGION I

RO Inspection Report No.: 50-201/72-03 Docket No.: 50-201
Licensee: Nuclear Fuel Services, Incorporated License No.: CSE-1
P.O. Box 124 Priority: 1
Category: A-(1)

Location: West Valley, New York 14171

Type of Licensee: Fuels - Reprocessing

Type of Inspection: Special - unannounced

Dates of Inspection: September 19-23 & 26-29, 1972

Dates of Previous Inspection: September 6, 1972

Principal Inspector: *Eugene Epstein* 1/4/73
Eugene Epstein, Radiation Specialist Date

Accompanying Inspectors: None _____
Date

_____ Date

Other Accompanying Personnel: None

Reviewed By: *R. H. Smith* Jan 4 1973
R. H. Smith, Acting Senior, Facilities Radio-
logical Protection Section Date

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SUMMARY OF FINDINGS

Enforcement Action

A. Violations

1. Solid radioactive waste not packed to prevent dispersion. (Report Details, Paragraph 15)
2. All batches of liquid effluent not analyzed for activity. (Report Details, Paragraph 13)
3. Violation of Procedures (Report Details, Paragraph 15)

B. Safety Items

None

Licensee Action on Previously Identified Enforcement Items

- A. Item No. 4, Enclosure 1, of licensee letter dated April 7, 1972 to Directorate of Regulatory Operations. (Report Details, Paragraph 2)
- B. Item No. 5, Enclosure 1 of licensee letter dated April 7, 1972 to Directorate of Regulatory Operations (Report Details, Paragraph 3)
- C. Item No. 6, Enclosure 1, of licensee letter dated April 7, 1972 to Directorate of Regulatory Operations (Report Details, Paragraph 4)
- D. Item No. 1, Enclosure 3, licensee letter dated April 21, 1972 to Directorate of Regulatory Operations (Report Details, Paragraph 5)
- E. Item No. 2, Enclosure 3, licensee letter dated April 21, 1972 to Directorate of Regulatory Operations (Report Details, Paragraph 6)
- F. Item No. 3, Enclosure 3, licensee letter dated April 21, 1972 to Directorate of Regulatory Operations. (Report Details, Paragraph 7)
- G. Item No. 4, Enclosure 3, licensee letter dated April 21, 1972 to Directorate of Regulatory Operations. (Report Details, Paragraph 8)
- H. Item No. 5, Enclosure 3, licensee letter dated April 21, 1972 to Directorate of Regulatory Operations. (Report Details, Paragraph 9)

- I. Item No. 6, Enclosure 3, licensee letter dated April 21, 1972 to Directorate of Regulatory Operations. (Report Details, Paragraph 10)

Design Changes

None

Unusual Occurrences

- A. Licensee letter dated June 21, 1972 to Directorate of Regulatory Operations reporting a liquid effluent release. (Report Details, Paragraph 11)
- B. Licensee telephone call on June 16, 1972 to Directorate of Regulatory Operations, Region I, reporting a malfunction of a stack monitor. (Report Details, Paragraph 12)
- C. Licensee telephone call on June 16, 1972 to Directorate of Regulatory Operations, Region I, reporting a release of liquid effluent to ground surface run-off. (Report Details, Paragraph 13)
- D. Licensee telephone call on July 12, 1972 to Directorate of Regulatory Operations, Region I, reporting contamination transferred to one employee's residence. (Report Details, Paragraph 14)
- E. Licensee letter dated July 26, 1972 to Directorate of Regulatory Operations reporting an overexposure. (Report Details, Paragraph 15)
- F. Anonymous letter dated September 3, 1972 to the AEC Directorate of Licensing. (Report Details, Paragraph 16)
- G. Licensee letter of September 12, 1972 to Directorate of Regulatory Operations, reporting external overexposure of nine contractor employees. (Report Details, Paragraph 17)

Other Significant Findings

A. Current Findings

The NFS plant is in shutdown condition. No fuel has been reprocessed since January 1972 and no irradiated fuel has been reprocessed since November 1971. Approximately 80 employees have been laid off. Licensee representatives stated that they use contract employees, for a minimum of 4 hours work. These employees are obtained from local labor contractors and are used, according to records of these contractors and statements of licensee representatives, to perform decontamination and replace hot cell

equipment. These employees work until a whole body exposure of 2 rem/calendar quarter has been received. Contractor records indicated a total of 516 such employees were used in 1972.

B. Status of Previously Reported Unresolved Items

None

Management Interview

A management interview was held September 29, 1972 with the following individuals:

- J. P. Duckworth, Plant Manager
- B. E. Knight, Manager, Operations
- W. A. Oldham, Manager, Construction
- T. K. Wenstrand, Manager, Health and Safety

The following subjects were discussed:

- A. The current AEC policy of providing the licensee with a copy of the inspection report to define proprietary information prior to release of the report to the Public Document Room.
- B. The proper packaging of radioactive waste and contaminated material particularly pointing out that failure to properly package such waste had caused a reportable incident. (Report Details, paragraph 15)
- C. The release of liquid effluent to ground water prior to analysis particularly pointing out that employees had failed to follow stated procedures. (Report Details, Paragraph 13)
- D. The failure to perform smear surveys of contaminated material prior to transfer. (Report Details, Paragraph 15)

DETAILS

1. Persons Contacted

T. K. Wenstrand, Manager Health and Safety
D. Coughig, Production Supervisor
R. T. Smolkowski, Supervisor, Contract Administration and Secretary of the Safety Committee
J. P. Maier, Health Physics Technician
M. Jump, Technical Services Manager
P. Burns, Product Operator
R. May, Chemical Operator

E. S. Rothschild, M.D.
H. Benz, Vice President, Benz Labor Agency
G. W. McDonald, Plant Assistant Engineer
J. E. Birchler, Supervisor, Plant Assistance

Current Status of Previously Identified Enforcement Items

2. Licensee representatives stated that they had identified the source of surface run-off water as being the wake from the Condensate and Cooling Tower. Licensee representatives stated that this cooling water gathers activity via small leaks in operational equipment. Licensee representatives stated that corrective action was achieved by re-routing the Condensate and Cooling Water to an interceptor holding pond which feeds into the Low Level Liquid Waste Treatment Facility. Surface stream activity which prior to the corrective action was as high as 1.85×10^{-5} uCi/cc beta was lowered to 7.8×10^{-9} uCi/cc beta.
3. Licensee representatives stated that the Diesel Motor drive to provide emergency power for the Head End Ventilation System was never installed. They stated that the propane gas motor, which was first evaluated in 1967 and submitted to DML and approved, was installed. Licensee personnel stated that a Diesel Motor requires several minutes to come to full power whereas a Propane Gas motor immediately gives full power.

The inspector inquired if other changes were evaluated to reflect whether a safety question existed. The following project reports were reviewed:

- a. Installation of a passport into the Process Mechanical Cell
- b. Addition of a tank to the Fuel Receiving and Storage Pool.

The inspector noted that in both of these additions a full safety evaluation was made as indicated by examination of the Safety Committee Minutes.

- 4. The inspector by examination of Safety Committee Minutes and observation, noted that the diesel engine driving the electric generator was scrapped and the originally approved propane gas motor electric generator was installed instead. The minutes of the Safety Committee indicated no unreviewed safety matters.
- 5. Licensee representatives reported that radiation levels within the plant and adjacent areas were due to the present acid recovery system. The inspector noted that a new acid recovery system housed within a separate concrete shielded building was under construction. Licensee representatives stated, that the plant was in a shutdown condition and had been for the past six months. They reported that the present work program activity consists of new construction, decontamination and replacement of faulty equipment.

Records of surveys, which were reviewed, revealed that the operation of the Head End Ventilation System caused a reduction in contamination, air concentrations and radiation levels within the Operations Building and adjacent areas. The inspector made a confirming survey throughout the Operations Building and adjacent areas. Radiation levels inside the building were noted not to exceed 1.0 mR/hr and were less than 0.2 mR/hr in any outside area within the fence restriction.

The inspector also examined film badge and TLD reports from December 1971 to September 1, 1972 and noted that the average whole body exposure for permanent plant employees was 2.4 rem during the first six months of 1972. Records also indicated that additional contract help was obtained from local labor agencies. Personnel monitoring records indicated that the average exposure for these persons was 1.73 rem. The average whole body exposure for the first six months 1972 has decreased from that noted during a similar period in 1971.

- 6. Licensee representatives stated that they have replaced the chest counter with a shielded whole body counter. He stated that all plant personnel are now routinely counted by the whole body counter once yearly and at any other time there is reason to believe an uptake has occurred. The licensee representatives also stated that there has been no case, within the plant itself, in 1972 where there was excessive exposure to concentrations of radionuclides in air. There was one case reported in 1972 where one person was exposed to concentrations of radionuclides in air at the waste burial site.

Nasal swabs are taken, according to records, after each zone entry and the swabs are counted in a pulse height analyzer as well as a beta counter. If activity is detected, urine analysis and whole body counting is performed. If alpha activity is detected, above a value of 3 dpm/day in urinalysis, fecal sampling is performed. Records of these analyses were examined and no overexposure was revealed, except as stated above.

7. Permanent Employees

Licensee representatives stated that all permanent employees have received formal classroom training including use of films and training guides. The curriculum was noted to include the subjects listed in the licensee reply. Formal written examinations were given and the examinations and grades obtained were observed in formal records. The examination covered types of radiation surveys, instrumentation, what readings mean, actions to be taken when instrument readings are obtained, exposure limits, working time limits, special work permit procedures, protective clothing, and emergency procedures. Questioning by the inspector, of three permanent employees revealed that they had received the training and had taken written examinations immediately following the lectures. They also stated that they periodically see training films and receive lectures from the Health Physics Staff.

Contractor Employees

One Health Physics technician was noted to be permanently assigned to contractor employees. The inspector spoke to one contractor employee, who stated that he had been at the NFS site for six years. He stated that he had received training in radiation safety when first employed and periodic refresher training since then. Two other contractor employees working at the NFS site for one and two years stated that they too had received training. Each one questioned, knew the exposure they could receive in any days work, reporting requirements, as well as emergency action and evacuation procedures.

Temporary Employees

The inspector verified by a visit to one labor agency that 516 such employees from this agency were used at NFS in 1972, to date. The labor contractor reported that these people do not receive formal training. Licensee representatives verified this and stated that they work only under the direct surveillance of a health and safety technician.

The licensee representative stated that these persons are instructed in the use of protective clothing and masks and also receive instruction in the use of self reading dosimeter pencils and wear two such

pencils, a low range 0-200 mR, and a high range, 0-1R. Licensee representatives stated that these temporary employees are used for exposure in any calendar quarter up to 2R, to the whole body.

All employees whether temporary, contractor or permanent were noted to have signed Forms AEC-4 with all entries completed.

8. Environmental Sampling

The program for sampling air and water was described by the licensee representatives as follows:

Section 3 of the licensee's Health and Safety Procedures Manual dated 5/3/72 specifies the location and frequency for sampling of: air and water; background radiation measurements, deer, fallout, fish, food crops, milk, silt from Buttermilk and Cattaraugus Creeks, and water from all sources of release were noted specified.

The inspector noted that the procedures specified the data sheets to be used and the method to record and calculate results. These data sheets were examined and in no case were AEC or Technical Specification limits exceeded.

Solid Waste Control

Solid Waste Management Control was noted to be covered completely in Sections 8 and 10 of the licensee's Health and Safety Procedures Manual. The Manual specifies the handling, packaging surveillance monitoring and control of both high level and low level solid waste.

Adequacy of Internal Quality Control Systems to assure reliability of Analytical procedures and specifications for checking and calibration of analytical instrumentation

Section 10.2.2.1 - 10.111 Health Safety Procedures describes stack monitors, what readings mean, set points and calibration of stack monitors to determine particulate and gaseous release. The inspector noted that the operation of these monitors are checked daily and that the results of checks are entered in a log maintained by the shift supervisors.

Section 10.3.1 - 10.4 describes liquid check procedures and analytical procedures to check the presence of fission products in liquid.

Sections 8.1 - 8.5 of the Health and Safety Procedures describes methods for taking all in-plant samples, logs for results, instruments used, calibration and analytical procedures to determine concentrations

of in-plant air concentrations. These procedures are dated 4/10/72.

Training for Transients and Visitors

Transient workers and visitors according to documentation are never unescorted. Licensee personnel stated that these persons receive instruction according to need. Visitors were noted to receive at the guard gate, a dosimeter pen and required escort, according to observations made by the inspector. They also pass through hand and foot monitoring stations, one located at the plant main entrance and one located at the guard reception shack. They receive from the escort, instructions commensurate with the hazards in the area to be visited.

Recording of data: exposures, personnel monitoring, notifications, bioassay, whole body counting and comparison of exposure determination methods

The licensee's Health and Safety Procedures prescribes precisely how the information obtained is to be recorded.

Environmental Samples of water were noted by the inspector to have been split between NFS, and two off-site contractors. The results were available and examined by the inspector and showed that all three split sample results were within 20%. Film badge and TLD systems were also compared and found to be within close agreement.

9. The licensee conducted a complete emergency evacuation drill on 4/22/72 which was filmed. The inspector reviewed the film and noted the following: Upon sounding the alarm, the plant was evacuated. Attendance of evacuee's was noted to be checked at the guard shack beyond the gate. Attendance revealed, one person missing, (a simulated casualty). A rescue force properly suited and equipped with survey instrumentation entered the plant and located the person, removed him via stretcher into a vehicle and transported him to Chaffee Memorial Hospital in Springville. The simulated casualty was wrapped in plastic to prevent spread of contamination. Twelve doctors and the nursing staff were in attendance and were briefed and instructed as to how to handle and treat a radiation casualty. All biological sera was collected and tagged. All notifications to NY State, AEC, Police, and Fire authorities were made.

Chapter 9 of the Safety Procedures Manual entitled Emergency Procedures was approved by the Safety Committee on 4/5/72 and the Plant Manager on 4/6/72. Section B also contained procedures for personnel at Chaffee Memorial Hospital.

The plan was noted to contain procedures for monitoring surveying and decontamination. A responsible person has been designated to notify outside agencies. The plan places duty upon the Technical Services Manager or in his absence a person designated by the Plant Manager. The plan contains criteria for notification of outside agencies.

The inspector noted all alarms were sounded and tested each Friday precisely at 11:00 a.m. with loud speaker announcements of a test. Records indicate evacuation drills have been held at least four times yearly.

10. Head End Ventilation System (HEVS)

Records examined included minutes of the Safety Committee. These records indicated a training program in filter removal was given to 16 people on 10/19 - 21/70. The system was transferred by the vendor to the licensee on 10/25/70 according to records. The committee minutes indicated that on 10/2/70 all TOP's (Temporary Operating Procedures), were approved for operation of the Head End Ventilation System. These were later changed to SOP's Nos. 15-20 and -21.

Operating logs of the Chemical Cell indicate that all operators worked with the vendor in going over all parts of the ventilation system. A licensee representative stated that a formal training program was given only 3 days before the system was scheduled to go into operation but insisted that this was a better method since the training received was fresh in the mens mind.

According to a written report dated 10/25/70, the HEVS was accepted without meeting design criteria as to air flow. The report listed some 50 system checks, the identity of the person responsible for each check, and the date the checks were completed. All checks were complete by 10/24/70 at 2300 hours. The data obtained showed that of 15 locations checked for air flow, 11 of the locations did not meet design specifications. Locations 11 and 12, the north and south glove aisle in the filter change room designed for 100 CFM had an airflow of 7 CFM.

Licensee representatives stated that the deficiencies were corrected by installing larger bearings and increased fan speeds. Airflow study reports which were reviewed, show that the design goal, negative pressure with respect to operating cells, was obtained. On 11/6/70, a work report to the safety committee stated that in the glove port aisles of the filter change room, the gloves were removed to obtain higher air flow and pressure differential. The report showed the radiation levels were below that required for Zone III entries. The Safety Committee minutes also show the requirement, that the gloves be replaced prior to any filter changes and that those persons performing this operation wear air supplied masks.

Licensee representatives stated that the spray system was not tested prior to turnover. The representatives stated that the duct spray system was initially available but locked out of the line at the time of turnover with all water supply valves closed. The spray system was checked out at a later date and found to meet design specifications.

Licensee representatives stated that the general DOP test procedure available at the time for testing filters required no special procedure to test the filters in the HEV system. Records of tests showed that they were performed on 10/21/70 showing 99.98% efficiency for the filters. Another DOP test was performed on 5/7/71 showing 99.98% efficiency. The licensee's procedures for DOP testing of filters are contained in Chapter 10.2.4 of the Health and Safety Procedures Manual dated 3/19/69. Licensee representatives stated that these procedures were followed.

Licensee representatives stated that original drawings of the HEV system were approved on 6/16/67. Revision 1 was approved 10/30/67. Revision 2 was approved 11/17/67 "As built" drawings were approved 6/22/70 and final drawings were assembled and submitted to the Plant Manager on 12/2/70.

Low Level Waste Treatment Facility (LLWT)

Training records maintained by Operations showed that all operators had received training in the operation of the LLWT on 4/20 and 21/71, approximately one month prior to turning over the facility to the licensee. Temporary operating procedures - TOP-02 and 04 were approved by the safety committee on 5/21/71, according to the Safety Committee minutes. The entire system was checked out with non-radioactive water on 4/15, 17 and 20/71 prior to operations. All checks were completed by 5/10/71. DOP tests of Filters were performed on 5/7/71 and found to be 99.98% efficient.

Licensee personnel stated that the LLWT facility did not meet design expectation of lowering Sr-90 concentrations to the extent anticipated. However, research is being continued with different ion exchange media which appears to have promise. The LLWT does, however, reduce other fission product concentrations in Cattaraugus Creek by a factor of 100. The records also show that Sr-90 concentrations exist in the order of 3×10^{-8} uCi/ml water after operation of the system. This is still below 10 CFR 20 Appendix B, Table II levels of 3×10^{-7} uCi/ml.

The inspector noted that the licensee has modified the LLWT system to increase its efficiency and operation by institution of

steady inflow rates and ph adjustment. Full sets of plans were noted to have been available prior to operation of the system.

11. Unusual Occurrences

A review of the licensee's "Health Physics Log" revealed that jet # 4C-7 was accidentally left open on May 25, 1972, causing an estimated release of 2.02 mci beta activity. The log revealed that prior to the incident a decontaminating solution had been run through this particular jet. The log revealed that the operator on the morning of May 26, 1972 noticed that the liquid level on Tank # 4D-8 was increasing and that solution was leaking out of the ratio-relay on the 4C-7 pressure pot. The operator closed the valve and notified the Health and Safety Division and his shift supervisor.

The log indicated that the Upper Extraction Aisle had a puddle of water on the floor due to a total leakage of 1 1/2 - 2 gallons acid-water mixture and that this area was isolated and surveyed. Surveys were performed with an Eberline PAC-4 and showed readings of 7000 cpm alpha on the liquid and the surrounding floor area 50,000 cpm alpha. Air concentrations of room air samplers in continuous operation were noted to be 8.4×10^{-13} uCi/ml, alpha and 3.0×10^{-12} uCi/ml, beta.

After several decontamination efforts, the contamination was reduced to 45 dpm alpha/100 cm² on 5/30/72. The activity in the puddle was identified as Pu-239. Bioassay records, which were reviewed, indicated that those involved in operations and in the decontamination effort were counted by a whole body counter on 6/9/71 and no alpha activity was found. The cause of the incident was determined by licensee representatives as due to a control room operator telling a workman to close the 4-C-7 jet. The workman stated that he did not hear the operator and left the jet open. Corrective action, according to licensee representatives, was the issuance of an SOP requiring that all valving operations be performed by the control room operator. The SOP, which was reviewed by the inspector, also specified that this duty cannot be delegated.

12. Records of the Health Physics log were examined and revealed that on June 15, 1972 operators in the Upper Extraction Aisle (UXA) had been preparing a permanganate solution to be used in decontamination. The record indicated that during the solution preparation, some solution splashed onto the walls of the UXA aisle and the operators cleaned and removed the permanganate with copious amounts of water. Some of the water splashed onto the

electronics portion of the continuous stack monitor, shorting out the system, which caused full scale readings. An air sampler filter paper mounted at the 80 foot level of the stack was immediately pulled and counted. Activity released was determined to have alpha concentrations of 1.15×10^{-12} uCi/ml and beta concentrations were 1.5×10^{-10} uCi/ml. These concentrations are 2.7% of the allowable release rate and correspond to 2.06×10^{-5} uCi/sec alpha and 2.68×10^{-3} uCi/sec, beta, and were within technical specification limits.

13. Licensee representatives stated that they change the anthracite filter media of their low level waste treatment facility (LLWT) at periodic intervals. The procedure requires flushing the filter media from the LLWT into two-1000 gallon burial tanks. The anthracite filter media settles to the bottom and the supernatant liquid is to be siphoned off into a drain which leads to Storage Lagoon #2 in accordance with SOP-15-1, Plant Liquid Releases.

A review of the "Health Physics Log", revealed that at 23:30 hours on 6/15/70, an operator, apparently decided that the siphoning action from the underground tank to the drain was proceeding too slowly. He inserted a second siphon pump but the nozzle end of the duct could not fit into the drain so the supernatant liquid, pulled from the underground tank by the second siphon, was allowed to flow along the ground surface. At 03:00 hours on 6/16/72, the water was noted to be running onto the ground.

The water remaining in the hose line was sampled on the morning of 6/16/72 by the Health Physics Group and beta activity of 8.9×10^{-4} uCi/ml was noted. An estimated 600 gallons had been released to the ground surface. A total of 2.02 mCi mixed beta activity was released. Licensee representatives stated that the soil, where activity was noted to exist because of the release, was removed, packed in waste drums, and buried in the ASDA burial site. The ground had measured radioactivity levels of 50 mR/hr at the surface. Licensee representatives stated that the liquid siphoned off the charcoal contained activity due to being in contact with contaminated equipment.

14. The incident report revealed that the subject involved was a laborer working at the waste burial site. The subject, by self monitoring at 16:45 hours on July 7, 1972, discovered contamination on his person and immediately notified his supervisor. Licensee representatives stated that a Health Physics technician immediately reported to the site, and using an Eberline GM end window probe, reported 3000 cpm on the subjects jacket, 6000 cpm, on his shirt and on his forehead 1000 - 2000 cpm.

On the evening of July 7, 1972 a visit was made to the subjects home at Scranton, N.Y., by a technician from the Health Physics

Group, and a survey with a GM revealed contamination existing on a pillowcase, washcloth, sheet and jacket in the order of 250 - 3000 cpm. A towel had activity of 25,000 cpm.

Urinalysis samples provided by the subject on 7/7/72 revealed in two samplings, 11 and 14 dpm/24 hours void of fission products, Cs-134, -137. A chest count performed July 10, 1972 revealed the presence of 32 nci Cs-137. With this quantity representing 12.5% of what was inhaled, then 256 nci could have been inhaled. Using 1×10^{-8} uCi/ml the limit expressed in Appendix B, Table I, 10 CFR 20 and an inhalation of 5×10^{-7} ml/40 hr week, 500 nci could have been inhaled to equal an exposure to 40 MPC hrs.

A nasal smear taken on 7/7/72 showed an activity of 5800 dpm, equivalent to 2.64 uci. Investigation by licensee personnel revealed the contamination occurred on July 6, 1972, when the laborer was oiling the lift crane in the waste burial area. Licensee personnel stated that procedures have been set forth whereby head covers would be worn in addition to other protective clothing.

15. Licensee representatives stated that on 6/26/72 at 13:00 hours, cement blocks, which had been used in the off gas aisle (OGA), were removed for burial. Examination of the Health Physics log indicated that the cement blocks were wrapped in plastic and brought to the roof of the OGA where they were transferred from the roof to a "Red Stake Truck". A health physics technician measured the dose rates and noted radiation levels of 5R/hr from the cement blocks. He stated and the records indicated that no contamination surveys were made. Licensee representatives stated that no person noted or repaired the torn plastic wrappings. Licensee representatives stated that the cement blocks were grossly contaminated and had been used to shield an acid recovery line in the OGA. They stated that the removal of the cement blocks was part of the current program to reduce radiation levels and contamination in production areas.

The person became exposed, for a period of approximately 5 minutes, while unloading manually, the cement blocks from the Red Stake Truck. On 6/23/72 SWP No. 5034 which authorized the removal of the cement bricks, showed dose rate measurements of 15, 40 and 250 R/hr at the surface of the blocks. During the 5 minutes unloading time a self-reading dosimeter showed a reading of 100 mR.

The person exposed followed the proper procedure by passing through a monitoring station at 16:30 and the monitor alarmed. The person notified his supervisor, who in turn notified the Health and Safety Group, which immediately responded to the scene. A Health Physics Technician immediately obtained a nasal swab which showed activity of 180 dpm alpha and 170,000 dpm beta equal to 77 nci beta activity. The nasal swab was analyzed chemically and

showed Ru-116 - 19.6 nci, Sr-90 - 0.24 nci, Pu-0.109 nci, Zr-Ni-544 nci. Ratio studies were: $\frac{\text{ZrNi-95 } 544}{\text{Ru106 } 19.6} = 27.7$

$\frac{\text{ZrNi-95 } 544}{\text{Sr-90 } .236} = 2305$ $\frac{\text{ZrNi-95 } 544}{\text{Pu-239 } .109} = 5000$

The person was decontaminated and also had nasal flushes performed. He was immediately whole body counted and the results of this count and succeeding whole body counts are shown in the licensee's letter of July 26, 1972. The licensee calculated that the subject was exposed to 71 MPC hours of combined concentrations of Pu-239, Ru-116 and ZrNi-95 or 1.77 X 40 hr MPC as stated in Appendix B Table I 10 CFR 20.

A review of the licensee's calculations revealed that the licensee used a total volume of 2150 ml for 15 respirations per minute. This resulted in a higher amount of millimeters of air breathed per 40 hour work week, than listed in Radiological Health Handbook, January 1970 edition., USHEW, page 216 of 9600 liters/8 hour work day. Using the licensee's method with 7.74×10^{-7} ml air/40 hour work week instead of 5×10^{-7} ml air/40 hour work week, an exposure of 75.5 MPC hours or 1.89 X MPC was obtained. The licensee in his calculations obtained 71 MPC hour or 1.78 X MPC, a slight difference. See Exhibit "A" for calculations. The inspector noted that the subject received written notice of his exposure from examination of records of personnel monitoring.

The licensee stated that the surveys of the blocks prior to transfer consisted only of direct radiation measurements. The records indicated that no survey was made to determine contamination levels. Licensee representatives stated that the cement blocks were being sent for solid waste burial and were not packaged to prevent contamination of handlers. The laborer, involved, was stated to be a handler. Proper packaging, according to the licensee representatives would include plastic covering over the cement blocks themselves plus a plywood container. The licensee representatives stated that no plywood container was provided for the cement block burial.

16. Licensee representatives identified the employee who died this spring as a laundry worker, age 72. Personnel records indicated that he worked at NFS as a laundryman between 10/12/66 and 1/19/72. Records of personnel monitoring indicate that the deceased's total whole body exposure in 5.25 years of work was 8.950 rem. Forms AEC-4 and -5 were examined and showed no quarterly exposure in excess of 1.2 rem. The records also indicate an extremity and skin exposure, for 5.25 years, of 11.7 rad.

The subject underwent routine urine analysis and whole body counting during his employment. Urine analysis record results were as follows:

| <u>Date</u> | <u>Volume of Sample</u> | <u>Fission Products net. dpm/ml.</u> | <u>Pu-239 dpm/l</u> |
|-------------|-------------------------|--------------------------------------|---------------------|
| 3/17/67 | 922 ml. | .14 | 1.06 (removed |
| 10/12/67 | 900 ml. | .08 | .3 for 50 days |
| 1/2/68 | 930 ml. | .03 | .3 from work) |
| 3/13/68 | 800 | .03 | .3 |
| 3/19/68 | 1000 | .03 | 0.732 |
| 6/20/70 | 1000 | .03 | None detected |
| 10/17/70 | fecal sample | .03/gm. | None detected |
| 3/19/71 | 1000 | .03 | 0.07 |

Whole Body Counting Record Results

| | |
|------|---------------|
| 4/67 | 13 nci Cs-137 |
| 4/68 | background |
| 4/69 | background |
| 4/70 | background |

An interview was held with the medical doctor who treated the subject. He stated that the subject underwent lung removal at the Chaffee Memorial Hospital in the Spring of 1972 and died shortly thereafter due to spread of a malignancy to other portions of the body. The physician involved stated that the subject smoked to excess and was of advanced age. His opinion voiced to the inspector, was that the malignancy noted, was in no way related to the occupation he had at NFS. Licensee representatives, interviewed, all stated that no suit at law was pending from any interested party.

Records of stack releases were examined from 4/1/70 to 9/1/72 and no excessive releases were noted. All releases appeared to meet Technical Specification limits and 10 CFR 20 limits. Inspections during 1972 have been unannounced and no advanced notification was given to the licensee. Smear data was reviewed and some 500 smears are counted weekly. There was some contamination noted with high levels in operating areas but there was also a constant cleaning effort. Work order records indicated a constant replacement of contaminated objects and consequent reduction of ambient radiation levels.

17. The licensee's investigation report, was reviewed and revealed that at 0800 hours on August 9, 1972 one contractor employee noticed what was later determined to be a 24 Ci Ir-192 source capsule and its pigtail, 9 inches long, hanging on a pipe inside an Acid Recovery Cell under construction. It had been determined that a

radiography company licensed by the State of New York had performed radiography inside the Acid Recovery cell after 1600 hours on August 8, 1972. The worker (Employee No. 1) finding the source examined it briefly, one or two seconds, holding the source between the thumb and forefinger of one hand and the hook end of the source cable between the thumb and forefinger of the other hand.

Employee No. 1 above handed the source to Employee No. 2 who inspected the object in the same manner at length. His statement was that it was 2 or 3 minutes but reenactment limited the handling time to 15 seconds. Employee No. 2 stated that he placed the object in his tool box and a short while later he took the object from his tool box to show it to employee No. 3. He stated that Employee No. 3 handled it in the same manner from 5 to 10 seconds and that Employee No. 3 replaced the object in the tool box. Employee No. 2 stated that at about 1600 hours on August 9, 1972 he saw the radiographer approaching the gate and asked employee No. 3 to give him the object. Employee No. 2 then carried the source to the gate approximately 25 feet away and held a conversation with the radiographer. He stated the radiographer denied that the object was his, but finally took the object and walked with it in his hand to his truck.

Licensee representatives stated that the radiographer reported the loss of two dosimeters; the one provided by his company and the one provided by NFS. Licensee representatives also did not know what had happened to the film badge worn by the radiographer.

On September 20, 1972 the inspector questioned contractor employees about the training NFS provided them. Employee No. 2 stated to the inspector, upon learning the inspector's identity, "Look what that thing did to me." The inspector noted what appeared to be two healed blisters one on the edge of the forefinger above the first joint and one on the thumb in the same position. The blistered area on each finger was noted to be approximately 0.2 cm².

Employee No. 2 stated that the blisters appeared 8 days after August 9, 1972 and that he brought the blisters to the attention of a physician who gave him the opinion that they might be due to his work as a welder.

The physician involved was interviewed by the inspector on September 20, 1972. He stated that no one had previously spoken to him relating to the actual circumstances of the exposure. He again called employee No. 2 to the infirmary and examined his fingers. After the employee left, the physician expressed the opinion that the blisters could represent a possible radiation syndrome, and that further expert evaluation was needed.

A licensee representative stated that he had made an evaluation of the hand exposure using the gamma constant for iridium-192 listed on page 131 of the 1970 edition of the Radiological Health Handbook and arrived at a dose rate for 24 Ci of Ir-192 of 20R/sec at contact. He stated that he realized that this exposure rate was low but that he had no other sources of information to refer to. The inspector referred him to the Handbook of Health Physics OSP-70, April 1963, page 158 which shows a dose rate per curie for Ir-192 at 1 cm distance of 5000 R/hr. The inspector calculated, using the same factor used by the licensee representative, a dose rate of 160 rad/sec to the area of the finger involved. See Exhibit "B" for calculations. Employee No. 2 could have received a calculated exposure to a limited portion of his finger during 30 seconds handling time of 4800 rad.

CALCULATIONS

1. From Vol. 12, Health Physics Journal 1966, "Task Group on Lung Dynamics".

15 respirations a minute x 2150 ml/respiration
x 60 min/hr x 40 hr/week = 7.74×10^7 ml. air breathed
by a workman during 40 hours.

Maximum amount of each radionuclide noted which could be inhaled during 40 hours. From Appendix B, Table I, 10 CFR 20.

$$\text{Zr-Ni-95} = 3 \times 10^{-8} \text{ uCi} \times 7.74 \times 10^{-7} \text{ ml} = 0.46 \text{ uCi or } 2130 \text{ nci.}$$

$$\text{Ru-106} = 6 \times 10^{-9} \text{ uCi} \times 7.74 \times 10^{-7} \text{ ml} = 0.46 \text{ uCi or } 460 \text{ nci.}$$

$$\text{Sr-90} = 5 \times 10^{-9} \times 7.74 \times 10^{-7} \text{ ml} = 0.39 \text{ uCi or } 390 \text{ nci.}$$

$$\text{Pu-239} = 2 \times 10^{-7} \text{ ml} = 15.5 \times 10^{-5} \text{ uCi or } 0.155 \text{ nci.}$$

The licensee used the amount in the nose plus the activity noted in a whole body count taken 3 hours post incident as the total uptake.

| | | | | | |
|-----------------|---------------|------------------|---|--------------|---------------|
| Zr-Ni-95 | Ru-106 | Sr-90 | + | Pu-239 | |
| 611 + 544 nci | 22 + 19.6 nci | 0.5 nci | | .10 + .109 | |
| <u>1155 nci</u> | + <u>41.6</u> | + <u>0.5 nci</u> | | <u>0.209</u> | |
| 2130 | 460 | 390 | | 0.155 | = 1.89 x |
| 0.54 | + .09 | 0 | | 1.35 | = 75.5 MPC hr |

Calculations of Dose Rate from a 24 Ci Ir-192 source at contact.

1. From page 131, Radiological Health Handbook, the gamma constant = 4.8 for Ir-192.

$$4.8 = \frac{R - \text{cm}^2}{\text{hr-mci}}$$

$$\text{mci} = 24 \times 10^3$$

$$\text{area of blister} = 0.2 \text{ cm}^2$$

$$\frac{4.8 \times 24 \times 10^3}{0.2} = R/\text{hr}$$

$$= 57.6 \times 10^4 \text{ Rad/hr}$$

$$\frac{57 \times 10^4 \text{ Rad/hr}}{36 \times 10^2 \text{ sec/hr}}$$

$$= 160 \text{ Rad/sec}$$