PDR 70-1113

GENERAL ELECTRIC

NUCLEAR ENERGY
PRODUCTS DIVISION

WILMINGTON MANUFACTURING
DEPARTMENT

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November 17, 1980

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

Attention: Dr. E. Y. Shum
Uranium Process Licensing Section
M/S 396-SS

Gentlemen:

Reference: NRC License SNM-1097, Docket #70-1113

Subjects: 1) MODIFICATION 1 TO APPLICATION AMENDMENT N-2, EXPANSION OF PLANT CONVERSION CAPACITY

2) MODIFICATION 1 TO APPLICATION AMENDMENT N-4/S-15, REPLACEMENT INCINERATOR FACILITY

With reference to activities authorized by SNM-1097, General Electric Company hereby encloses the additional information requested in your recent letter related to our requests for amendments to SNM-1097, concerning a planned replacement incinerator facility and a planned addition to UF_6-to-UO_2 conversion capacity, at the GE fuel fabrication plant in Wilmington, N. C.

The following attachments are enclosed, which contain the specific information requested:

Attachment 1 - Conversion Plant Expansion

Attachment 2 - Incinerator Replacement

Attachment 3 - Environmental Report (NEDO-20197, January 1974)

General Electric Company personnel would be pleased to discuss this matter with you and members of your staff as you deem necessary.

Very truly yours,

GENERAL ELECTRIC COMPANY

Arthur L Kaplan

Arthur L. Kaplan, Manager
Licensing & Compliance Audits
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GENERAL ELECTRIC

Dr. E. Y. Shum
November 17, 1930

ATTACHMENT 1

QUESTIONS ON CONVERSION PLANT EXPANSION

1.0 Question

Page 1 - Amendment Letter - The letter states that the addition "would increase the conversion capacity by 40%." In NEDO-20197 (page 4-42), it is stated that the "Wilmington plant can supply the annual feed requirements for more than a hundred 1000/MWe light-water reactors." Can an additional statement be provided that clearly demonstrates the present need for the plant expansion?

Please provide detailed discussion on the alternatives on siting of the proposed plant expansion and also the alternatives on UF_6 conversion operational process. For both discussions, please quantify the impact, advantage and disadvantage as much as possible.

1.1 Referenced Paragraph in Amendment Letter

There are at present five process lines for conversion of UF_6 to UO_2 in the manufacture of nuclear fuel at the Wilmington plant. General Electric proposes to add two additional process lines which would increase the conversion capacity by about 40%.

1.2 Referenced Statement in NEDO-20197 (Page 4-42)

The uranium dioxide fuel produced in 1 year at the Wilmington plant can supply the annual fuel requirements for more than a hundred 1000-MWe light-water reactors. The electrical energy output from these nuclear reactors is the same as that which would be produced if 250 million tons of coal were consumed in coal-fueled plants.

1.3 GE Response to Question

The major thrust behind the addition of UF_6-to-UO_2 conversion capacity is to implement use of the GECO process, a dry conversion process which produces a greatly reduced environmental impact from that already extremely small impact from present ADU conversion operations; as well as to take advantage of the improved economics associated with GECO conversion as compared to the presently used ADU conversion.

Also, our intention is to maintain the present ADU conversion capacity intact for use when the additional conversion capacity might be required to meet business needs.

A statement of present need as requested is summarized below:

Alternatives	Implemented?	Reason
o Add GECO conversion	Yes	To take advantage of environmental and economic superiority of GECO over ADU conversion.
o Add ADU conversion	No	Increase in conversion capacity is not needed at this time.
o No addition (neither GECO nor ADU)	No	Business decision was made to take advantage of environmental and economic superiority of GECO over ADU conversion.

2.0 Question

Pages 2 and 3 - Please provide a demography up to a 50-mile radius from site and reflecting the most current population distribution. Also, if possible, project the future population growth in the area at the end of the plant's life.

2.1 Referenced Information in Attachment 1, Pages 2 and 3

The five county area surrounding the plant site is essentially rural with a low population density. The population characteristics of the five county area are below.

County	1970 Population	Percent Urban	Population Density, Persons per Square Mile
Bladen	26,477	0	30.0
Brunswick	24,223	0	28.3
Columbus	46,937	8.9	49.7
New Hanover	82,996	69.5	448.6
Pender	18,149	0	20.0

The closest metropolitan area is the city of Wilmington with a 1970 population of 46,169. Wilmington is the central city of the Wilmington Standard Metropolitan Statistical Area (SMSA), defined as New Hanover and Brunswick counties.

Wilmington SMSA characteristics are shown below:

City of Wilmington	46,169	
Other Urban	11,476	
Total Urban		57,645
Places of 1000-2500 Population, Total	5,584	
Places of <1000 Population, Total	2,434	
Other Rural	41,556	
Total Rural		49,574
Total SMSA Population		107,219

Castle Hayne, the nearest community (3 miles north) has a population of 700. Other than Wilmington, only three centers within 20 miles of the site have populations larger than 1000.

Population centers within a 2 ile radius of the plant are as follows:

Population Center	1970 Population	Location from Plant Site
Burgaw	1744	16 miles north
Wrightsville Beach	1701	11 miles southeast
Carolina Beach	1663	20 miles south

Located 45 miles to the northeast are Jacksonville, N. C., with a 1970 population of approximately 16,000, and the nearby Camp LeJeune (U. S. Marine Corps) which had a 1970 population of 34,549.

During the 1960-70 period, population growth in the five county area has been significant only in the Wilmington SMSA, principally in suburban areas. Though New Hanover County's growth was 15.7 percent over 10 years (11,254 persons), Wilmington's growth was only 5 percent. Projected growth for the area indicates continuation of these trends.

2.2 GE Response to Questions

The population within a 50-mile radius has been obtained. We will utilize this information to perform an analysis of potential radiation exposure to the public, considering the total dose commitment to the population within a 50-mile radius of the plant.

3.0 Question

Attachment 1, Page 12 - It is mentioned that a cooling tower and 200-ton water chiller will be installed. Will these units occupy any of the previous open land on the site or will they be located in areas in which construction has already occurred?

3.1 Referenced Information in Attachment 1, Page 12

(4) Add the services required to support GECO process installation in FMOX.

- o Install waste treatment filtration capacity (inertial filter) to remove uranium solids from defluorinator scrubber solutions.
- o Install additional GECO offgas vacuum system capacity of 170 SCFM.
- o Install a cooling tower (fully automatic of 8.2 million Btu/hr capacity) and a 200-ton water chiller to provide cooling water and chilled water for FMOX facilities.

3.2 GE Response to Question

The cooling tower and the 350-ton* water chiller both will occupy areas in which construction has already occurred. The chiller will be located inside the fuel manufacturing building at the west side of the building. The cooling tower will be located outside the building near the northwest corner.

4.0 Question

Attachment 1, Page 13 - Hydrogen for the conversion reactor and the defluorinator is supplied from a dissociated ammonia (DA) system. Where is this unit located and what provisions are made to avoid hydrogen fires or explosions in the production unit and the hydrogen distribution system?

4.1 Referenced Information in Attachment 1, Page 12

2.2 Process Description - The GECO process for converting uranium hexafluoride (UF_6) to uranium dioxide (UO_2) is a direct dry process. This process, developed by the General Electric Company, has been through numerous development steps at Wilmington since 1972. The GECO

*Changed since the original submittal.

process to be implemented in the planned expansion, is the same as that currently in use for the two GECO lines presently operating in FMO. This process is described below:

(1) Vaporization - Uranium hexafluoride (UF_6) is received in steel cylinders containing 4800 pounds of solid material. The cylinder is placed in an autoclave and heated by the condensing steam. The UF_6 melts at 150° F and the liquid is heated to about 180° F developing a gas pressure of 50-psia. The hot UF_6 gas is fed to the reactor.

(2) Reactions - The reactor is a vertical, cylindrical chamber. Gaseous UF_6, hydrogen from dissociated ammonia (DA), and oxygen from dry air, are introduced through a nozzle assembly into the top of the reactor. The critical flow rate of each component is measured and controlled within ± 2% of the component parameter.

4.2 GE Response to Questions

The system supplying dissociated ammonia for the chemical conversion reactor is in a structure located about 100 feet west of the fuel manufacturing building.

There are no special precautions taken to avoid hydrogen fires or explosions in the production unit or in the hydrogen distribution system because of the safeguards inherently built into these systems as described below:

- Dissociated ammonia production unit
  - Dissociated gases are cooled in the unit and pressure regulated to 7-psig (0.5 kg/cm^2 gauge).
  - Pure hydrogen will not explode unless there is oxygen or air present and the hydrogen content of the mixture has to be less than 75%. Air is excluded from the system by design.
- Hydrogen distribution system
  - The piping used for the hydrogen distribution system consists of all-welded lines. Air is excluded from the lines by design.
  - Pressure in the line is limited to 15-psig (1.1 kg/cm^2) gauge by a pressure reducing valve.
  - Lines are purged with nitrogen and pressure-tested at 100-psig prior to each use of the system.

5.0 Question

Please clarify Section 2.1 on Page 11 versus the table on Page 13.

5.1 Information Referenced in Section 2.1 on Page 11

2.1 - Plans for Expansion - At the present time, there are three ADU production lines and two GECO production lines for UO_2 powder. The sixth existing line (UPS) is used for scrap recycle. These production lines are located in the older part (FMO) of the fuel manufacturing building.

Present project plans call for the addition of two GECO production lines for UO_2 powder in the newer part (FMOX) of the fuel manufacturing building. In addition, one existing ADU line in FMO has been converted to the GECO process design. Two of the existing ADU powder production lines will be retained for short term fuel market growth and for capacity to produce JNF powder and B&W contracted fuel pellets. A third ADU line will serve as a dual ADU/UPS production line. Powder preparation systems, material handling equipment, services, and support equipment for the additional GECO lines will also be installed.

5.2 Table on Page 13

Conversion Lines Before & After Project:

	Before -	After -
FMO	3 ADU 2 GECO 1 UPS	2.5 ADU* 2.0 GECO 1.5 UPS*
FMOX	0	2.0 GECO
UPS	1	1.5
Plant Capacity (# lines producing virgin UO_2)	5	6.5
Total Lines	6	8.0

*One ADU line will be utilized 50% to supplement UPS output.

5.3 GE Response to Question

At present, there are six conversion lines in the fuel manufacturing building. Three of these lines convert UF_6 to UO_2 using the ADU process. Two of these lines convert UF_6 to UO_2 using the GECO process.

Also, one existing production line is the so-called "uranium purification system (UPS)," used for recycling most uranium scrap materials. These lines are all presently in the older part (FMO) of the fuel manufacturing building.

Thus, the present configuration for UO_2 is as follows (five $UF_6 \rightarrow UO_2$ conversion lines and one scrap $\rightarrow UO_2$ conversion line):

3 ADU lines ($UF_6 \rightarrow UO_2$)
2 GECO lines ($UF_6 \rightarrow UO_2$)
1 UPS line (Scrap $\rightarrow UO_2$)

Present plans call for the addition of two GECO conversion lines in the newer part (FMOX) of the fuel manufacturing building. Two of the three existing ADU lines will be kept in reserve to accommodate short-term fuel market growth (if it occurs) and for capacity to produce powder for Japan Nuclear Fuels (JNF) or Babcock & Wilcox under a contract for supply of PWR fuel pellets.

Also, the third of the three existing ADU lines will be utilized about half of the time for UF_6 to UO_2 conversion and the rest of the time for conversion of scrap to UO_2 (UPS).

Thus, the final configuration for production of UO_2 is as follows (6.5 $UF_6 \rightarrow UO_2$ conversion lines and 1.5 scrap $\rightarrow UO_2$ conversion lines):

2.5 ADU lines ($UF_6 \rightarrow UO_2$) - in FMO building
4.0 GECO lines ($UF_6 \rightarrow UO_2$) - 2 in FMO, 2 in FMOX
1.5 UPS lines (Scrap$\rightarrow UO_2$) - in FMO building

Effectively, we will end up with eight conversion lines in the fuel manufacturing building, as described above, an increase of two over the present total.

6.0 Question

Attachment 1, Page 16 - What provisions are made to ensure that hydrogen cannot pass through the convertor reactor, particularly under upset conditions? What is the fate of the small amount (0.001%) of the U_3O_8 and UO_2F_2 powders that pass through the primary filter?

6.1 Referenced Material in Attachment 1, Pages 13, 16 & 17

2.2 - Process Description - The GECO process for converting uranium hexafluoride (UF_6) to uranium dioxide (UO_2) is a direct dry process. This process, developed by the General Electric Company, has been through numerous development steps at Wilmington since 1972. The GECO process to be implemented in the planned expansion, is the same as that currently in use for the two GECO lines presently operating in FMO. This process is described below:

(1) Vaporization - Uranium hexafluoride (UF_6) is received in steel cylinders containing 4800 pounds of solid material. The cylinder is placed in an autoclave and heated by the condensing steam. The UF_6 melts at 150° F and the liquid is heated to about 180° F developing a gas pressure of 50-psia. The hot UF_6 gas is fed to the reactor.

(2) Reactions - The reactor is a vertical, cylindrical chamber. Gaseous UF_6, hydrogen from dissociated ammonia (DA), and oxygen from dry air, are introduced through a nozzle assembly into the top of the reactor. The critical flow rate of each component is measured and controlled within ± 2% of the component parameter.

The chemical reactions for this process are:

- o Primary reaction -

$$UF_6 + 6H_2 + 3.2O_2 \rightarrow 1/3\ U_3O_8 + 6HF + 3H_2O + 0.37O_2$$

- o Secondary reaction -

$$UF_6 + 2H_2 + O_2 \rightarrow UO_2F_2 + 4HF$$

About 80% of the UF_6 is converted to U_3O_8 and the remaining to UO_2F_2. These reactions take place as a flame in which the UF_6 burns in the presence of hydrogen and oxygen. Excess air is provided to ensure complete consumption of the hydrogen.

Interlocks such as flow, temperature, and flame sensors ensure safe operation of the reactor.

The reactor pressure is controlled to a sub-atmospheric pressure. A special high-volume vacuum scrubber system pulls the gases from the reactor through the filters and HF recovery system.

The hot reaction products, U_3O_8 and UO_2F_2 powder, water vapor (H_2O), hydrogen fluoride (HF), nitrogen (N_2), and oxygen (O_2) are discharged from the bottom of the chamber to the primary filter.

(3) Solids separation - The reactor product contains U_3O_8 and UO_2F_2 powder which must be removed from the gaseous phase. This separation takes place in the primary filter, containing hollow, porous monel filter tubes. The powder is collected on the external surface of the filters and the gas is pulled through the porous metal by a high volume vacuum system. The efficiency of these filters is 99.999%.

(4) Defluorination - The defluorinator is a rotating, gas-fired kiln, similar to the ADU defluorinator. Dry powder from the primary filter is fed into the defluorinator and dissociated ammonia and steam are introduced into the discharge end flowing countercurrent to the powder.

In the defluorinator, the fluoride is removed from the UO_2F_2 and the U_3O_8 powder is reduced to UO_2 at temperatures up to 700° C. The UO_2 powder discharged from the defluorinator is collected in 5-gallon cans, weighed, and sent to the powder preparation operation.

The gas stream removed from the front of the defluorinator is cooled and scrubbed with deionized water and discharged to the process ventilation system. Ammonium hydroxide is added to the scrub water to neutrlize the hydrogen fluoride, and the water is sent to waste treatment. This is the only systematic loss of uranium from the GECO process.

(5) HF Recovery - The gas stream from solids separation contains hydrogen fluoride (HF), water vapor (H_2O), nitrogen (N_2), and oxygen (O_2). This gas passes through an absorption system to recover the HF as an acid solution. This is a standard absorption system commonly used in the chemical industry for recovery of acid gases.

The acid solution contains about 30% HF. It is purified by distillation and stored for sale or disposal. The gas from the absorption system contains mostly nitrogen and oxygen with trace concentrations of HF and water vapor. This gas goes to the vacuum system where it is scrubbed with ammoniated water to remove any HF and discharged to the process ventilation system.

(6) Waste Treatment - The waste water from the GECO process originates in the defluorinator scrubber and the vacuum system. Both contain ammonium hydroxide and a small amount of fluoride. The water from the defluorinator scrubber is pumped to a high efficiency filtration system (inertial filtration) for recovery of uranium solids. The waste water is sent to waste treatment where the solution is treated with lime to precipitate the fluorides, and the ammonia is recovered. The ammonia as ammonium hydroxide is returned to the process. The residual solution is pumped to a lagoon where the calcium fluoride precipitant is settled.

6.2 GE Responses to Questions

(1) There are provisions to assure that hydrogen will not pass through the reactor even under upset conditions. These are:

- o The reactor gases are always maintained in an oxidative environment (i.e., ratio of H_2 to O_2 is always <1.9; minimum H_2/O_2 ratio of 2.1 required for detonation).
- o Gas inlets are automatically shut off and the reactor shut down under "upset conditions" such as:
  - Loss of vacuum inside the reactor
  - High hydrogen flow
  - No hydrogen flame
- o After reactor shutdown, a five minute post-operation purge of the system with nitrogen occurs.

(2) The small amount (<0.0001%) of U_3O_8 and UO_2F_2 powder that passes through the primary filter is carried into the HF recovery system with the off-gas from the primary filter. There this powder is captured by the exhaust gases that go to the roof scrubber and HEPA filter in the chemical area exhaust stack. This stack is monitored daily for compliance with requirements for uranium and fluoride contents in gaseous effluents to the atmosphere.

7.0 Questions

Pages 16 and 17 -

(1) Is the UF_6 introduced to the conversion reactor completely reacted under upset conditions? Is uranium carried on occasion into the vacuum system scrubber?

(2) What provisions are made to ensure that unreacted hydrogen from dissociated ammonia is not discharged to the offgas from the defluorinator?

7.1 Referenced Material on Pages 16 and 17

Please see Section 6.1 on Page 7 of this attachment.

7.2 GE Reply to Questions

(1) There are cases where UF_6 could be carried through the reactor under upset conditions. For example, if both

the H_2 and O_2 (air) systems failed at the same time (double failure), some unreacted UF_6 could pass through the system before the inlet valves automatically closed. (They close within a few minutes if such upset conditions occur.)

Under such conditions, most of the UF_6 will condense out into the pipes as UO_2F_2 and travel into the primary filter, and then be caught in the hydrogen fluoride recovery system. The small remainder will be caught in the offgas system and be exhausted to the roof scrubber where it would be converted to UO_2F_2 in liquid form. Thus all such UF_6 would be trapped before reaching the roof exhaust stack.

(2) Please see the answer to question #1 above. No significant quantities of unreacted hydrogen can reach the defluorinator because of the provisions described in the above answer to ensure that no unreacted UF_6 passes through the conversion reactor.

8.0 Question

Page 17 - Are the gas streams from the defluorinator, the primary filter and the vacuum system combined into a single stream?

8.1 Referenced Material on Pages 16 and 17

Please see Section 6.1 on Page 7 of this attachment.

8.2 GE Response to Question

The gas from the primary filter, which contains HF, water vapor, nitrogen and oxygen, as well as the very small quantities of U_3O_8 and UO_2F_2 (0.0001% of the powder in the gaseous phase before passing through the primary filter), all goes to the HF recovery system. This is a standard absorption system commonly used in the chemical industry for recovery of acid gases. The gas from the absorption system goes to a vacuum system where it is scrubbed with ammoniated water to remove any HF and then discharged to the process ventilation system.

The gas stream removed from the front of the defluorinator is cooled and scrubbed with ammoniated deionized water and discharged to the process ventilation system.

Thus, eventually, the gas stream from the primary filter as well as those from the vacuum system and from the defluorinator, are all discharged into the same process ventilation system.

9.0 Question

Pages 13, 16 and 17 - Please provide a block flow diagram showing the flow of uranium and other chemical reactants to clarify the routing of process streams.

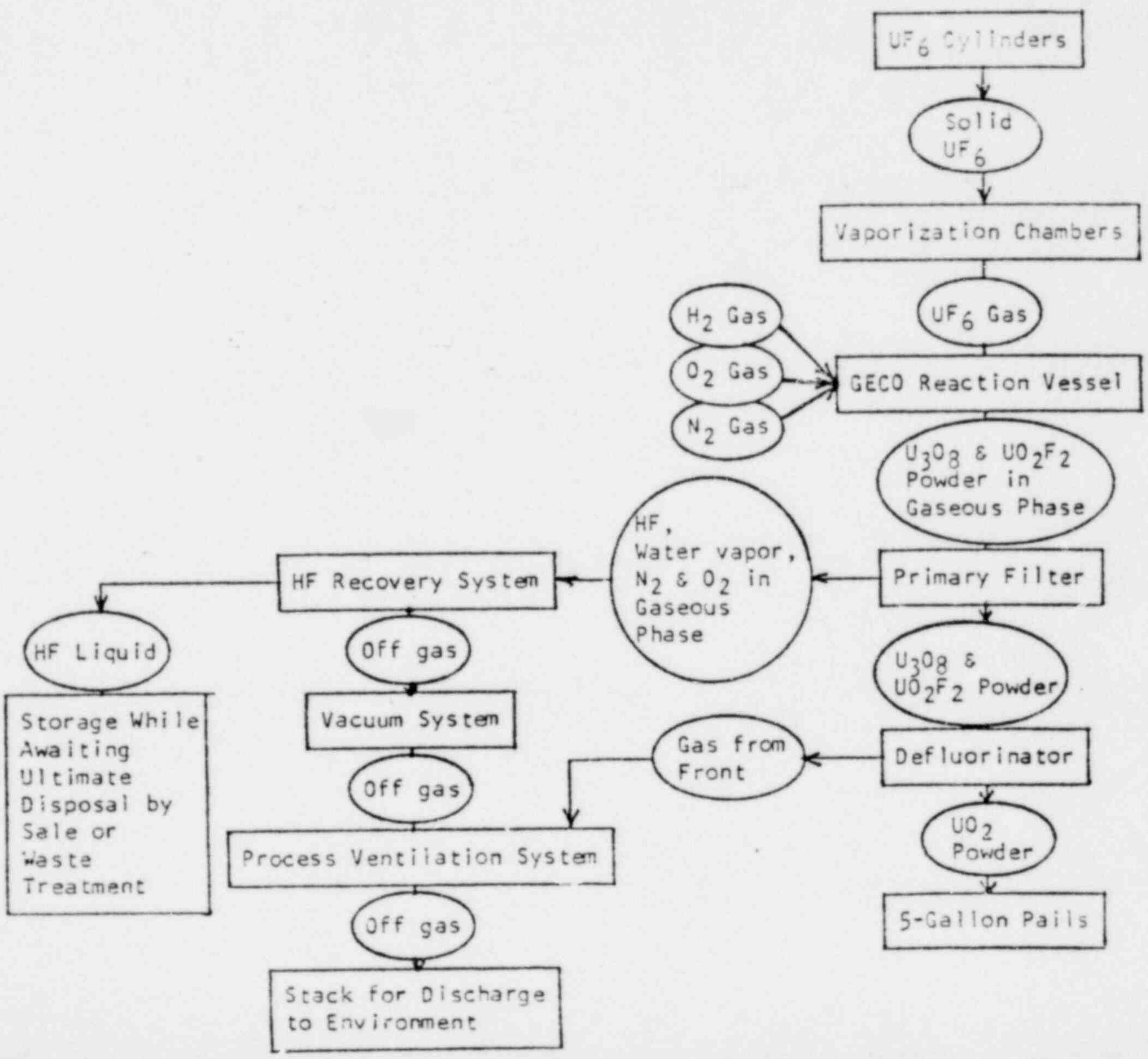
9.1 Referenced Material on Pages 13, 16 and 17

Please see Section 6.1 on Page 7 of this attachment.

9.2 GE Response to Question

The following is the requested diagram.

BLOCK FLOW DIAGRAM
SHOWING FLOW OF URANIUM & OTHER CHEMICAL REACTANTS



10.0 Question

Page 24 - The statement that "the dry conversion process does offer an environmental advantage due to the lower volume of liquid wastes generated per unit weight of uranium hexafluoride converted" does not seem to be substantiated by the data given in the table in Section 6.5. The projected volume in the table is 50% greater than the initial volume (1.8 MGPD vs. 1.2 MGPD) and the plant throughput increase is given as 40%. Please clarify this.

10.1 Referenced Information on Page 24

The liquid wastes from both conversion processes can be treated using similar technology. The dry conversion process does offer an environmental advantage due to the lower volume of liquid wastes generated per unit weight of uranium hexafluoride converted.

10.2 Table in Section 6.5, Pages 27 and 28

6.5 Effluent Characteristics - The effects that the proposed actions have on plant effluent streams are presented below in tabular form. The average allowable releases for both 1978 and the forecast allowable releases for the period of proposed licensing action are shown in order to provide a basis for comparison.

Allowable releases are those quantities specified either in State issued environmental permits or Nuclear Regulatory criteria or license conditions in the cases of uranium chemical concentration or activity concentration. Actual releases are and would be expected to continue below these levels.

	Allowable Releases	
	1978	Forecast
Treated Liquid Discharges to River		
o Process		
Fluoride, average pounds/day	29	80
Nitrogen, average pounds/day	77	145
Copper, average pounds/day	1	1
Nickel, average pounds/day	.5	.5
Chromium, average pounds/day	.5	.5
Volume, million gallons/day	1.2	1.8
Activity concentration, µCi/cc	3×10^{-5}	3×10^{-5}
pH, standard units	6-9	6-9
Treated Discharge to Atmosphere		
o Sanitary		
Volume, million gallons/day	0.075	0.075
pH, standard units	6-9	6-9
Biological oxygen demand, average pounds/day	18.8	18.8
Total suspended solids, average pounds/day	18.8	18.8

	Allowable Releases	
	1978	Forecast
o Activity concentration, µCi/cc	3×10^{-12}	3×10^{-12}
o Nitrogen dioxide	No visible emission	No visible emission
Transfer of Ammonium Nitrate Liquid for Offsite Treatment		
o Uranium, parts/million - max.	5*	5

*At 4% enrichment, this equates to $\sim 1 \times 10^{-5}$ µCi/cc.

10.3 GE Response to Question

The data given for liquid effluents in the table in Section 6.5 represent allowable daily average discharges specified in the NPDES permit for this facility. The table heading should be:

Allowable Releases	
NPDES Permit Issued 8/72	NPDES Permit Issued 8/78

The activity concentrations shown in the table are the 10 CFR 20 criteria and not an NPDES requirement.

It should also be noted that we have applied for a routine renewal of the NPDES permit and have not requested any increase in allowable discharge quantities. In other words, the activities described in the NRC licensing application are not expected to cause an increase in effluents over currently permitted levels for the anticipated life (5 years) of the NPDES permit.

A comparison of the allowable discharge volumes in the 1978 permit (1.8 MGPD) to that requested in the 1980 renewal application, would show no change.

11.0 Questions

Page 27 - Is the data given in the table in Section 6.5 for fluoride and nitrogen correct? With the plant throughput increased by 40%, why are the releases of fluorides increased by a factor of 2.7 and nitrogen releases by a factor of 2?

11.1 Referenced Material in Section 6.5

Please see Section 10.2 on Page 13 of this attachment.

11.2 GE Response to Questions

Again, the data are correct and the table headings should read as above.

A comparison of the allowable discharge quantities for fluoride and nitrogen in the 1978 permit with the values requested in the 1980 permit renewal would show no change.

12.0 Questions

In relation to the data given in Section 6.7, with a 50% increase in plant releases to the river, it would be expected that the concentrations of copper, nickel and chromium would be affected to some degree as the total quantities of these materials are expected to remain constant. Please clarify.

Are the "present" values given in the table in Section 6.7 based on the measurements made for these contaminants?

12.1 Referenced Information on Pages 29 and 30

6.7.1 Ambient Concentration Summary - The impact of the present and forecast releases on ambient concentrations are summarized in the table below for comparison. In addition, each of the identified effluents is discussed further in subsequent paragraphs.

	Incremental Additions to River Concentrations at 10 Year, 7 day low flow of 15-cfs	
	Present	Future
Treated Liquid Discharges to River		
o Process		
Fluoride, ppm	0.35	0.99
Nitrogen, ppm	0.95	1.8
Copper, ppm	.012	.012
Nickel, ppm	.006	.006
Chromium, ppm	.006	.006
Volume ratio, discharge: river	.12	.185
Activity concentration, μCi/cc	3.6×10^{-6}	5.5×10^{-6}
pH, standard units	No change	No change

	Incremental Additions to River Concentrations at 10 Year, 7 day low flow of 15-cfs	
	Present	Future
o Sanitary		
Volume, rates discharged to river	.0009	.0009
pH, standard units	No change	No change
Biological oxygen demand, ppm	.23	.23
Total suspended solids, ppm	.23	.23
Treated Discharges to Atmosphere		
o Activity concentration at site boundary	3×10^{-14}	3×10^{-14}
o Nitrogen dioxide, ppm	<.05	<.05
Transfer of Ammonium Nitrate Liquid for Offsite Treatment		
o Uranium, ppm - maximum	5*	5

*At 4% enrichment, this equates to $\sim 1 \times 10^{-5}$ μCi/cc.

12.2 GE Response to Questions

(1) The copper, nickel and chromium concentrations are a function of variations in treated effluents from plating operations, variations in degree of corrosion of plant piping and variations in final lagoon chemistry as well as the variations in total water volume discharged. It is not anticipated that the total quantity discharged will exceed the allowable quantities specified in the 1978 permit. No increase has been requested in the 1980 permit renewal application.

(2) The present values given the table in 6.7 are not based upon measurements but are derived from daily monitoring results for 1979.

For reference, 1979 data on treated process liquid releases are in the table shown below

1979 Data on Treated Process Liquid Releases
Data from Daily Effluent Monitoring

	pH Range	Volume MGD	Lbs/Day, Monthly Avg. F	N	Cu	Ni	Cr
JAN	6.6-8.7	.650	16	73	.09	.10	.07
FEB	6.5-8.7	.604	26	71	.08	.08	.07
MAR	6.6-8.7	.610	18	49	.06	.07	.06

	pH Range	Volume MGD	Lbs/Day, Monthly Avg. F	N	Cu	Ni	Cr
APR	6.5-8.9	.590	26	60	.05	.06	.06
MAY	6.0-8.9	.647	28	67	.06	.08	.06
JUN	6.5-9.0	.638	24	51	.08	.06	.07
JUL	6.6-8.7	.610	29	48	.08	.08	.07
AUG	6.5-8.8	.571	15	25	.08	.10	.08
SEP	6.6-8.8	.765	25	54	.10	.07	.06
OCT	7.0-8.8	.780	30	57	.08	.07	.07
NOV	6.8-8.7	.658	28	73	.06	.06	.06
DEC	6.6-9.0	.587	40	67	.06	.08	.06

13.0 Question

Page 30 - What are the units for the activity concentration at the site boundary for discharges to the atmosphere?

13.1 GE Response to Question

The units for the activity concentration at the site boundary for discharges to the atmosphere are microcuries per cubic centimeter ($\mu Ci/cm^3$).

14.0 Questions

Page 31 - Please supplement information in Section 6.7.2.5. The pH of the discharge is apparently corrected from a pH greater than 10 to a pH in the 6-9 range. What is the agent used for pH adjustment and what is its concentration (Table, Section 6.7) when it enters the river?

14.1 Referenced Information in Section 6.7.2.6
(6.7.2.5 deals with activity concentration in treated liquids discharged to the river.)

6.7.2.6 pH Effect - The pH of the discharge is anticipated to have no discernable effect on the receiving stream. Prior to 1974, the discharge was released with an alkaline pH greater than 10 without discernable effect on river pH. The present mode of adjusting the discharge to the 6-9 pH range before release results in an even less of a potential effect.

14.2 Table in Section 6.7

Please see this attachment, page 15.

14.3 GE Response to Questions

Sulfuric acid is used to adjust the pH of the final lagoon effluent (the discharge point for treated process wastes) to the specified 6-9 range.

The sulfate concentration at the lagoon outfall averaged 170-ppm for the period from June 1979 to May 1980. The concentration at the confluence with the NE Cape Fear River is variable and dependent upon the amount of rainfall runoff that mixes with the lagoon effluent. The sulfate concentration in the river is also dependent upon rainfall. While the sulfate concentration in the river is usually under 20-ppm, during extended periods of low rainfall, back-mixing from the ocean occurs in the river and it is not unusual for the river concentration to exceed 170-ppm during these periods.

15.0 Question

General - Will the addition to the conversion facilities cause any change in the number of personnel at the Wilmington Plant?

15.1 GE Response to Question

No significant changes in the number of personnel at the GE Wilmington fuel manufacturing plant are expected as a result of adding the new GECO conversion lines.

A. L. Kaplan
:bmw

GENERAL ELECTRIC

Dr. E. Y. Shum
November 17, 1980

ATTACHMENT 2

QUESTIONS ON INCINERATOR REPLACEMENT

1.0 Question

Over what period is the quantity of combustible waste generated?

1.1 Referenced Information on Page 1 *

Introduction - In connection with the manufacturing of nuclear fuel at the Wilmington plant, a quantity of combustible waste contaminated with uranium is generated. Approximate quantities of combustible waste generated are as follows:

Number of waste boxes, each 60 cubic feet (1.7 cubic meters) in volume	400
Volume, total	24,000 cubic feet (1,020 cubic meters)
Net weight per box (average)	1,000 lbs (450 kgs)
Total	400,000 lbs (180,000 kgs)
Net UO_2 content per box (average)	25 lbs (11.3 kgs)
Total	10,000 lbs (4,500 kgs)
Net uranium content, total	4,000 kgs U
Net U-235 content, total	100 kgs U-235

1.2 GE Response to Question

The information in the above table represents approximate quantities of combustible waste generated annually.

2.0 Question

Pages 1 and 2 - The dimensions for the waste boxes are given as 4 x 4 x 4 feet, or 64 cubic feet. The volume of a box is given in the table as 60 cubic feet. Which value is correct?

*See Section 3.3 on Page 3 of this attachment for corrected table.

2.1 Referenced Information on Pages 1 and 2

(1) Information in table on Page 1:

Number of waste boxes, each 60 cubic feet (1.7 cubic meters) in volume	400
Volume, total	24,000 cubic feet (1,020 cubic meters)

(2) Information on Page 2:

2.1 Design Criteria - Incinerator - 1) Combustible solid waste will be incinerated "as is" within 4' x 4' x 4' wooden boxes.

2.2 GE Response to Question

Both the stated volume (60 cubic feet per box) and stated dimensions (4' x 4' x 4' wooden boxes) are rounded off values used for convenience. Actual values are as follows:

- o Outside dimensions - 4' x 4' x 3.5', each box (including skids)
- o Inside volume (i.e., volume of waste contents) - 46.32 cubic feet per box

3.0 Question

Page 2, Item 8 - The quantity of boxes indicated to have been accumulated in one year is 600. The production data on Page 1 is based upon 400 boxes. Please clarify.

3.1 Referenced Information on Page 2, Item 8

2.1 Design Criteria - Incinerator - 8) The incinerator capacity operating at (first year) 3-shifts, 5 days per week, must be capable of incinerating within a one year time frame 2,500 boxes (1,900 boxes backlog plus *600 generated.*)

3.2 Referenced Information on Page 1

1.0 Introduction - In connection with the manufacturing of nuclear fuel at the Wilmington plant, a quantity of combustible waste contaminated with uranium is generated. Approximate quantities of combustible waste generated (annually) are as follows:

Number of waste boxes, each 60 cubic feet (1.7 cubic meters) in volume	400

3.3 GE Response to Question

The correct generation rate several years ago was about 400 waste boxes per year, rising to a rate of about 600 per year during 1980. The incinerator is actually being designed with a capacity for burning about 2,000 boxes per year during a single shift of operation.

Thus, the data in Section 1.0 can all be multiplied by a factor of 1.5 (to adjust them for this increase in generation rate as shown below).

Number of waste boxes, each about 56 cubic ft (1.585 cubic meters) in volume, in 1 year	600
Volume, total	33,600 cubic feet (951 cubic meters)
Net weight per box (average)	1,000 lbs (450 kgs)
Total	600,000 lbs (270,000 kgs)
Net UO_2 content per box (average)	25 lbs (11.3 kgs)
Total	15,000 lbs (6,800 kgs)
Net uranium content, total	6,000 kgs U
Net U-235 content, total (assuming maximum authorized enrichment of 4%)	150 kgs U-235

4.0 Question

It is stated in Section 3.1 that "no organics" will be incinerated; however "paper, wood, plastics" are organics. Please clarify.

4.1 Referenced Information in Section 3.1

3.1 Incineration - The contaminated waste incinerator will have a nominal rating of 1,500 lbs/hr of type 1 waste (paper, wood plastics, etc., *no organics*). The boxes of combustible waste will be delivered from storage by forklift and placed on a gravity roller conveyor. From the gravity roll conveyor, the crates will be transferred to a powered conveyor and conveyed to the incinerator via a single ram feeder. A pumping station will be installed for burning contaminated waste oils from 5-gallon pails.

The incinerator will be fired with natural gas or propane from the existing storage facilities. Exhaust from the incinerator will be passed through a refractory-lined pipe to the scrubbing section of the facility.

4.2 GE Response to Question

The term "organics" as used above is the same as that used in the description of "waste composition" in our air emission permit application for the incinerator, as shown below:

Type of waste or refuse to be incinerated: Industrial process waste description - Combustible wastes containing small quantities of low enriched uranium. The wastes are comprised of:

- o Cloth (mopheads, rags, coveralls)
- o Elastomers and plastics (polyethylene, PVC)
- o Paper (cardboard and kraft)
- o Wood
- o Waste oil

5.0 Question

Page 8 and Figure 3 - The process flow diagram shows a heat recovery unit in the offgas stream; however, no mention of this unit is made in the process description on page 8. Please clarify.

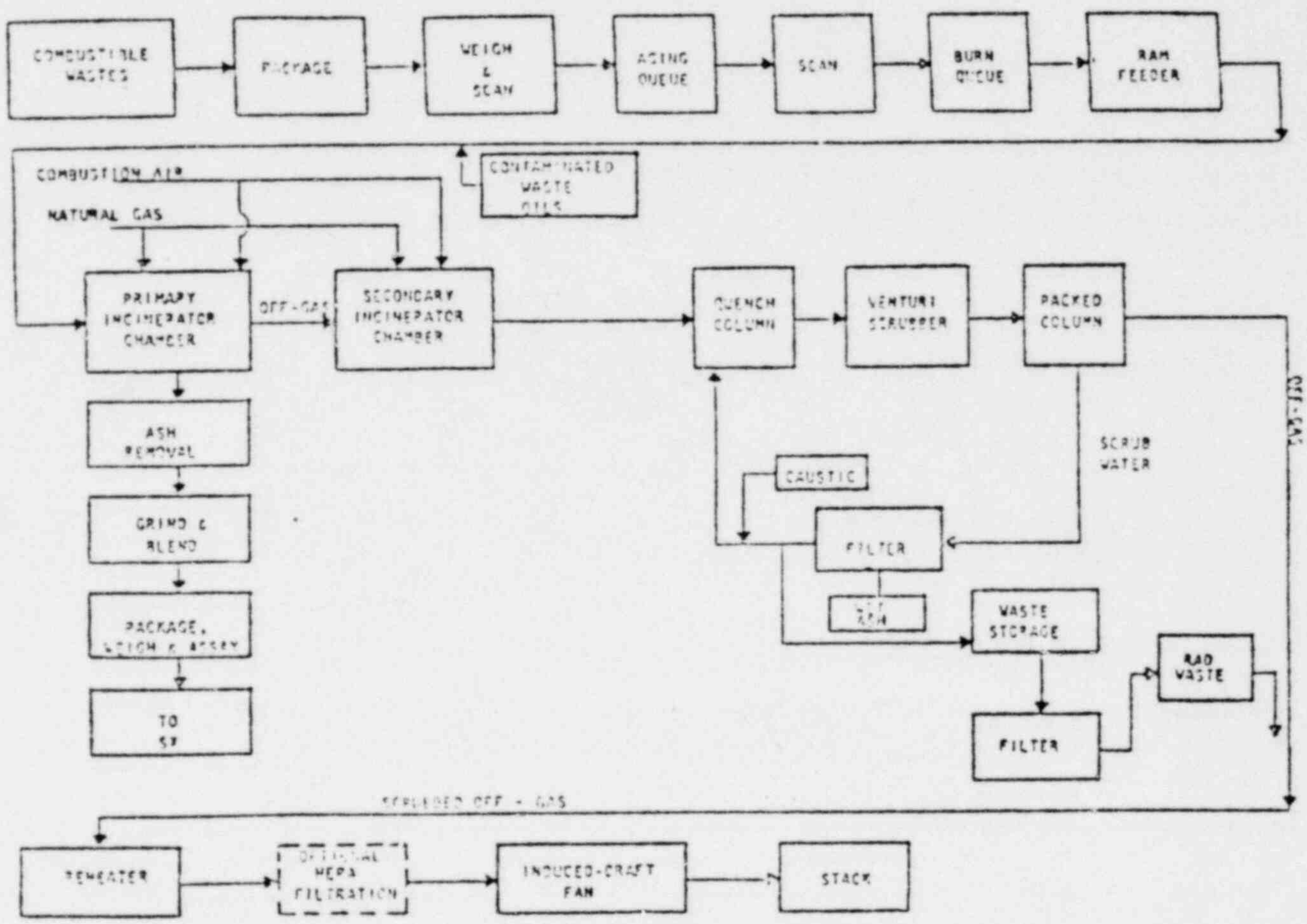
5.1 Referenced Information on Page 8

3.0 Process Description - The proposed incinerator facility has been designed for the incineration of contaminated combustible waste generated at the Wilmington nuclear fuel plant, according to the design criteria described in Section 2.0. The process is divided into three systems: incineration, scrubbing and ash collection. Figure 2 shows a conceptual schematic of the proposed process flow for this incinerator facility, while Figure 3 shows the details of the proposed process flow.

3.1 Incineration - The contaminated waste incinerator will have a nominal rating of 1,500 lbs/hr of Type 1 waste (paper, wood plastics, etc., no organics). The boxes of combustible waste will be delivered from storage by fork-lift and placed on a gravity roller conveyor. From the gravity roll conveyor, the crates will be transferred to a powered conveyor and conveyed to the incinerator via a single ram feeder. A pumping station will be installed for burning contaminated waste oils from 5-gallon pails.

The incinerator will be fired with natural gas or propane from the existing storage facilities. Exhaust from the incinerator will be passed through a refractory-lined pipe to the scrubbing section of the facility.

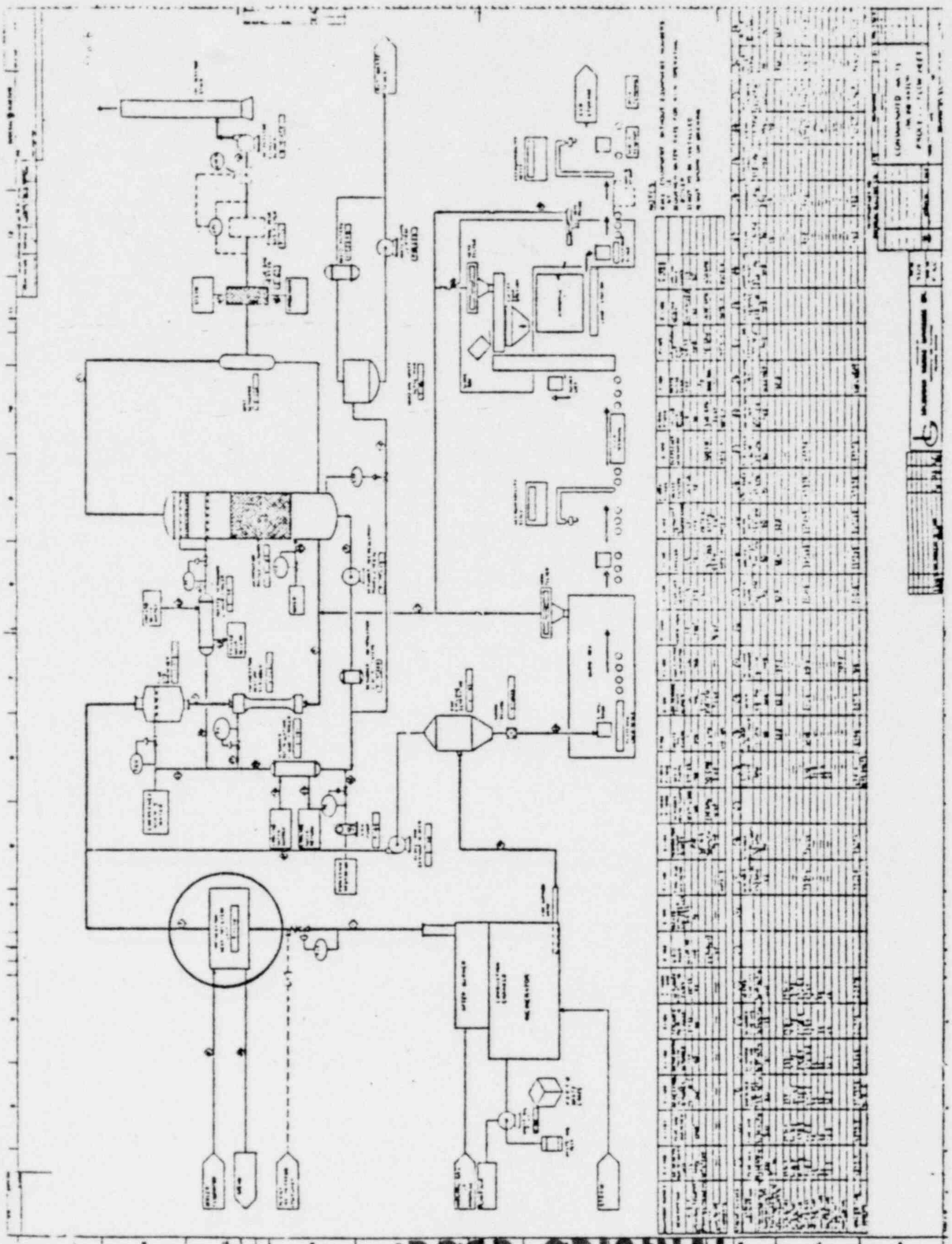
FIGURE 2 - CONCEPTUAL PROCESS FLOW DIAGRAM



POOR ORIGINAL

Dr. E. Y. Shum
November 17, 1980
Attachment 2 - Page 6

FIGURE 3 - DETAILED PROCESS FLOW DIAGRAM



POOR ORIGINAL

3.2 Scrubbing - Incinerator flue gas will pass through a refractory-lined Hastelloy "C" gas quencher where the temperature will be reduced from 2,000° F to 300° F. Quenched gas is passed through a Hastelloy "C" adjustable throat Venturi scrubber for particulate matter removal.

From the Venturi, the gas stream will enter a packed scrubber where it will be scrubbed with a potassium hydroxide solution (pH 7.0). The scrubber will be constructed of a fire retardant FRP with polypropylene packing. The scrubbing efficiency will be 99.5% of the entering HCl, NH_4F and HNO_3; the discharge from the scrubber will be passed through a mist separator, heated to 200° F and discharged through the stack. Stack emissions level will be continuously monitored to measure activity levels in the gaseous effluent.

Plant water will be used for emergency quenching if re-circulating water flow has been interrupted. A diesel powered emergency generator and a compressor will also be installed to ensure continuity of all critical process equipment.

3.3 Ash Collection - The incinerator will be shut down once per day for ash removal. The ash will be vacuumed and passed through a cyclone separator fitted with micro-metallic filter elements to remove fines. The discharge ash from the cyclone separator will be transferred to 5-gallon buckets and ground in a SWECO vibromill. The ash from the vibromill is discharged to 5-gallon buckets, the uranium content is assayed, and accountability weighed. The buckets are then transferred to pad storage pending offsite recovery of the uranium.

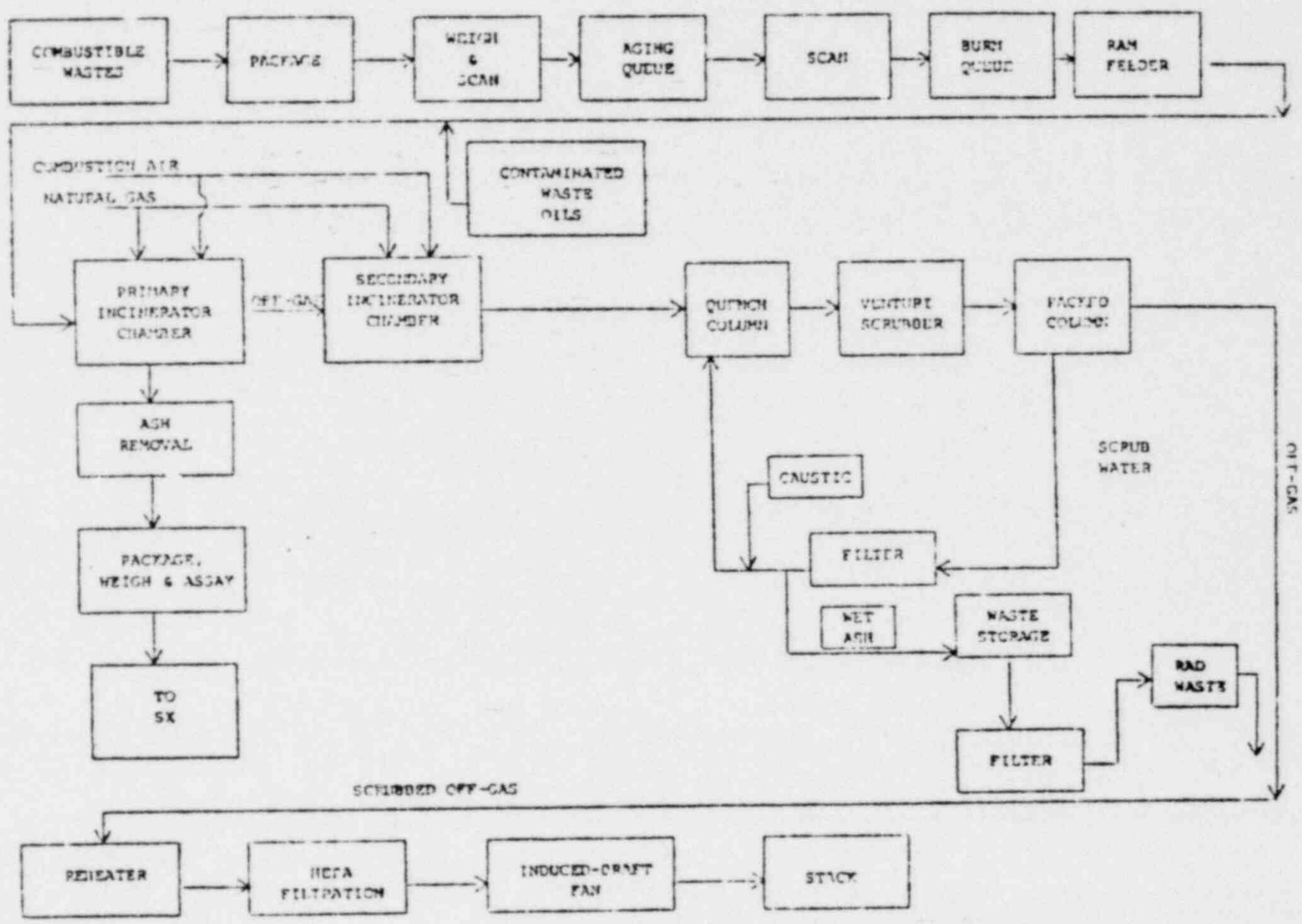
5.2 <u>Referenced Information In Figure 3</u>

Please see page 6 of this attachment.

5.3 <u>GE Response to Question</u>

The heat recovery unit was originally planned. However, later analysis demonstrated that the unit was not economically feasible. Therefore, this unit is no longer included within the project scope and it has been eliminated from the detailed process flow schematic shown in Figure 3. A new process flow schematic is shown on Page 8 of this attachment. The new detailed conceptual schematic will be provided when it has been completed (within about 4 months).

CONTAMINATED COMBUSTIBLE WASTE INCINERATION



POOR ORIGINAL

6.0 Question

Figure 3 - There are no flame sensors or flame control devices for the incinerator or the afterburner indicated on the diagram. What provisions are made to insure that unburned natural gas or propane will not enter the remainder of the system?

6.1 Referenced Material in Figure 3

Please see page 6 of this attachment.

6.2 GE Response to Question

The total incinerator system will be controlled by a programmable process control device (brand name of Eagle Signal Company). This device senses the temperatures and other primary operating conditions within the incinerator system. The temperatures in the incinerator and afterburner are designed to provide complete burning of natural gas or propane, respectively. If these temperatures vary significantly from the design values, the control device will shut down the system. If the control device fails, the system will be shut down (i.e., it is fail-safe).

7.0 Questions

Page 8 -

It is stated in Section 3.2 that "The scrubbing efficiency will be 99.5% of the entering HCl, NH_4F and HNO_3." With the wide variability in contaminants in "as is" waste (page 2), how can this criterion be satisfied?

It is stated in Section 3.2 that "stack emissions level will be continuously monitored to measure activity levels in the gaseous effluent." How will the levels of other contaminants, F, Cl, and NO_x in the offgas stream be determined?

7.1 Referenced Information in Section 3.2

3.2 Scrubbing - Incinerator flue gas will pass through a refractory-lined Hastelloy "C" gas quencher where the temperature will be reduced from 2,000° F to 300° F. Quenched gas is passed through a Hastelloy "C" adjustable-throat Venturi scrubber for particulate matter removal.

From the Venturi, the gas stream will enter a packed scrubber where it will be scrubbed with a potassium hydroxide solution. The scrubber will be constructed of a fire retardant FRP with polypropylene packing. The scrubbing efficiency will be 99.5% of the entering HCl,

NH_4F and HNO_3; the discharge from the scrubber will be passed through a mist separator, heated to 200° F and discharged through the stack. Stack emissions level will be continuously monitored to measure activity levels in the gaseous effluent.

Plant water will be used for emergency quenching if recirculating water flow has been interrupted. A diesel powered emergency generator and a compressor will also be installed to ensure continuity of all critical process equipment.

7.2 Referenced Information on Page 2 in Section 2.1

2.1 Design Criteria - Incinerator - 1) Combustible solid waste will be incinerated "as is" within 4' x 4' x 4' wooden boxes.

7.3 GE Response to Questions

(1) Although there is a wide variability in contaminants contained in "as is" wastes, on a box-by-box basis, on the average over a number of boxes, the variability will not be large enough to cause the design specifications for scrubber efficiency to be exceeded when averaged over the period of time used for determining compliance with regulatory requirements for atmospheric and liquid effluents.

(2) Fluoride discharge levels in the offgas stream will be determined in the same manner as is presently done for the chemical discharge stacks. Chloride and oxides of nitrogen levels will not be measured. Calculations demonstrate that we are within regulatory limits for visible emissions and ambient air quality. (These calculations are addressed in the answers to Question 8 below.)

8.0 Questions

Page 14 -

Are the air emission quantities given in Section 6.2 to be added to those given on page 28 of the Environmental Information submitted on December 29, 1979?

Also, show the calculation with assumptions used for the projected discharge of radiological and chemical effluents as summarized in Table 1.

8.1 Referenced Material in Section 6.2 on Page 14

6.2 Air Emission Quantities - Estimated quantities of different materials in air emissions from the proposed incinerator facility are shown in Table 1. These quantities are well within limits set by state and federal agencies for such discharges.

Table 1 - Air Emission Quantities

Emission	Quantity, Maximum
Uranium	3×10^{-12} µCi/ml at the stack
HCl	50 lbs/hr
NH_4F	120 lbs/hr
HNO_3	70 lbs/hr

8.2 GE Response to Questions

The actual estimated quantities of these materials in air emissions from the proposed incinerator facility corrected from those in Table 6.2, are shown below:

Airborne Discharge	Design Limit*	Expected Operating Limit*
Uranium activity (annual average)	$<1\times10^{-11}$ µCi/ml	$<3\times10^{-12}$ µCi/ml
Particulate	<.08 grains/dscf	<.02 grains/dscf
HCl	.07 lbs/hr	.01 lbs/hr
Fluoride	≤200 grams/week	<100 grams/week
NO_x	2 lbs/hr	<2 lbs/hr

*Values at stack

The values for uranium discharge to the atmosphere given on page 28 of the Application Amendment N-2, Expansion of Plant Conversion Capacity, submitted on 12/21/79, are regulatory limits at the site boundary. The information in the table above are actual design values and the limits of expected operating values for the various airborne discharges (including uranium).

Therefore, the values in the table above are not to be added to values given on Page 28 of the submittal dated 12/21/79.

Calculations used for the projected discharge of radiological and chemical effluents as summarized in Table 1 above are as follows:

(1) Assumptions

- o Average weight of box contents = 800 lbs
- o Maximum throughput of incinerator = 928 lbs/hr
- o Estimated weight per box of chloride from neoprene, vinyl gloves, PVC, etc. = 1.21 lbs/box
- o Estimated weight per box of NH_4F from mops, rags, etc. = 1.75 lbs/box
- o Estimated weight per box of sulfur from polysulfide shoe covers, contaminated oil, etc. = 0.41 lbs/box
- o 600 boxes per year

(2) Yearly average rate (600 boxes)

- o Chloride: 1.21 lbs Cl/box x 600 boxes/year x 99.2% = 6.2 lbs/yr
- o NH_4F: 1.75 lbs NH_4F/box x 600 boxes/year x 99.2% = 8.7 lbs/yr
- o Sulfur: 0.41 lbs/box x 600 boxes/yr x 99.0% = 2.6 lbs/yr
- o Nitrogen oxides: 1.0 lbs/box* x 600 boxes/yr = 600 lbs/yr

9.0 Question

General - Will the operation of the incinerator cause any change in the staffing levels for the Wilmington plant/

9.1 GE Response to Question

No significant changes in the number of personnel at the GE Wilmington fuel manufacturing plant are expected as a result of operating the replacement incinerator facility.

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*Based upon material balance from revision B of architect-engineer's process flow sheet dated 7/28/80.

ATTACHMENT 3

QUESTIONS ON ENVIRONMENTAL REPORT (NEDO-20197, JANUARY 1974)

1.0 Question

Page 1-23 - Will the new incinerator stack be visible from offsite locations?

1.1 Referenced Material on Page 1-23 (and 1-22)

1.6.1.2 Buildings & Structures - Photographs of the site, its surroundings and principal buildings are contained in Sections 1 through 4. Buildings are typically single-story light manufacturing structures of modern design, with bricks and stone used on office and laboratory annexes to relieve the Spartan appearance of the main structures. Except for a flagpole and water tank there are no prominently high structures. The operations do not require significant gaseous releases (steam, smoke, etc.), and none are visible from adjacent property or the public roads.

Other than buildings, water tanks, and a flag pole, there are specially constructed lagoons - a part of the extensive water treatment systems. Fourteen wells are located on site.

1.2 GE Response to Question

The new incinerator discharge stack will be visible only from portions of the wooded area along the southern fence line.

2.0 Question

Page 1-24, Table 1-2 - Have the energy requirements differed from the projections for years 1973-1978?

2.1 Referenced Material in Table 1-2 on Page 1-24

Table 1-2 - Summary of Plant Energy Requirements

Year	Electricity, megawatt hrs	Natural Gas, megawatt hrs
1969	49,100	88,800
1970	65,700	114,500

Year	Electricity, megawatt hrs	Natural Gas, megawatt hrs
1971	66,600	137,800
1972	69,000	137,500
1973*	75,000	149,500
1974*	75,800	151,000
1975*	75,000	149,500
1976*	133,500	266,100
1977*	138,800	276,600
1978*	179,300	357,300

*Projected

2.2 GE Response to Question

The actual energy requirements for 1973-78 have not differed significantly from the projected values for those years.

3.0 Question

Pages 1-24 and 1-25 - Will the expansion of the conversion facility and the replacement of the incinerator cause a change in energy or water requirements per unit of production?

3.1 Referenced Material on Pages 1-24 and 1-25

1.6.1.4 - Plant Energy Requirements - The primary energy source for the plant site is electricity, utilized for manufacturing activities, and building heat and air conditioning. The secondary energy source for the plant is natural gas, utilized for steam generation and other process operations.

A liquid propane facility is provided as a backup source to enable the natural gas service to be diverted during periods of high residential demand. The total energy requirements are quite low and are detailed in Table 1-2, with projected loads from 1973 through 1978.

See Table 1-2 above.

While the electrical and natural gas energy usage for 1972 was equivalent to only 109,300 megawatt hours, the potential realizable electrical energy from that year's production of nuclear fuel was 125,500,000 megawatt hours. These low input energy levels account for the negligible thermal discharge from the facility.

1.6.1.5 - Plant Water Requirements - There are 14 wells on the site to furnish water for the plant. Water usage for 1969 through 1972, and estimated usage for 1973 through 1978, are as follows:

Year	Water Usage, Millions of Gallons
1969 (estimated)	240
1970	295
1971	310
1972	310
1973*	335
1974*	350
1975*	360
1976*	430
1977*	480
1978*	510

*Projected

About 94 percent of the water withdrawn from these wells is returned to the Northeast Cape Fear River and its purity meets the North Carolina state regulations as they apply to sanitary and industrial wastes. Waste system and process system descriptions are found elsewhere in this report.

3.2 GE Response to Question

The expansion of the conversion facility and the replacement of the incinerator will not cause a significant increase in energy or water requirements per unit of production. In fact, introduction of the GECO conversion process should significantly decrease the water requirements (if not the energy requirements) per unit of production.

4.0 Question

Page 1-25 - Has the plant continued to operate in a safe manner since 1974?

4.1 Referenced Material on Page 1-25 (and 1-26)

1.6.1.5 - Chemical & Radiological Summary - The manufacture of nuclear fuel (Figure 1-2) at the Wilmington facility requires the use of various chemicals and uranium dioxide (UO_2). When the facility was designed, careful attention was given to the safe use of these materials - safe for people working in the plant, safe for people living and working in areas around the plant, and safe for the environment. Five years of operating experience has validated the design basis.

Uranium hexafluoride (UF_6) is received at the plant by truck transport, and chemically processed to prepare uranium dioxide (UO_2). The UF_6 is shipped in cylinders within Model OR-30 protective shipping containers (Figure 5-1 and 5-2), certified under Department of Transportation (DOT) regulations, which comply with AEC regulation 10 CFR 71. This packaging is designed to prevent release or criticality under the most severe accident conditions.

Low-enrichment radioactive materials are also shipped and received in other forms, including finished fuel assemblies, returned, unirradiated fuel rods, low specific activity uranyl nitrate solutions, and waste materials shipped to licensed vendors for offsite disposal. All of these shipments are made in containers which meet the DOT specifications and AEC regulations.

Radiation exposure to transportation workers, on lookers, and people along with shipping route is well within established limits. The highest exposure possible for the truck drivers under normal shipping conditions is extremely low (i.e., if one driver handled the total year's plant production, he would receive less than 5 mRem, or less than 5 percent of natural background radiation dosage.) Bulk tank truck shipments of anhydrous ammonia, aqueous ammonia, nitric acid, hydrofluoric acid, hydrated lime, and sodium hydroxide solutions are received and utilized on-site. The frequency of these receipts is less than 25 per week. These materials are all shipped in accordance with DOT regulations.

4.2 <u>GE Response to Question</u>

The plant has continued to operate in a safe manner in all respects since 1974.

5.0 <u>Question</u>

Page 2-1 (first paragraph) - Has there been any significant change in the land use patterns in the region around the site since 1974?

5.1 Referenced Material on Page 2-1 (First Paragraph)

2.1 Location & Layout - General Electric's plant at Wilmington, North Carolina, is situated on a 1664-acre site in New Hanover County, approximately 6 miles north of the city of Wilmington. (Refer to maps, Figures 2-1 and 2-4.) New Hanover County is located in the southeastern corner of the state, in the coastal plains region. The county is bounded by the Atlantic Ocean and by Pender and Brunswick counties. The region around the site is sparsely settled, and the land is characterized by heavily timbered tracts occasionally penetrated by short roads. Farms, single family dwellings, and light commerical activities are located chiefly along highways.

5.2 GE Response to Question

There has not been a significant change in land use patterns around the plant site since 1974. The trend toward increase in number of residences in this portion of the county is continuing. A small housing development has been started about 500-feet from the north property line (about 4000-feet from FMO).

6.0 Questions

Page 2-17 -

Have there been any significant changes in the North Carolina Water Quality Standards or in the designation for the Northeast Cape Fear River since 1974?

Have there been any significant changes in the EPA requirements or standards that may affect the National Pollutant Discharge Elimination System Discharge Permit NC 0001228? Will the proposed GE incinerator and plant expansion or other GE activities onsite result in an increase of effluent discharge and exceed the limits allowed under the current NPDES permit? If so, please discuss.

6.1 Referenced Material on Page 2-17

2.5.1.3 Related Classification of Receiving Streams - The pH of the river water is generally acid although values as high as 9, indicating a basic pH, have been measured. Fluorides are present in concentrations of nearly 1 ppm and are thought to be of natural origin from fluoride-bearing minerals. Nitrates, ammonia and other ions are also present in varying but low concentrations. The color of the river is dark brown, indicative of the contributions from swamps in the drainage area. Detailed ecology information is given in paragraph 2.7.

The river is classed as "SC" at the site by the North Carolina Office of Water and Air Resources. This classification means that the best use of the water in this classification is designated as "fishing, and any other usage except bathing or shell fishing for market purposes." The North Carolina Water Quality Standards are included in Appendix 2-2. A copy of the conditions for the National Pollutant Discharge Elimination System Permit issued by the US Environmental Protection Agency is also attached as Appendix 4-3.

6.2 GE Response to Questions

(1) North Carolina has revised the State Water Quality Standards. The primary change has been to add additional quality criteria for toxic substances and pesticides to the state standards. The US EPA "Quality Criteria for Water" was used as the basis for these additions. The most significant changes were made for higher water classifications (e.g., Classes A and B). The classification of the NE Cape Fear River is Class C, swamp water, at the plant site. It has not been necessary to revise NPDES permit criteria in order to meet these standards.

(2) There have not been significant changes in EPA requirements that affect NPDES (National Pollutant Discharge Elimination) Permit NC0001228. The addition of the incinerator and the dry conversion capability will not exceed the limits allowed under the current NPDES permit.

General Electric is in the process of planning and installing the capability to manufacture aircraft engine components at this site. It is too early in the planning stages to establish what, if any, affect this new manufacturing capability will have on the NPDES permit. The anticipation is that any effect will be minimal.

7.0 Questions

Page 4-3 -

Ground water samples are taken from the vicinity of the calcium fluoride pits on a periodic basis. Do the analytical results continue to show no increase in fluoride?

Please provide ground water sampling data and results since 1974. Had leakage been detected in any of the onsite lagoons? What remedial action will be taken if lagoon leakage is found?

7.1 Referenced Material on Page 4-3

Two small, fenced areas on the site have been set aside for landfill storage of calcium fluoride, a byproduct of plant processes. It is anticipated that the calcium fluoride, an extremely stable material, will ultimately be reprocessed for its chemical value. One of these storage areas is in the far northwest corner of the site. The other is adjacent to the discharge lagoons. These storage sites are monitored to assure that they exert no adverse environmental impact. Locations of these pits are shown in Figure 6-2.

- o Calcium fluoride pit in northwest corner of site - After an investigation of the suitability of the terrain and groundwater level and with the approval of the State of North Carolina, this area has been used as a storage area for calcium fluoride solids and covered with dirt to prevent wind scattering. There are four groundwater taps around the perimeter of this area. Groundwater samples are taken periodically and analyzed to be certain that no material is leaving the pit. These samples have shown no increase in the level of these materials.
- o Calcium fluoride pits adjacent to discharge lagoons - This area has been used to store calcium fluoride solids removed from the discharge lagoons. There are twelve groundwater taps around the perimeter of this area. Groundwater is analyzed periodically and has shown no increase in the level of these materials.

7.2 GE Response to Questions

(1) The results of the analyses from the shallow ground water samples taken in the vicinity of the calcium fluoride storage area show no continued buildup of fluoride concentrations. There is no change from background levels in the storage pits in the northwest corner of the site and in the majority of the wells at the final process lagoon area. Two of these later shallow wells do show fluoride concentration in the 2-4 ppm range. Ground water sampling results in these storage areas are shown in Table 2.

(2) Nitrates were detected in the shallow ground water at the waste treatment lagoon area. Deterioration of an underground manhole and connecting piping between the

nitrate lagoons was determined to be the cause and was corrected. Nitrate values are slowly returning to normal.

In the other instance, deterioration of a sump in the equipment area at the waste treatment facility was detected at the nearest shallow ground water monitoring well. The sump was repaired. Contaminant values have stabilized and it is anticipated that they will slowly return to normal.

Ground Water Sampling Results by Storage Area
Median Values

	pH	F, ppm	U, ppm	NO_3, ppm	NH_3, ppm
Calcium fluoride pits in NW corner of property (4 wells):					
1976	6.6	0.12	<0.01	0.11	0.02
1977	6.9	0.25	<0.01	0.2	0.7
1978	8.4	0.2	<0.01	2.2	<0.15
1979	---	0.3	<0.01	---	---
1980*	---	0.46	<0.01	---	---
Final effluent lagoons (12 wells):					
1975	7.1	0.2	<0.01	0.5	1.0
1976	6.9	0.2	<0.01	1.4	1.0
1977	7.2	0.2	<0.01	1.4	0.6
1978	7.2	0.2	<0.01	0.6	0.4
1979	7.2	0.2	<0.01	0.5	1.1
1980*	7.0	0.35	<0.01	0.6	1.1

*1980 - one-half year

8.0 Question

Page 4-5 and Tables 4-1 and 4-2 - Will the planned modifications to the conversion process or the incinerator cause any significant changes in the storage quantities or locations of chemicals used onsite?

8.1 Referenced Material on Page 4-5 and Page 4-4 and in Tables 4-1 and 4-2

4.2 Effects of Plant Operations - The following subsection evaluates the potential effects of the General Electric plant operations on fence-line neighbors, wildlife, or other aspects of the local ecology. Approximately two-thirds of the total plant operations (equipment and tube manufacturing) are primarily involved with metal-forming operations. These operations have had insignificant adverse effects on the environment during 5 years of operation. The remaining operations are involved with the highly specialized manufacture of fuel assemblies for nuclear power reactors, so important in meeting national energy goals. These operations have also had insignificant effects on the plant environment, and conservative control procedures ensure continuing minimal effects in the future. The fuel manufacturing operations involve low-enriched uranium as well as tonnage quantities of ammonia, nitrate, and fluoride. Accordingly, these materials receive principal emphasis in the following discussion. A detailed listing of all chemicals used onsite, including maximum inventories and locations, is shown in Tables 4-1 and 4-2.

(Tables 4-1 and 4-2 are shown on pages 10 and 11 of this attachment, respectively.)

8.2 GE Response to Questions

Additional chemical storage facilities associated with these licensing activities are not planned for the immediate future.

9.0 Question

Page 4-5 and Table 4-3 - Are the quantities of contaminants listed in Table 4-3 based on measured or calculated values?

9.1 Referenced Material on Page 4-5 and in Table 4-3

4.2.1.1 Waste Effluents - Summaries of the various liquid and gaseous effluents are presented in Table 4-3. The plant sewer system is diagrammed in Figure 4-3. Discharges of materials that contain nitrogen, uranium and fluoride are considered the most significant for potential environmental effects because these discharges account for the major part of the total waste material. Even though the tabulations show that insignificant amounts of gaseous wastes are emitted to the atmosphere, these wastes, particularly those containing uranium and fluoride, are discussed in detail in the following section.

(Table 4-3 is on pages 12 and 13 of this attachment.)

9.2 GE Response to Question

The quantities of contaminants listed in Table 4-3 are derived from the measured data where available or calculations where data is not available.

Table 4-1
CHEMICAL INVENTORY–MAXIMUM

Material	Chemical Formula	Percent Concentration	Specific Gravity	Max. Storage	Building Area	Relative Location
Acetone (Liquid)	$(CH_3)_2CO$	100 100	0.792	550 gals 550 gals	Equip Fuel	Outside Outside
Anhydrous Ammonia (Liquid)	NH_3	100	0.771	15 M gals 15 M gals	Equip Fuel	Outside Outside
Aqueous Ammonia (Liquid)	NH_4OH	29.4	1.218	20 M gals	Fuel	Outside
Hydrochloric Acid (Liquid)	HCl	30	1.160	7 M gals 110 gals	Fuel Equip	Outside Outside
Hydroflouric Acid (Liquid)	HF	37 72	1.143 1.261	5 M gals 15 M gals	Fuel	Outside Outside
Isostearic Acid (Liquid)	$C_{17}H_{35}COOH$	100	0.847	550 gals	Fuel	Inside
Lime (Powder)	CaO	100	N.A.	100 M lb	Fuel	Outside
Nitric Acid (Liquid)	HNO_3	56 56 67.3	1.355 1.355 1.410	5 M gals 5 M gals 550 gals	Tube Fuel Equip	Outside Outside Outside
Sodium Hydroxide (Liquid)	$NaOH$	50 50	1.51	2 M gals 7 M gals	Tube Fuel	Outside Outside
Sulphuric Acid (Liquid)	H_2SO_4	93 93	1.835 1.835	110 gals 110 gals	Fuel Equip	Outside Outside
Degreasal (Liquid)	Proprietary	N.A.	N.A.	110 gals	Tube	Inside
Uranium Hexafluoride (Solid)	UF_6	N.A.	N.A.	200 tons	Fuel	Outside
Uranyl Nitrate (Crystal)	$UO_2(NO_3)_2 \cdot 6H_2O$	N.A.	1.0	25 tons*	Fuel	Outside

Notes: *Typical

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Table 4-2
GASES INVENTORY–MAXIMUM

Material	Chemical Formula	Percent Concentration	Maximum Storage	Building Area	Relative Location
Argon	A	100	2400 gal	Fuel	Outside
			1500 gal	Tube	Outside
			1500 gal	Equip	Outside
Carbon Dioxide	CO_2	100	6 tons	Fuel	Inside
Helium	He	100	220 M ft^3	Equip	Inside
			220 M ft^3	Fuel	Outside
			220 M ft^3	Tube	Outside
Hydrogen	H_2	100	65 M ft^3	Fuel	Outside
Nitrogen	N_2	100	10.5 M gal	Fuel	Outside
			150 lbs	Fuel	Inside
			500 gal	Equip	Outside
Oxygen	O_2	100	6 M gal	Fuel	Outside
Propane	C_3H_8	100	143 M gal	Fuel	Outside

Table 4-3
WASTE EFFLUENT SUMMARY

Source		Contaminant	Nonradioactive Concentration	Normal Release Rate lb/hr	Normal Uranium Concentration* 10^{-12} μCi/ml	Allowable Release Rate lb/hr	Allowable Uranium Concentration* 10^{-12} μCi/ml
Gaseous Effluents							
Chemical		U	–	–	0.00139	–	3
		F	4.2 μg/m^3	–	–	–	–
Conversion Area	*	NO_x	39 ppm	9 lb/hr	–	18	–
Vapor Degreaser	*	1,1,1	33 ppm	1 lb/hr	–	–	–
		Trichloroethane			–	–	–
Vorcinerator®		U	–	–	0.00247	–	3
		NO_x	17 ppm	0.07 lb/hr		–	–
Zirconium Incinerator	*	ZrO_2	Visible	50 lb/hr (once per month)	–	–	–
Calciner Burners	*	HC	0.2 ppm	0.001 lb/hr	–	–	–
	*	NO_x	17 ppm	0.07 lb/hr	–	–	–
	*	CO	3.2 ppm	0.015 lb/hr		–	–
Boilers	*	NO_x	17 ppm	0.67 lb/hr	–	–	–
	*	CO	3.2 ppm	0.14 lb/hr	–	–	–
	*	HC	0.2 ppm	0.010 lb/hr	–	–	–
Sintering Furnaces		UO_2	–	–	0.00009	–	3
Pellet Grinding		UO_2	–	–	0.00024	–	3
Powder Processing		UO_2	–	–	0.00242	–	3
Pelletizing		UO_2	–	–	0.00065	–	3
Laboratory Hoods	*	Ethyl Acetate	0.003 ppm	0.1 lb/hr	–	–	–
	*	Nitric Acid	0.03 ppm	1 lb/hr	–	–	–
		UO_2	–	–	0.00014	–	3
Powder Storage		UO_2	–	–	0.00013	–	3
Machine Shop		UO_2	–	–	0.00019	–	3
Metal Cleaning	*	NO_x	<0.1 ppm	<0.03 lb/hr	–	–	–
Metal Cleaning and Plating	*	NO_x	<0.1 ppm	<0.03 lb/hr	–	–	–
Waste Treatment	*	NH_3	–	150 lb/hr	–	–	–
Absorber Rod	*	Boron Carbide	0.003 g/ft^3	0.03 lb/hr	–		
Paint Booth	*	Xylol		0.7 lb/hr	–		
	*	Butanol		0.8 lb/hr	–		
	*	Methyl Iso Butyl	0.2 ppm	0.5 lb/hr	–	40 lb/day	
	*	Ketone			–		
	*	Gycol Ethyl Ether		0.4 lb/hr	–		
	*	Isopropyl Alcohol		2.5 lb/hr	–		

*Calculated values

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Table 4-3 (Continued)

Source	Containment	Nonradioactive Concentration	Normal Release Rate lb/hr	Normal Uranium Concentration* 10^{-12} μCi/ml	Allowable Release Rate lb/hr	Allowable Uranium Concentration* 10^{-12} μCi/ml
Gaseous Effluents (Continued)						
Woodworking	Sawdust	Not calculated Manufacturer's design efficiency 99% of all material over 10 μM	–	–	–	–
Laboratory	UO_2	–	–	0.00016	–	3
Centrifuge Room	UO_2	–	–	0.00008	–	3
Chrome Plating	*** CrO_3	8 X 10^{-6} grains/ft^3	0.1 lb/day	–	–	–
Decontamination Facility	UO_2	–	–	–	–	3
			Normal Release Rate lb/day	**Normal Uranium Concentration 10^{-5} μCi/ml**	**Allowable† Release Rate lb/day**	**Allowable† Uranium Concentration 10^{-5} μCi/ml**
Liquid Effluents						
Treated Process Effluents	U	0.43 ppm	1.8	0.06	–	3
	F	3 ppm	12.7	–	29	–
	NH_3	5 ppm	21 } 50 (Total N)	–	} 77 (Total N)	–
	NO_3	34 ppm	144 }	–		–
	Ni	0.01 ppm	0.04	–	0.5	–
	Cr	0.01 ppm	0.04	–	0.5	–
	Cu	0.012 ppm	0.05	–	1.0	–
	P	0.1 ppm	0.4	–	1.0	–
	Cl	136 ppm	570	–	–	–
	SO_4	10 ppm	42	–	–	–
	pH	11.8**		–	12.6	
Treated Sanitary Wastes	BOD	50 ppm	10	–		–

Notes: *Values are those at nearest site boundary assuming 10^{-3} dilution factor.

**To be adjusted to 6.0 – 9.0 effective 6/30/74.

†Per N.C. Permit No. 2282 and NPDES Permit No. NC-000-1228

***Calculated values

10.0 Question

Page 4-40 and Table 4-41 - Will the planned modifications to the conversion process or the incinerator cause any significant changes in the resource commitments listed in Table 4-26?

10.1 Referenced Material on Page 4-40 (and Pages 4-42 and 4-43) and in Table 4-21

4.3 Resources Committed - Low-enriched uranium fuels must be used to produce electricity. Therefore, the short-term and long-term commitment of environmental resources involved in the fabrication of nuclear fuel must be evaluated. The considerations of environmental resource commitments from the construction and operation of the General Electric facilities at Wilmington are summarized in Table 4-21 and in the following discussion:

4.3.1 Land - Table 4-21 gives the distribution of GE's land commitments and shows that no land is permanently committed.

4.3.2 Biotic Communities - The current survey of biotic communities shows that the major portion of GE's land is functioning as a wildlife refuge, a desirable situation considering the encroachment tendencies of human neighbors. The surrounding regions are large in area, with large inventories of biotic populations compared with similar populations found on the Wilmington GE site. Consequently, the land area and the biotic populations represented on it are but a small fraction of the like resources available in the general region. However, the effects to date of the plant operations show no serious negative effect on the onsite biotic populations, much less with those offsite, and it is concluded that no significant commitment of biotic resources has occurred as the result of plant construction and operation.

4.3.3 Water - The consideration of water applied only to the extent of use or diversion and represents no irretrievable commitment either with respect to the quality or extent of the source or to the Northeast Cape Fear River to which the water is diverted. This is because water is being withdrawn from aquifers at rates well below available incoming supp.y.

4.3.4 Fossil Fuel - The uranium dioxide fuel produced in 1 year at the Wilmington Plant can supply the annual fuel requirements for more than a hundred 1000-MWe

Table 4-21
RESOURCE COMMITMENTS

Resource Use	Total
Land (Acres)	
Temporarily committed (plant use)	150
Undisturbed area	1370
Disturbed area (burrow)	144
Permanently committed	0
Water (10^6 gal)	
Ground water diverted to Northeast Cape Fear River per year	365
Fuel	
Electrical energy (10^3 MW-h/y)	179.3
Equivalent coal (10^3 tons)	81.4
Natural gas for steam and process (10^6 scf)	357.3
Effluents	
Chemicals (tons/year)	
Gases	
*SO_x	2670
*NO_x	696
*Hydrocarbons	9
*CO	17.4
F	0.05
Liquids	
N as NH_3	318
N as NO_3	112
F	4
Solids	
CaF_2	1047
Radiological (μCi/yr)	
Gases	
U	6×10^3
Liquids	
U	2.4×10^4
Solids (buried)	
U	3.6×10^4
Thermal (10^9 Btu)	500

* Note SO_x, NO_x, hydrocarbons, and CO_x are effluent gases from the combustion of coal for power generation.

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light-water reactors. The electrical energy output from these nuclear reactors is the same as that which would be produced if 250 million tons of coal* were consumed in coal-fueled plants.

Resources committed, shown in Table 4-21, do not consider, of course, the significant electrical energy required to enrich the UF_6 for feed to the fuel plant. Table 4-21 shows the annual resources committed by the fuel plant site to produce the nuclear fuel.

Approximately 357×10^6 scf of natural gas are consumed in furnace operations, most of which is used in the fuel-making process. This quantity of natural gas could be used to generate roughly 40,000 MW-hr of electricity, which is less than 1 percent of the annual output of a 1000-MWe reactor. Therefore, the commitment of such fossil energy resources to uranium-fuel fabrication is justified when the available alternatives (fossil and nuclear) are compared for energy production, i.e., their fuel cycles.

4.3.5 Effluents - In Table 4-21, the gaseous effluents (SO_x, NO_x, hydrocarbons, CO) correspond to the effluents produced when fossil-fuel is used to generate the Wilmington plant electrical requirements.

4.3.6 Chemicals - The commitment of approximately 1400 tons of chemicals per year, as indicated in Table 4-21, is considered to provide an economic investment of resources when this mass is compared with that of the oxygen-consuming alternatives (coal and natural gas) to produce electrical energy. Approximately 75 percent of the mass of process chemicals, i.e., CaF_2, is available for potential reclaiming or further processing. There are no significant irretrievable commitments of chemical resources.

4.3.7 Radiation Exposure - The resource to be considered in this paragraph is the potential for exposure to harmful radiation of human or other biotic populations

*The figures for energy consumption and the corresponding quantity of coal required to supply this need are based on information published by the USAEC Directorate of Licensing, Fuels and Materials, "Environmental Survey of the Nuclear Fuel Cycle," United States Atomic Energy Commission, Nov. 1972.

that might lie in the pathway to human populations. The extremely small exposure potential is shown by historical analysis in paragraph 4.2.3 and by the conservative estimates shown in Table 4-21. The airborne concentrations are sufficiently small that a fence-line neighbor might stand continuously at the boundary without receiving more exposure than is measurable in background radiation from natural causes.

4.3.8 Summary of Irretrievable Commitments - In summary, there have been no irretrievable commitments of resources at the Wilmington site.

10.2 <u>GE Response to Question</u>

No significant changes in the resource commitments are expected from the planned modifications to the conversion process or the incinerator.

11.0 <u>Question</u>

Page 5-16 - The analysis of the amount of radioactivity during a criticality excursion was based on 10^{18} fissions with the accident lasting one second. The regulatory position a. given in NRC Reg Guide 3.34 is that an excursion is assumed to occur in a vented vessel and multiple excursions occur with bursts lasting 0.5 seconds at intervals of 10 minutes for a period of 8 hours. A total of 1 x 10^{19} fissions occur during the excursions. Please revise the criticality analysis given on pages 5-16 and 5-18 and extend to cover the conditions of 10^{19} fissions set forth in Reg Guide 3.34.

11.1 <u>Referenced Material on Pages 5-16 through 5-18</u>

5.4.3.1 Criticality Accident Postulation - It is reasonable, based on the past accident experience, to assume that the most probable maximum criticality accident will result in a total of 10^{18} fissions. Since there are no significant fission products existing in the mass of uranium prior to the initiation of the accident, the only fission products which could be released are those formed during the accident

The assumptions used in determining the amount of radioactivity released where as follows:

- o The release results from 10^{18} fissions in a liquid supercritical system.
- o Initial fission product inventory is zero and the accident lasts one second. Radioactive decay begins at this time. Only volatile fission products are considered to be released.

- o The volatile fission product cloud is released from the liquid system and is drawn into the building ventilation system. The time required for the cloud to exit the stack is based on the rate of room air changes in the UF_6 conversion and is 13 minutes.
- o The velocity of the cloud once it is released from the conversion area stack is one m/sec toward the southern site boundary which is 574 feet from the stack. Time for this travel is 3 minutes. Therefore, the fission products are 16 minutes old at the time the site boundary is reached. A conservative age of 10 minutes is used in the calculations.

It should be noted that an individual at the site boundary would receive exposure from both internal and external sources of radiation. The doses (Table 5-5) were calculated from the individual's submersion in a semi-infinite cloud of beta and gamma emitters, from inhalation of the fission products, and from the direct radiation associated with the incident.

The dose from prompt fission gamma rays and neutrons were obtained from the Reference: Y-1272, Y-12 plant Nuclear Safety Handbook, J. W. Wachter, et al., March 27, 1973, Union Carbide Nuclear Co., Oak Ridge, Tenn.

The wholebody dose due to submersion in the fission product cloud was calculated by the standard semi-infinite cloud assumptions (Reference: Safety Guide 3).

The inhalation dose to the thyroid was calculated based upon the resulting short-lived radioactive waste contained in the fission products.

A median atmospheric diffusion factor at the nearest site boundary of 10^{-3} was used in these calculations.

Table 5-5
Doses to an Individual at the Nearest Site Boundary
Resulting from a Criticality Accident

Direct dose (prompt neutrons and gamma rays)	2.8 Rem
Submersion dose	2.1 Rem
Inhalation dose (thyroid)	0.8 Rem

As can be seen from Table 5-5, the doses to an individual at the nearest site boundary from a criticality accident are smaller than the maximum permissible occupational exposure for individuals working with radioactive materials.

Therefore, even the incredible case of a criticality accident in the fuel fabrication plant in which low-enriched uranium is processes, no significant environmental impact (i.e., radiation dose to an individual at the nearest site boundary) would result.

11.2 GE Response to Question

The analysis described above will be extended to cover the conditions of 10^{19} fissions set forth in Regulatory Guide 3.34, as soon as possible.

12.0 Question

Page 6-3 and Table 6-1 - Please extend the information given in Table 6-1 to include the latest available data on water impurities.

12.1 Referenced Material on Page 6-3 (and on Page 6-1) and in Table 6-1

6.1 Preoperational Environmental Programs

6.1.1 Water - Early programs undertaken by GE to obtain baseline information for the Northeast Cape Fear River were to determine levels of chemical concentrations. Since the waste discharges from GE were expected to be typically those of a small chemical plant, the areas of concern included chemicals in river water and ground water.

The liquid samples taken from the plant effluents, from the Northeast Cape Fear River, and from surface and ground water (wells) are one-quart "grab" samples. Figure 6-1 shows the location for these preoperational samples from the Northeast Cape Fear River. Baseline data (1968-1969) from the analysis of river water samples were tabulated in Section 4.

It was recognized in 1969 that additional information was needed on the complex mixing characteristics of the estuarine system involving the Northeast Cape Fear River. Cooperation was given to the North Carolina Department of Water and Air Resources and the Department of the Interior in a dye mixing study conducted during 1969 to 1970. An abstract of the study follows:

Abstract

This report presents the results of a fluorescent-dye-tracing study to determine the concentrations of a pollutant that would be present in the Northeast Cape Fear estuary at various rates of continuous waste injection and fresh-water inflow.

Rhodamine WT dye was introduced into the estuary at a constant rate over a 24.8-hour period (two tidal cycles) at a point 6.4 miles upstream from the mouth in Wilmington, N. C., and concentrations were monitored at several selected sections in the tide affected part of the river for 17 days. The range between high and low tide in this reach of the estuary averages about 3.5 feet, and there is usually strong flow in both directions.

Results of the dye study indicate that if a pollutant were injected at a rate of 100 pounds per day under the conditions of relatively low inflow existing at the time, concentration would ultimately build up to 20 micrograms of dye per liter of water 1,000 feet downstream. The flushing time during the study is estimated to be 17 days. These results are extrapolated to include periods of lower or higher inflow. For example, at average intervals of 10 years, it is estimated that inflow is so low that 100 days are required for a pollutant to travel the 6.4 miles from the point of waste release to the mouth of the river. Under these conditions, it is expected that 1,000 feet downstream from the point of waste discharge, daily maximum concentrations will average about 130 micrograms per liter for each 100 pounds of pollutant injected per day.

Results of the continuous discharge measurement of flow made by current meter during a complete tidal cycle are presented as a part of this report. Data from this measurement and other evidence indicate that net upstream flow in the estuary is possible over a period of several days.

Ground water was sampled and analyzed in 1968. Resulting data for impurity concentrations in the plant well water supply are shown in Table 6-1 for the years 1968, 1972 and 1973. (See page 21 of this attachment for Table 6-1.)

12.2 GE Response to Question

The information in Table 6-1 has been extended up through 1980 as shown in the table on page 22.

Table 6-1

ON-SITE WELLS IMPURITY CONCENTRATION*

Chemical	1968	1972	1973	Comparable Standard[a]
Calcium (Ca)	100	50	---	---
Iron (Fe)	0.09	0.7	---	0.3
Magnesium (Mg)	7	2	---	---
Sodium (Na)	57	26	---	---
Manganese (Mn)	0.01	0.01	---	0.05
Uranium (U)	---	<0.01	<0.01	0.01
Bicarbonate (HCO_3)	132	198	---	---
Carbonate (CO_3)	0	0	---	---
Hydroxyl (OH)	0	---	---	---
Chloride (Cl)	40	16	20	250
Sulfate (SO_4)	1	6	---	250
Nitrate (NO_3)	NIL	0.03	0.07	44
Fluoride (F)	---	0.01	0.14	1
Ammonia (NH_3)	---	---	0.10	0.6
Phosphorous (P)	---	---	---	0.08
Total Hardness	107	132	---	---
Alkalinity[b]	123	162	37	500
Alkalinity[c]	0	---	---	---
pH	7.3	---	---	6.0 - 8.5
Total Solids	200	219	205	500
Free CO_2	13	8	---	---
Silica (SiO_2)	17	16	---	---

Notes: *Parts per Million (ppm)

a Water Quality Criteria, 1968 Edition (Permissible values shown)

b Methyl Orange

c Phenophthalein

ONSITE WELLS IMPURITY CONCENTRATION

Chemical	Parts per Million 1974	1975	1976	1977	1978	1979	1980
Calcium	--	--	--	64	51.5	40.5	--
Iron	--	--	--	1.9	1.9	3.1	--
Magnesium	--	--	--	2.7	3.0	4.3	--
Sodium	--	--	--	13.0	19	14.4	--
Manganese	--	--	--	0.44	0.2	<0.2	--
Uranium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Bicarbonate	--	--	--	--	161.0	148.0	--
Carbonate	--	--	--	--	0.0	0.0	--
Hydroxyl	--	--	--	--	--	--	--
Chloride	12	20	15	19	21	23	19
Sulfate	--	--	--	3.0	<1.0	<0.5	--
Nitrate	--	<0.1	0.18	0.12	0.11	<0.02	<0.10
Fluoride	--	--	0.15	0.14	0.23	--	--
Ammonia	0.08	<0.05	0.20	0.12	<0.2	<0.02	0.34
Phosphorous	--	12	0.29	0.09	0.14	0.30	0.37
Total hardness	--	--	--	168.0	148.0	150	--
Alkalinity*	--	--	--	--	--	--	--
Alkalinity**	--	--	--	--	--	--	--
pH	--	--	--	6.9	7.2	7.4	--
Total solids	--	238	253	--	204.0	37.0	259
Free CO_2	--	--	--	--	--	--	--
Silica	--	--	--	--	--	--	--

*Methyl orange

**Phenophthalein