ATTACHMENT G

PROPOSED REVISION C3, NEDO-21326C
CONSOLIDATED SAFETY ANALYSIS REPORT
FOR
MORRIS OPERATION

The material in this attachment consists of proposed revisions and additions to NEDO-21326 made in compliance with requirements of 10 CFR 72. Revised and new material is indicated by double-bar vertical lines in the right margins. Some incidental editorial changes and new material is included when they occurred on the same page as Part 72 revisions, or were otherwise related. These changes are indicated by a single bar and the letters E (Editorial) or N (New Material).

See the attached letter for other comments applicable to this material.

In December 1975, General Electric received a license amendment to increase the fuel storage capacity of the facility from about 100 TeU[3] to 750 TeU by the installation of fuel storage system of a new design and through appropriate changes in fuel handling and support systems. This project, designated by GE as Morris Operation-Project I, converted the former high level waste storage basin to a fuel storage basin. The capacity expansion project was completed in 1976

1.1.1 Corporate Entities, Business, and Experience

The facilities described in this report are owned and operated by General Electric Company, a corporation under the laws of the State of New York, with its principal place of business at Schenectady, New York. The facility is operated through General Electric's Nuclear Fuel and Services Division (NF&SD), with head- E
quarters at San Jose, California and operations at Morris, Illinois.

General Electric is a broadly diversified corporation involved in research, design, manufacturing, and marketing products and services in several fields including industrial products, technical systems and materials, consumer products, and power systems. The latter activity includes nuclear systems, equipment, fuel and services.

General Electric's experience in nuclear activities includes research and development of prototype reactors for nuclear submarines, operation of the government's Hanford facilities for more than 17 years and the development, design, manufacture, and erection of 41 boiling water reactors currently operating at electric power stations in the United States and throughout the world. The staff of the Company's Nuclear Energy Group includes literally thousands of scientists, engineers, and technicians, representing one of the largest pools of nuclear knowledge and experience in the world.

1.1.2 Plant Location

Morris Operation faciities are located on the northern end of a rectangular tract of about 815 acres owned by General Electric Company in Gooselake Township, Grundy County, Illinois, near the confluence of the Kankakee and Des Plaines rivers (Figure 1-1).[4]

The tract (Figure 1-2) is about 15 air miles southwest of Joliet and about 50 miles southwest of the Chicago, Illinois - Gary, Indiana area. Morris, Illinois, the county seat of Grundy County, is about 7 miles to the west of the tract. The Illinois Waterway and Kankakee River are separated from the tract to the north and east by lands owned by Commonwealth Edison Co., the site of the Dresden Nuclear Power Station (DNPS) and related facilities, and a privately owned plot of about 50 acres. The developing Gooselake Prairie State Park is to the west and a refractory mining operation borders the tract to the south.

The terms used in the text of this document to describe the General Electric property are as follows:

Tract/Controlled Area[4a] - all land holdings of General Electric as defined in Section 3.

Site - the developed area of the General Electric tract, including the protected area, sanitary lagoons, and evaporation pond.

1.1.3 Existing Facilities

The existing facilities occupy about 52 acres at the north edge of the tract (Figure 1-3). The principal plant structures, including the ventilation stack, are within a 15-acre fenced protected area, while the sanitary waste treatment facilities and the industrial waste evaporation pond are located immediately south of the protected area. The sanitary waste facilities are fenced, also, but not as part of the protected area. The evaporation pond is not fenced.

1.1.4 Fuel Type and Exposure

The design basis fuel to be stored is UO_2 fuel having had an initial enrichment of 5% U-235 or less, with stainless steel, zirconium or Zircaloy cladding, and in a "bundle of rods" geometry. The design basis fuel may have been irradiated at specific power levels of up to 40 kW/kgU, with exposure to 44,000 MWd/TeU (reactor discharge batch average), and must be cooled for at least 1 year after reactor shutdown and prior to receipt at Morris Operation.

1.1.4.1 Fuel in Storage

Irradiated fuel from PWR's and BWR's has been received and stored at the Morris Operation facilities since 1972.[5] These activities have reaffirmed experience elsewhere that fuel can be handled and stored safely with no impact on the environment. There has been no significant fuel leakage (as determined by measurement of basin water activity), indicating that the fuel is a stable, inert material while in the storage basin environment. Effective control of water quality, radioactive material concentration in the water, cask contamination, and airborne radioactive material has been demonstrated.

1.2 GENERAL PLANT DESCRIPTION

The following descriptions are of those aspects of the Morris Operation facilities that are related to irradiated fuel storage or shipment. Facilities originally intended for reprocessing are mentioned only as related to fuel storage operations.

1.2.1.5 **Environs Summary**

The distances from the plant stack to the tract (controlled area) boundaries are 2265 ft to the east, 6512 ft to the south and 3100 ft to the west. The tract boundary to the north is about 950 ft from the stack; however, the DNPS site provides an effective exclusion distance[7] of about 5950 ft. Studies of population and land usage in surrounding areas were made and reported in the course of DNPS development, as well as during the MFRP program and Morris Operation Project I. Factors of specific interest are summarized below.

a. Industrial: On the DNPS site there are three nuclear power reactors situated about 0.7 mile northeast of the Morris Operation stack location. A large fossil-fired power plant is located about 4 miles west-southwest of the stack. A chemical plant is located about 1.5 miles from the stack to the northwest. Adjacent to the south boundary of the Morris Operation tract there are clay mining and clay products manufacturing activities about 1.4 miles from the stack.

b. Residential: The residences nearest to the tract are on about 50 acres directly east of the facilities, between General Electric property and the Kankakee River. The tract owner, who maintains his permanent residence there (about 0.5 mile from the stack), has leased individual river front sites on which approximately 30 cottages have been built, largely for recreational purposes. There are other residences across the Kankakee River, the nearest about 0.7 mile from the stack.

The total population within a 5-mile radius is estimated to be about 5000 including summer visitors, increasing to about 8830 by the year 2000. A population of about 32,400 resides within a 10-mile radius of the plant, and should increase to about 68,000 by the year 2000. N

Population in the 5- to 20-mile radius zone, which includes the cities of Aurora and Joliet, is about 252,900. This population should increase to about 432,500 by the year 2000.

In general, population projections for the State of Illinois have been lowered in recent years. Current projections indicate a relatively slow growth rate as compared to the over-all U.S. rate. N

c. Recreational: In addition to fishing, hunting, and boating activities near the confluence of the Kankakee and Des Plaines Rivers 1 to 2 miles east of the plant, the Goose Lake Prairie State Park has been established adjacent to the Morris Operational tract. This natural prairie preserve of about 1800 acres is west of the tract, with the nearest point being about 0.6 mile from the stack.

1.2.1.6 **Tract Ownership**

The tract is wholly owned by General Electric Company. Since purchase of the original tract, which then totalled 1380 acres, approximately 70 acres located at the southwest corner and approximately 50 acres in a 400-ft-wide strip along the south edge of the tract have been sold to A. P. Green Refractory Company, Illinois Products Division, to be used in connection with their clay mining and clay products manufacturing activities. A parcel to the north and east was sold to Commonwealth Edison Company for construction of canals to a cooling lake for the DNPS reactors.

1.2.2 Facility Descriptions

The largest building on the site (the main building) was originally constructed to house the fuel reprocessing chemical facilities, as well as waste management, fuel handling, and fuel storage facilities (Figure 1-4).

1.2.2.1 **Main Building**

The main building is a massive structure of reinforced concrete, about 204 ft by 78 ft in plan, and about 88 ft high above ground. The western end of the building houses most of the fuel storage facilities. This portion of the building is of steel frame and insulated metal siding construction, and is attached to the concrete main building.

1.3.7 Emergency Provisions

The structures and systems at Morris were designed to more rigorous standards than would be required for spent fuel storage. Emergency plans are in effect, and assistance agreements exist with appropriate local agencies. Structures provide access for law enforcement, medical, fire, or other emergency services.

1.4 REFERENCES

1. License and docket information and a list of applicable documents are contained in Appendix A.1 and A.2.

2. The Morris Operation does not encompass BWRTC activities, although both are General Electric operations.

3. Storage capacity expressed in terms of metric tons of uranium (TeU) as contained in LWR fuel rods. A metric ton equals 1,000,000 grams, or one megagram (Mg). Abbreviation for metric tonne (Te) used as recommended by American Institute of Physics, American Chemical Society, and others. Throughout this report, TeU = MTU.

4. The BWRTC is also on this tract. Hereafter BWRTC is referred to only when germane to the purpose of this report.

4a. "Controlled area" as defined in 10 CFR 72.3 (h).

5. K. J. Eger, Operating Experience - Irradiated Fuel Storage - Morris Operation, Morris, Illinois, General Electric Company, May 1978 (NEDO-20969B).

6. See Chapter 8.

7. See 10 CFR 100.3 (a) definition.

8. Previously, the floor could be drained to the site runoff drain system or the cladding vault. The runoff drain has been disconnected and capped.

9. Also, see Figures 1-12 and 1-13. In various documents, the cask unloading ba has been called fuel unloading pit, cask unloading pit, etc.

3.2.2.4 Boundaries for Establishing Effluent Release Limits

The controlled area boundary (the tract boundary shown in Figure 1-2) is the boundary for establishing dose equivalents as defined in 10 CFR 72.67 and 72.68.

No credible acts of nature, man-induced events or accidents have been identified that would result in a biologically significant release of radioactive material or a direct radiation dose in excess of the limits of 10 CFR 72.68 outside of the controlled area boundary. Therefore, the Emergency Planning Zone (EPZ) for Morris Operation coincides with the controlled area boundary.

3.2.3 Population, Distribution and Trends

The data base for the following sections is founded on information developed by agencies of the States of Illinois and Indiana, as well as information developed by General Electric and Commonwealth Edison.[1a,1b,1c]

3.2.3.1 Population Between 0 and 5 Miles (Figures 3-4 through 3-5A)

The population in the immediate vicinity of the Morris Operation is very low. Within a radius of 5 miles the population is about 5,000, including 1,500 in the village of Channahon, about 4 miles to the northeast. Included in this accounting are several residences at the Dresden Lock and Dam. The 1970 population figures within a 5-mile radius are based on a 1974 actual house count assuming three persons per house and are not intended to represent 1970 U.S. census data. The 1980 projections for the 0- to 5-mile radius are based on an assumed 5% annual growth in all areas except those in which the tract is located.[2]

The population within 5 miles of the site is projected to increase to 8830 by the year 2000. Within 10 miles, the existing population is about 32,400 and is projected to reach 68,000 by the year 2000.[2a]

3.2.3.2 Population Within 50 Miles (Figures 3-4 through 3-7A)

The total population within the 50-mile radius was found to be about 6,251,500 in 1970 and is projected to reach 7,500,600 by 2000 with about 91% of the total beyond the 30-mile radius.[3]

The 1978 population projections prepared by the State of Illinois and the State of Indiana for counties within a 50-mile radius surrounding the facility anticipate relatively minor population growth between 1978 and the year 2005.[3a]

Studies by Commonwealth Edison's Industrial Development Department indicate that since 1946, 82% of the new industries locating within the Commonwealth system are located within 25 miles of downtown Chicago. In 1965, 80% of the new industries also located according to this pattern. Current indications are that this industrial growth pattern is slowing but continuing within the 25-mile belt. Thus, the growth adjacent to the GE-DNPS sites (which are outside of the 25-mile belt) should continue but at relatively low rates. The Joliet and Aurora areas are the closest areas that are likely to see significant population increases.

3.2.3.3 Transient Population

There are small seasonal variations in population in the farm lands of the area because of harvest manpower requirements. Unlike some farm areas, harvest activities are highly mechanized and relatively few additional workers are needed.

Almost all manufacturing and other industrial activity is nonseasonal and draws upon a population base that resides in the same general area. For example, with the largest part of Chicago's industrial and residential areas within the 50-mile radius, the daily movements of people within Chicago and environs result in a relatively insignificant statistical change from the viewpoint of considerations applicable to the Morris Operation site.

As discussed elsewhere in this chapter, recreational uses of lands and water in the area result in small seasonal changes in population in cottages, etc. These changes have been estimated by observation and incorporated in Figures 3-4 and 3-5.

3.2.4 <u>Users of Nearby Land and Waters</u>

The immediate neighbors of Morris Operation (Figure 3-3) are the DNPS site on the north, the A. P. Green Refractory Company, Illinois Products Division, on the south and the Goose Lake Prairie State Park to the west. To the east is the Dresden cooling lake and a privately owned property of about 50 acres, divided into about 30 cottage sites. Commonwealth Edison's Collins Station (a fossil-fired plant) is to the west-southwest of the Morris site.

The present land use patterns in the area seem likely to continue for some time to come. The Northeastern Illinois Planning Commission does not expect a change in the pattern in the southwestern corner of adjacent Will County, either. (The county line is approximately 1-1/2 miles east of the GE tract.)

3.2.4.1 Industrial

In addition to the A. P. Green Refractory Company operations south of the tract and the Commonwealth Edison holdings to the east, north, and northwest, another industrial area is located along Highway I-55. This highway runs north and south, about 4-1/2 miles directly east of the tract (Figure 1-1). Two miles east of I-55 is the inactive Joliet Army Ammunition Plant. A large Mobil Oil petroleum refinery is located where I-55 crosses the Des Plaines River. Industrial sites are also located on the north bank of the Illinois River.

3.2.4.2 Residential Use and Population Centers

Residential occupancy in the immediate vicinity of Morris Operation is low. There is a cluster of about 30 cottages on the west shore of the Kankakee River, about 0.5 mile from the Morris Operation stack. These are located between Dresden Road and the Kankakee River on a tract of about 50 acres adjacent to the GE and DNPS sites. Any residential development in the immediate vicinity or Morris Operation would be limited to this tract which is now nearing saturation.

There is also a similar group of cottages on the east bank of the Kankakee River at a distance greater than 1 mile from the Morris Operation stack. Some of the homes in this area are permanent residences, although most have been developed for part-time recreational purposes. Surveys by Commonwealth Edison indicate that within 2-1/2 miles of the DNPS site there are a total of 129 permanent homes and 191 part-time recreational cottages along the

Kankakee River. Other residences in the area include several at the Dresden Dam about 1.2 miles to the north. There are no major residential centers developing south of the Kankakee and Illinois Rivers in the vicinity of the General Electric tract.

Cities and towns having populations greater than 1,000 located within 30 miles of the Morris Operation are listed in Table 3-1. Population centers of less than 1,000 within about 5 miles of the tract are as follows:

- Village - Minooka, 5.2 miles N
  768 people as of 1970. Population is compact.
- Subdivision - Dresden Acres, 3.5 miles NW
  Approximately 200 people as of 1975. Population is compact.
- Shady Oaks Trailer Park - 5.1 miles NNE
  Approximately 400 people (150 trailers) as of 1975. Population is compact.
- Goose Lake Subdivision - 3 to 5 miles SW and SSW
  Approximately 1100 people as of 1975. Population is diffuse.
- Feather Woods Subdivision - 1 mile E and ESE
  Approximately 650 people as of 1975. Population is compact.

Other areas and sites involving intermittent and temporary congregations of persons within 5 miles of the Morris Operation are as follows (data as of 1974-1975):

a. Schools - Enrollment[4]

Minooka High School	587
Minooka Junior High School Minooka Grade School	777
Channahon School	772
Illinois Youth Center[5]	30

No access is allowed by Commonwealth Edison to the Dresden cooling lakes for recreational uses. The Illinois Waterway, one of the major inland waterways, is adjacent to the DNPS site. An agreement between GE and Commonwealth Edison provides for access to the Illinois Waterway through the DNPS site so that facilities for boat docking and access roads to the waterway could be developed at some future time if required.

There are two small "finger lakes" about 2-1/2 miles south of the GE tract where homes have been built, while other lakes on which houses are being built are located about 3-1/2 miles southwest. Some of these houses are solely for recreational purposes.

3.3 NEARBY INDUSTRIAL, TRANSPORTATION AND MILITARY FACILITIES

None of the industrial, military, or transportation activities in the area present a credible hazard to the fuel storage facility nor to the transport of irradiated nuclear fuel. Fuel in storage is located well below ground level in a steel-lined, reinforced concrete water basin, and held in stainless steel baskets latched in a supporting grid. Explosions or fires at "nearby" industrial facilities would be much too far away to have any influence on fuel in storage. Even the explosion of a passing tank truck would not affect the safety of stored fuel. Likewise, the structural characteristics of fuel casks and the nature of nearby activities result in minimum hazard to transportation of spent fuel.[4a] N

3.3.1 Nearby Nuclear Facilities

The location and identification of nuclear facilities within 50 miles of the Morris Operation site are shown in Table 3-2. The closest facilities are the DNPS Units 1, 2 and 3, located about 0.7 mile north of the Morris Operation stack. The combined radiological impacts from Morris Operation and the DNPS are within the requirements of 10 CFR 72.67 as indicated by calculations and environmental monitoring results. The calculated dose commitments from Morris Operation are a small fraction of the dose commitments from DNPS, even considering the design basis accidents evaluated in Chapter 8.

3.3.2 Industrial and Military

The GE tract is near several industrial sites in an industrial area along the Illinois River (Figures 1-1 and 1-2). Most of the development is north of the Illinois River at a distance of over 1 mile from the Morris Operation. The rapid development of the last few years is slowing as most of the suitable industrial sites are already occupied and the Goose Lake Prairie State Park now occupies most of the remaining land south of the river.

Table 3-2

NUCLEAR REACTORS[a] WITHIN 50 MILES OF MORRIS OPERATION

Type	Capacity (MWe)	On Line	Latitude	Longitude	Airline Miles to Morris Operation	Name
BWR	200	1960	41°22'	88°14'	1	Dresden 1
BWR	809	1970	41°22'	88°14'	1	Dresden 2
BWR	809	1971	41°22'	88°14'	1	Dresden 3
BWR	1,078	1978	41°21'	88°36'	20	LaSalle 1[b]
BWR	1,078	1980	41°21'	88°36'	20	LaSalle 2[b]
BWR	1,100	1981	41°16'	88°13'	10	Braidwood 1[b]
BWR	1,100	1982	41°16'	88°13'	10	Braidwood 2[b]

In addition to DNPS immediately to the north and the A. P. Green Refractory Company's clay products plant immediately to the south, other industry in a 6-mile radius of the Morris Operation is listed in Table 3-3.

3.3.3 Transportation

One of the principal factors in the original selection of the Morris site was the ready availability of excellent rail and highway access to all parts of the United States and water transportation that could be developed if required in the future.

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[a]All plants owned by Commonw lth Edison.

[b]Under construction.

Highway access to the tract is via a paved county road, known as Dresden Road, extending south from the DNPS site parallel to the Morris tract and intersecting Pine Bluff Road (Figure 1-2). Pine Bluff Road (named Lorenzo Road in Will County) runs in an east-west direction approximately 1 mile south of the GE tract boundary and provides access to Interstate 55 approximately 4 miles east of the site, and Illinois 47 to the west. Interstate 55/U.S. 66 is a limited-access highway between Chicago and St. Louis. Another limited-access highway, Interstate 80, which traverses the State from east to west, is approximately 5 miles north of the GE lands and is accessible either from Interstate 55 or from a State highway, Illinois 47, at a point approximately 2 miles north.

Table 3-3

INDUSTRIAL, TRANSPORTATION, AND MILITARY ACTIVITIES[a]

(6-mile radius)

Installation	Function	Proximity
Reichold Chemical Plant	Chemical plant	1.5 mi NW
Amax	Aluminum mill products	3 mi NW
Northern Illinois Gas Co.	Natural gas mfg	3 mi NW
Rexene Polymers Co.	Chemical plant	4 mi ENE
Mobil Oil Co.	Oil refinery	4 mi ENE
Collins Power Station	Electricity generation (fossil-fired)	4 mi WSW
ARMAK Co.	Mfg of fatty acid derivatives	4 mi WNW
Northern Petro Chemical Co.	Mfg of polyethylene and ethylene glycol	4 mi NW
Joliet Arsenal	Munitions plant (inactive)	6 mi ENE
Demert and Dougherty	Filling aerosol cans	6 mi S

[a]See Table 3-2 for nearby nuclear power stations.

The seismic risk map (Figure 3-12) of the conterminous United States was prepared by a group of research geophysicists headed by Dr. S. F. Algermissen of the United States Coast and Geodetic Survey and issued in January 1969. The site area lies well within zone 1 where minor earthquake damage can be expected. According to this map, zone 1 corresponds to intensities V and VI on the modified Mercalli scale.

Modified Mercalli intensity VI seems to be the greatest intensity experienced historically in the site area. This intensity was the result of the 1912 earthquake which was centered approximately 15 miles from the site, and may also have been the result of the 1811-1812 New Madrid, Missouri, earthquakes. Intensity VI, with its corresponding acceleration (according to Newmann's curve) of 0.01g may be reasonably expected to occur again within the lifetime of the facility.

3.7.5 Earthquake Design Basis

The design earthquake basis for the basin was a horizontal ground motion of 0.1g. The basin structure and fuel storage system are designed to withstand the design basis earthquake without damage to structures or components essential to the integrity of stored fuel or fuel being moved in the normal process of storing or shipping fuel. The design earthquake is defined as a seismic event that has a reasonable probability of occurrence during the life of the facility, based on studies of seismic history and geology. A maximum earthquake with ground accelerations of 0.2g is also considered in the seismic analyses. The design bases are discussed in Chapter 4.

3.8 TRANSPORTATION OF IRRADIATED FUEL

Irradiated fuel is received by truck or rail at Morris Operation in casks certified to comply with applicable U.S. Nuclear Regulatory Commission regulations.[37] Typical shipping casks are discussed in Section 1.3.

As of the end of 1980, 510 shipments of fuel had been completed, moving about 316 tonnes - heavy metal in 1220 fuel bundles. Shipments to Morris Operation have been completed without highway or rail accidents. Rail shipments were all from DNPS.

The environmental impact of these transportation operations has been negligible, thus supporting the conclusions of various studies and analyses.[38,39]

Projected transportation activity required to store a full complement of fuel - about 700 TeU, total, or about 1300 additional bundles assuming a 60:40 ratio between PWR and BWR fuel - is shown below. This estimate is based on the assumption that all shipments are by truck; shipments by rail would result in even lower environmental impacts.

a. 1000 shipments (varies with PWR/BWR mix)

b. 1500-mile trip (one way)

c. Elapsed time per trip - about 45 hours

d. Turnaround per cask - 18 to 20 hours

e. Maximum shipments per year - 300 to 400

The nonradiological and radiological impacts of transportation are analyzed in the literature.[40] Environmental impact assessments of the Morris Operation facility by the Nuclear Regulatory Commission staff have also found no significant environmental impact from spent fuel transport.[41,42]

3.9 SUMMARY OF CONDITIONS AFFECTING FACILITY OPERATING REQUIREMENTS

E

Irradiated fuel storage operations have been underway at the Morris Operation since January 1972 when the first shipment of irradiated fuel was received under Materials License No. SNM-1265, Docket 70-1308, issued December 1971. Throughout this period of operating experience and during the on-going environmental studies and monitoring programs, no condition has been found to detract from the desirability of this site as a fuel storage location.

3.9.1 Significant Factors E

The following factors were significant in selecting the design bases for the existing Morris Operation facility.

3.9.1.1 Meteorology E

The climate at the site offers no severe extremes except tornadoes. Analysis of tornado activity, including official and unofficial records, indicates a frequency close to the average for all states east of the Rocky Mountains.

The topography of the site introduces little perturbation in diffusion calculations; only the 630-ft elevation of the Dresden Heights, about 1-1/2 miles north of the Morris Operation stack is of concern in selecting stack design bases. Local fog conditions are involved in dispersion considerations. Diffusion climatology and characteristics have been firmly established and confirmed by the meteorological measurement program.

3.9.1.2 Hydrology E

Surface hydrology of the site offers no characteristics significant to the selection of design bases (except for the usual consideration of natural drainage pathways, etc.). Subsurface hydrology shows excellent separation between the upper strata and the deeper aquifers that provide the water supply - almost exclusively - for municipal and industrial use.

The intrusion of groundwater is of concern during construction, based on experience during MFRP work. These flows indicate a complex near-surface groundwater system that becomes significant because of localized fracturing induced during construction.

3.9.1.3 Geology and Seismology E

The site is located in a stable area which has experienced historically low seismic activity. The existing construction is founded on bedrock of Ordovician (Paleozoic) age. Design of the facility and its fuel storage equipment for horizontal ground motion of 0.10g is considered conservative.

3.10 REFERENCES

1. See Appendix A.1 for document list.

1a. State of Illinois, Bureau of the Budget, Illinois Population Projections (Revised 1977), Springfield, September 1977.

1b. State of Indiana, State Board of Health, Indiana County Population Projections, Indianapolis, 1978. E

1c. Northeastern Illinois Planning Commission, Regional Data Report, Chicago, June 1978.

2. The 5% growth in the 0-5 mile area was developed from the assumption that farmland will not experience growth (urbanization) except in a few selected areas. This growth was estimated and the overall area growth integrated. Most people working in local industries live in the Western Joliet and Morris areas; there has been little growth in smaller communities.

2a. Beyond the 5-mile area, population data totals on charts have been rounded off to the nearest 100.

3. The USNRC staff reported an adjusted estimated 1980 population for the area within the 50-mile radius of about 9,169,337 (Environmental Impact Appraisal, Docket 70-1308, NR-FM-002).

3a. During research for these data, differences were noted between (for example) the Northeastern Illinois Planning Commission data and Federal census figures. In general, however, the data appear mutually supportive, particularly at the county levels.

4. Within 5 miles of the site the total school population is 800, but at slightly more than 5 miles it increases to about 2,140; the larger number is shown.

4a. See Reference 39: WASH-1238, Section II, E.

5. Correctional institution (juvenile) at Channahon, 3 miles WNW.

6. **Climatography of the United States**, No. 60-11, revised and reprinted June 1969.

7. H. E. Landsberg, "Climates of North America," **World Survey of Climatology**, Vol. 11, edited by Bryson, et al., Elsevier Scientific Publication Co. (1974).

8. S. S. Visher, **Climatic Atlas of the United States**, Harvard University Press, Cambridge (1966).

9. U.S. Department of Commerce, **Climatography of the United States No. 86-9**, "Decennial Census of United States Climate," for Illinois, Washington, D.C. (1964).

10. "Final Environmental Statement related to operation of the Midwest Fuel Recovery Plant by the General Electric Co.," Doc. 50-268, USAEC (December 1972).

11. Fluor Cooling Products Company, "Evaluated Weather Data for Cooling Equipment Design," Addendum No. 1, Winter and Summer Data, Santa Rosa, CA (1964).

12. D. W. Phillips, et al., "The Climate of the Great Lakes Basin," Climatological Studies Number 20, Environment Canada, Toronto (1972).

13. J. L. Vogel, et al., "Fog Effects Resulting from Power Plant Cooling Lakes," Journal of Applied Meteorology, Vol. 14 (August 1975).

14. **Final Environmental Statement related to the operation of Dresden Nuclear Power Station Units 2 and 3** by the Commonwealth Edison Co., Docket No. 50-237 and 50-249, AEC (November 1973).

15. **Applicants Environmental Statement, Dresden Nuclear Power Station Unit 3**, Commonwealth Edison Co., Docket No. 50-249 (July 1970).

16. Thom suggests an annual extreme-mile (fastest mile) wind speed of 82 ph for 30 ft above ground and for a 100-yr mean recurrence interval. Thom, H.C.S., "New Distributions of Extreme Winds in the United States," Journal of the Structural Division, Proc. ASCE, Vol. 94 No. St. 7 (1968) **Applicants Environmental Report, Midwest Fuel Recovery Plant Morris, Illinois**, June 1971.

17. Murry and Trettel, Inc. Consulting Meteorologists, Chicago, IL. Letter, Literski (M&T) to Eger (GE), September 23, 1976.

18. An increase of 5% for a reprocessing facility; less for a storage facility.

19. From Braidwood Station Environmental Report, Commonwealth Edison Co., Chicago, IL. Year of record: July 1971 - June 1972.

20. The application of these methods to the Dresden reactors and the description of the techniques used there can be found in Appendix A of the Final Safety Analysis Report for Dresden 2 and 3, Docket 50-237.

21. The description of the first year's data taken at the site can be found in Amendment No. 13, Question B-11, to the Dresden Unit No. 2 Final Safety Analysis Report, Docket 50-237.

22. E. C. Watson and C. C. G mertsfelder, "Environmental Radioactive Contamination as a Factor in Nuclear Plant Siting Criteria," February 14, 1963, HW-SA-2809.

23. Dames & Moore report dated January, 1971 (Appendix B).

24. Dames & Moore, 1550 Northwest Highway, Park Ridge, Illinois 60068.

25. Payne, 1940, page 7; and Eardley, 1962, page 45.

26. Willman and Templeton, 1951, page 123.

27. Bristol and Buschbach, 1973, Plate 1.

28. Willman and Templeton, 1952; also Bristol and Buschbach, 1971, Figure 3.

29. Ekblau, 1956; Dames & Moore, 1965.

30. Kempton, 1975.

31. See Table 3-13 for studies referenced in this section.

32. Payne, 1940; Willman and Templeton, 1951.

33. Willman and Templeton, 1951.

34. Dames & Moore, report dated December, 1967 (Appendix B).

35. J. A. Udden prepared a report describing observations of this earthquake. He presents an isoseismal map for this earthquake and, according to his map, the site was in the area which experienced Rossi-Forel intensity VI (about V-VI on the modified Mercalli scale).

36. This intensity is based on an isoseismal map prepared by O. W. Nuttli and presented in the Bull. Seis. Soc. Am., Vol. 63, No. 1, 1973.

37. K. Eger, Operating Experience Report - Irradiated Fuel Storage at Morris Operation - January 1972 to December 1979, General Electric Company, September 1980 (NEDO-20969B).

38. 10 CFR 51, Summary Table S-4, "Environmental Impact of Transportation of Fuel and Waste To and From One Light-Water Cooled Nuclear Power Reactor," U.S. Nuclear Regulatory Commission, especially Note 4, "Although the environmental risk of radiological effects stemming from transportation accidents is curently incapable of being numerically quantified, the risk remains small regardless of whether it is being applied to a single reactor or a multireactor site."

39. Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Power Plants, U.S. Atomic Energy Commission, December 1972 (WASH-1238); and U.S. Nuclear Regulatory Commission, April 1975 (Supplement 1, NUREG-75/038).

40. Final Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes, U.S. Nuclear Regulatory Commission, December 1977 (NUREG-0170).

41. Environmental Impact Appraisal by the Division of Fuel Cycle and Material Safety Related to License Amendment for Materials License Amendment for Materials License No. SNM-1265 Morris Operation Facility - Grundy County, Illinois for General Electric Company - Docket No. 70-1308, Nuclear Regulatory Commission, December 1975 (NR-FM-002), especially Section 6.

42. Environmental Impact Appraisal related to the Renewal of Materials License No. SNM-1265 for the Receipt, Storage and Transfer of Spent Fuel at Morris Operation - General Electric Company - Docket No. 70-1308, U.S. Nuclear Regulatory Commission, June 1980, especially Sections 7.5 and 8.2.

4. DESIGN CRITERIA AND COMPLIANCE

4.1 INTRODUCTION

A general description of the Morris Operation and a summary of its operational functions are contained in Chapter 1.* The original design criteria for Morris Operation facilities were developed and established as part of the design for a fuel reprocessing plant - the Midwest Fuel Recovery Plant. The criteria herein are those applicable to the use of those facilities for spent fuel storage.

4.1.1 Material To Be Stored

The Morris Operation is licensed to store irradiated light water reactor fuel from nuclear power stations. The design basis fuel is UO_2 fuel with an initial enrichment of 5% U-235 or less, with stainless steel, zirconium, or Zircaloy cladding, in a "bundle of rods" geometry. The design basis fuel may have been irradiated at specific power levels of up to 40 kW/kgU, with exposure to 44,000 MWd/TeU (batch average), and must have cooled for at least 1 year after reactor shutdown before entering storage at Morris Operation. The accident analyses in this report were originally prepared for fuel cooled 90 and 160 days, and these analyses have not been changed. The calculated fission product activity contents of fuel irradiated at 40 kW/kgU, exposed at 44,000 MWd/TeU, and cooled 90 days and 160 days are presented in Table 4-1.

Fuel to be received and stored typically will have exposures of 33,000 MWd/TeU or less, with cooling periods much longer than 1 year. As of the first of February 1977, the average exposure of BWR fuel in storage was about 3,100 MWd/TeU and that of PWR fuel about 23,700 MWd/TeU. The average exposure was less than 15,000 MWd/TeU, far less than 44,000 MWd/TeU. As of the first of February 1977, the average cooling time of BWR fuel in storage was about 61 months and that of PWR was about 52 months. Overall, the average cooling time was about 56 months (4.7 yr).[1]

Realistic exposures and cooling times based on the fuel in storage have been used in some analyses, as appropriate. Table 4-2 contains a list of analyses and fuel exposures and cooling times on which each is based.

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*See Section 4.7 for references. E

including the forces that might be imposed by natural phenomena such as earthquakes, tornadoes, and flooding conditions.

Standards for assuring that systems, structures and equipment will perform safety functions for their intended service life with a low probability of failure have been based on upper limit temperatures, corrosion rates and other stress conditions derived from comprehensive analyses, including consideration of:

a. accessibility for in-service surveillance, monitoring and repair (or replacement);

b. potential for short-term exposure to abnormal operating or accident conditions; and

c. consequences of component failure; no single component failure or multiple failures caused by a single initiating event shall result in significant radiation exposure to the public.

d. accessibility for emergency services, including ambulance attendants, fire and police services, and other emergency activity.

4.2.1 Wind and Tornado Loadings

4.2.1.1 Criteria

Plant structures and components essential for safety shall be designed to withstand the effects of short-term wind velocities of 300 mph with pressure differentials of up to 3 psi without damage to fuel in storage to an extent endangering public health and safety. The site is located in USNRC Tornado Intensity Region I, as defined in Regulatory Guide 1.76.

4.2.1.2 Compliance

The fuel basin structure (enclosure) was analyzed with wind loads applied as uniform static loads on the vertical or horizontal projected areas of the walls and roof. Only dead load was considered as resisting uplift. Horizontal wind loads are distributed by the walls to the floor and roof systems, which transfer loads to the lateral load-carrying elements of the structures.

Plant structures and components were designed to withstand sustained wind velocities of 110 mph without loss of functions. At higher velocities, the enclosure covering may fail or blow away.

These analyses included consideration of a drop in atmospheric pressure of 3 psi in 3 seconds. This condition would damage the basin enclosure, probably damage or even remove much of the roof and wall sheathing from the basin enclosure, but would cause no off-site radiological effect.

4.2.2 Tornado Missile Protection

4.2.2.1 Criteria

Plant structures and components essential for safety shall be designed to withstand the effects of windborne missiles without damage to fuel in storage to an extent endangering public health and safety.

4.2.2.2 Compliance

The following summary of analyses indicate that the public health and safety would not be endangered as a result of tornado missiles impacting the fuel storage structures or components.

Only those windborne objects which could have a significant downward velocity on entry into the water-filled basin have the potential for causing damage to basin contents. Such objects must have been at a significant elevation above ground level, prior to entry, to develop the required vertical velocity component to result in damage. Potential missiles can be classified in regard to their relative elevation, as follows:

1. Objects in the immediate area which, when the tornado strikes, are at elevations above the level of the basin surface (operating equipment and auxiliaries, components of the enclosing structure, etc.).

4.2.7 Basic Water Cooling

4.2.7.1 Criteria

Means shall be provided to maintain basin water temperature less than 200°F (93.3°C).

4.2.7.2 Compliance

Basin water is cooled by a system described in Section 5.5.3.

4.3 SAFETY PROTECTION SYSTEMS

4.3.1 General

There are no site-related factors that are sufficiently unusual to require protection systems or special design considerations beyond those normally required for a facility of this type. Operations shall take into account the proximity of DNPS to assure that the cumulative effects of these operations do not constitute an unreasonable risk to public health and safety.

4.3.2 Protection by Multiple Confinement Barriers and Systems

The total confinement system consists of one or more individual confinement barriers and systems that successively minimize the potential for release of radioactive material to the environment. These features also protect the fuel in storage by protecting the fuel from damage and providing a favorable environment. E

4.3.2.1 Criteria

Equipment and systems containing radioactive or potentially contaminated materials shall provide a continuous boundary against escape of such material and be designed to have a low probability of gross failure or significant uncontrolled leakage during the design lifetime.

Secondary confinement barriers such as vaults, ventilation system, etc., shall be designed and constructed to contain the results of primary system failure, under conditions that may have initiated such failure, without loss of required integrity and to continue operation for the maximum anticipated period of stress.

Storage vaults and basins shall be designed and constructed for a low probability of gross failure or uncontrolled leakage, with means provided to monitor leakage and preclude transport of radioactive materials to underlying aquifers. For lined structures containing radioactive or potentially contaminated liquids, leak detection and empty-out means shall be provided between the liner and the structure so that release of radioactivity to the environs can be avoided by pumping leakage back into storage, effecting repairs where leaks can be located and are accessible, or installing additional facilities in the event repair is not feasible. Water systems shall be designed to prevent accidental removal of water from the basins by any means to less than a safe level. Basin water level shall be indicated and alarmed (low water alarm) in the control room.

4.3.2.2 Compliance

All criteria described above have been satisfied; refer to Chapter 5.

4.3.3 Building Ventilation

4.3.3.1 Criteria

Radioactive material in the building ventilation exhaust shall be reduced to levels that are as low as reasonably achievable before being released to the environs. Special venting lines and special enclosures shall be employed when necessary, such as during cask venting operations, to confine airborne radioactive particulate materials.

4.3.3.2 Compliance

The principal methods used to meet these criteria include the following:

a. Generation: Airborne radioactive material may originate from cask decontamination and venting operations; low activity solid waste compactor operation; preparation of contaminated equipment for disposal; and from operation of the low-activity liquid waste treatment systems. Other than these principal sources and the minor leakage from fuel in storage, no other significant source exists.[8a] These activities can be suspended on short notice whenever higher than prescribed levels of radioactive materials are detected in the ventilation air exhaust stream. The waste evaporator system is designed to limit radioactive material in its effluent.

b. Confinement: The building ventilation system utilizes pressure differentials to maintain air flow paths to exhaust all ventilation air through the filter system and the discharge stack. Special venting systems and special enclosures may be employed to confine airborne particulates from cask venting, decontamination activities, or similar sources to the filter - discharge stack system. The ventilation system is designed for all credible normal or anticipated off-normal conditions.

c. **Release:** The building ventilation system is designed to collect all ventilation air and exhaust it through a final sand filter of demonstrated capability for removing particulate matter, and a 300-foot-high discharge stack.

4.3.4 Protection by Equipment and Instrumentation

4.3.4.1 Criteria

Equipment and instrumentation shall be provided to monitor radioactivity and other parameters of operation, and to perform related control functions in accordance with the following:

a. Equipment and systems shall be set and adjusted to alarm and/or initiate action such that specified limits are not exceeded as a result of normal or abnormal occurrences.

b. Redundancy and independence shall be provided to a degree sufficient to assure that no single failure of an instrument or equipment item can result in loss of protection functions.

c. Equipment shall be designed to permit inspection, testing, and maintenance.

d. The control room shall permit occupancy and allow monitoring of important systems and functions during normal operations and under anticipated off-normal or accident conditions.

4.3.4.2 Equipment Compliance

Equipment is designed to permit inspection, maintenance, and periodic testing of functions to specified parameters. Temporary removal of single items of equipment from service has no safety significance.

4.3.4.3 Instrumentation Compliance

Instrumentation is provided to assure proper operation or notification of the failure of systems. Instrumentation is designed or specified to standards of known reliability. To assure instrument reliability, periodic testing and calibration checking are performed in accordance with Operations Specification 10.4.4.1.

Alarms indicating a set point has been exceeded are annunciated in the control room, and where there may be an immediate effect on personnel such as radiation exposure they are alarmed locally as well.

4.3.4.4 Control Room

The control room is described in Section 5.5.5.4.

4.3.5 Nuclear Criticality Safety

4.3.5.1 Criteria

Every reasonable precaution shall be taken to preclude a criticality within the Morris Operation. Both design and administrative controls shall be utilized.

4.3.5.2 Design Control Compliance

The design of the spent fuel storage system includes the following controls to preclude a criticality incident:

a. Initial analyses were made in sufficient detail to demonstrate that the criticality control concepts considered (e.g., favorable geometry) were feasible under all credible conditions. Additional detailed nuclear criticality safety evaluations of the final design were made by qualified experts in the field to assure that final dimensions and other factors affecting safety margins were adequate to prevent a criticality incident. The additional detailed analyses required to confirm the final design are included in this document in Appendices A.10 and B.5. E

b. In the derivation of subcritical limits, the K_{eff} calculated for the most reactive credible conditions was specified as 0.95 at a 95 percent confidence level.[9]

4.3.5.3 Administrative Control Compliance

The operation of the spent fuel storage facility includes the following administrative controls to preclude a criticality incident.

a. Safety evaluation, review and approval of operating procedures related to design control parameters.

b. Verification of nuclear fuel parameters for fuel scheduled to be stored at Morris Operation.

c. Verification of fuel identity for fuel received at Morris Operation for storage.

d. Maintenance of fuel storage location records.

e. Specific fuel and cask handling procedures.

f. Personnel training.

Independent review and audit procedures are utilized to determine the adequacy of nuclear safety control provisions and the effectiveness of implementing activities.

4.3.6 Radiological Protection

4.3.6.1 Criteria

Radiation and radioactive contamination conditions at the Morris Operation shall be controlled to provide protection of personnel health and safety at all times. Emphasis shall be placed on minimizing both individual exposures and total exposure (man-Rem) to as low as reasonably achievable (ALARA).

During normal operations, including anticipated occurrences, the annual dose equivalent to any person located beyond the controlled area boundary shall not exceed 25 mRem to the whole body, 75 mRem to the thyroid and 25 mRem to any other organ as a result of either planned discharges or direct radiation from the facility.

Any person located at or beyond the nearest boundary of the controlled area shall not receive a dose greater than 5 Rem to the whole body or any organ from a design basis accident.

4.3.6.2 Compliance

Criteria are satisfied through the following design features and operational practices:

a. Confining radioactive materials to prescribed locations.

b. Clearly defining areas in which significant radiation or contamination levels exist.

c. Applying special provisions and appropriate procedures to assure personnel safety.

d. Applying rigorous surveillance, housekeeping, and clean-up practices.

e. Providing comprehensive personnel training in radiological safety.

Dosimeters are provided for assuring accurate detection and assessment of personnel exposure to ionizing radiation, in accordance with applicable procedures. Thermoluminescent devices (TLD's) are positioned throughout the site to assess trends in background dose rates so that increases may be detected and corrective plans initiated.

4.3.6.2.1 Access Control (Restricted Areas)

Provisions have been established for controlling personnel access to areas in which radioactive material is present and are maintained to keep the potential for contamination spread and exposure to radiation as low as reasonably achievable. This is accomplished by maintaining a series of access control barriers with increasingly restrictive occupancy constraints and access authorization requirements. These access controls were designed as follows:

a. General Electric Tract: Agricultural fencing with appropriate posting encloses the tract. Routine surveillance by operating and security personnel is utilized to assure that unauthorized occupancy for significant periods of time is prevented.

b. Protected Area: An 8-ft-high chain link fence topped with barbed wire surrounds the protected area in which the Morris Operation storage facilities are located. Personnel and vehicle access gates are locked or manned by security personnel at all times. While in the protected area, personnel are required to wear personal identification and dosimeters. All vehicles, materials and equipment are checked into and out of the area following procedures that require potentially contaminated or radioactive items to be monitored and cleared before entry or exit is authorized.

c. Operating Area: Personnel access to the operating areas in which radioactive material is stored is controlled by limiting entrance such that occupancy authorization requirements can be strictly enforced. Access to the various areas is controlled by the structural compartmentalization and by authorization procedures commensurate with the conditions existing in the particular areas. Access to all potentially contaminated areas requiring personnel occupancy is limited to specific routes that have been provided and is in accordance with prescribed procedures, clothing and monitoring requirements, which are varied according to the particular conditions. Exit from the operating areas, except under emergency conditions, is by the same controlled routes, through necessary clothing change stations and monitoring facilities. Routine radiation surveys of the area are performed, and TLD's are posted. Equipment requiring access (e.g., basin coolers) can be decontaminated to permit maintenance.

Materials and equipment required for operation and maintenance will be checked into the areas and will be monitored before leaving the areas in accordance with prescribed control procedures. Access for transfer of such items is limited to specific points which are provided with means for precluding unauthorized usage.

d. Controlled Access Areas: Areas with the potential of high dose rates are locked, with access controlled from the Control Room.

4.3.6.2.2 Shielding

Radiation shielding is provided to restrict personnel exposure to levels that are as low as reasonably achievable.

4.3.6.2.3 Radiation Alarm Systems

Sampling and detection systems are provided that have sufficient sensitivity and scope of coverage to assure that any radiation or contamination condition of potential safety significance is accurately and promptly assessed.

Area radiation monitors meet the following requirements:

a. Monitors will detect gamma radiation within the range of 0.1 to 1000 mR/hr.

b. The high trip alarm is audible locally and also annunciates in the control room.

c. The criticality accident alarm system meets the following requirements:

(1) The system has gamma-sensitive monitors that meet the sensitivity requirements of 10 CFR 70.24(a)(1).

(2) The system produces an audible alarm that is unique and cannot be shut off even if the exposure rate decreases.

(3) Two detectors are provided in the basin.

(4) The system is continuously functional.

(5) Detectors are located in the storage basin area but not underwater.

(6) The upper alarm trip circuits for the system are arranged in parallel so that either alarm will energize all criticality alarms.

(7) The alarm circuit that energizes the criticality horns is designed to stay on once it has been initiated and a manual reset in the control room must be employed to silence the horns.

4.3.6.2.4 **Effluent Monitoring**

Sampling and monitoring systems and associated procedures are provided to measure radionuclides in ventilation effluent and in sample wells. Meteorological data and off-site radioactive materials monitoring are provided by a joint program with DNPS.

4.3.7 Fire and Explosion Protection

4.3.7.1 Criteria

Structures, systems and components directly involved in the storage of fuel shall be protected so that performance of their functions are not impaired when exposed to credible fire and explosion conditions.

4.3.7.2 Compliance

This criterion is met by using noncombustible and heat-resistant materials whenever practical throughout the facility, particularly in locations vital to the functioning of confinement barriers and systems such as the basin areas and the pump room. Fire detection, alarm, and suppression systems are installed in warehouse areas, and certain areas of the main building. Fire extinguishers and other equipment are strategically located throughout the facility. Fire brigade training is furnished to operational personnel. Fire alarms are audible in the control room.

4.3.8 Fuel and Radioactive Waste Handling and Storage

4.3.8.1 Spent Fuel Receiving and Storage Criteria

The cask and fuel handling systems shall provide for the safe, reliable and efficient handling of casks and fuel.

4.3.8.2 Compliance

The cask and fuel handling system is capable of receiving irradiated fuel bundles in shielded casks mounted on trucks or railroad cars. All major equipment such as cranes located above basin areas containing fuel are designed to ensure that components will not fall into the basins. The cask handling system has been designed to preclude a cask from being moved over the fuel storage basins. Means are provided to preclude lifting a fuel bundle or a fuel storage basket to an elevation within a basin such that the shield provided by the basin water is reduced sufficiently to cause excessive exposure to personnel.

Cask drop analyses have determined that energy absorption provisions in the fuel unloading basin are adequate.

Treatment of the storage basin water is adequate to minimize corrosion and prevent undue exposure of personnel.

4.3.8.3 Radioactive Waste Treatment Criteria

Radioactive waste shall be stored on-site in a manner that does not preclude retrieval and transfer off-site. Provisions shall be made for inspection and sampling of the waste material. No liquid radioactive waste shall be discharged from the site. Solid radioactive waste shall be disposed of in accordance with current regulations.

Criteria for storage facilities are given in Section 4.3.2.1.

4.3.8.4 Compliance

Radioactive liquid waste is stored in the low activity waste vault, and periodically reduced in volume by evaporation. The vault can be emptied for retrieval. No radioactive liquid waste is discharged from the site. A solid waste compactor is provided to reduce the volume of solid waste before disposal via a licensed contractor.

4.3.9 Utility Systems

4.3.9.1 Criteria

Utility systems important to safety shall maintain the capability to perform functions important to safety, assuming a single failure.

4.3.9.2 Compliance

See Section 5.7.1.

4.4 CLASSIFICATION OF STRUCTURES, COMPONENTS, AND SYSTEMS

The primary quality objective of General Electric Company is to provide a nuclear fuel storage facility in which structures, systems and components contributing to the prevention (and/or mitigation of consequences) of conditions that could result in undue risk to public health and safety will perform their required functions in a predictable manner during their intended service life.

The degree of reliability that must be provided for various structures, components, and systems is determined primarily by the consequences of failure of that unit. Failure of some structures, systems, or components could - if uncorrected - expose people to ionizing radiation. However, in a passive facility such as a fuel storage basin, repair or replacement of the failed structure, system or component can usually be accomplished long before the consequences could pose undue risk to public or employee health and safety. Failure of still other structures, systems or components could result in an unacceptable loss of operating efficiency, but would pose no significant long or short-range danger to employees or the public.

Quality assurance history and a list of structures, systems, and components important to safety are contained in Chapter 11. The quality assurance plan is contained in Appendix B.8.

4.4.1 Intensity of Natural Phenomena

Provisions have been made to monitor natural phenomena in the region related to Morris Operation. Meteorological data is provided through a joint program with DNPS (Section 3.4.3). Likewise, provisions for seismic measurements are in place at the adjacent DNPS.

4.5 DECOMMISSIONING

4.5.1 Criteria

The Morris Operation facility shall permit effective decontamination and decommissioning to an extent permitting return of the site to unrestricted use.

4.5.2 Compliance

The Morris facility design provides a stainless-steel-lined basin that facilitates cleaning, volume-reducing waste management facilities, and a ventilation sand-filter that will facilitate decontamination and decommissioning operations. Other features - originally designed for a reprocessing facility - facilitate removal of components and contamination control (e.g., the canyon area and LAW evaporator). See Appendix A.7.

4.6 CODES, GUIDES, AND STANDARDS

Codes, guides, and standards applicable to the Morris Operation facility, as noted in this report, are listed in Table 4-4.

Table 4-4

CODES, GUIDES, AND STANDARDS

Item	Section Where Referenced
Uniform Building Code	5.3.1
ASTM C150 (Cement)	5.5.1.2
ASTM A15 (Rebar)	5.5.1.2
ASTM 262 (Stainless Steel Liner)	5.5.1.3
Regulatory Guide 1.76	4.2.1.1
Regulatory Guide 1.60	4.2.4.2
Regulatory Guide 1.61	4.2.4.2
AISC Steel Construction Manual 7th Edition, Appendix A	4.2.4.2.4[a]
ACI 318	4.2.5.2.1
ANSI-N18.2A 1975	4.3.5.2
API-650, Appendix D	5.6.1.2
ASTM A514 (Stainless Steel)	Appendix A.8
ASTM A285 (Stainless Steel)	Appendix A.13
ASTM A240 (Stainless Steel)	Appendix A.13
AWS-ASTM (welding rod)	Appendix A.13

[a]Other references, also.

4.7 REFERENCES

1. K. J. Eger, Operating Experience - Irradiated Fuel Storage - Morris Operation, Morris, Illinois, General Electric Company, May 1978 (NEDO-20969B).

2. Other postulated missiles (pipe, wood planks, steel rod, etc.) have less damage potential than those missiles considered.

3. D. R. Miller and W. A. Williams, Tornado Protection for the Spent Fuel Storage Pool, General Electric Company, November 1968 (APED-5696).

4. F. C. Bates and A. E. Swanson, Tornado Design Considerations for Nuclear Power Plants, Black & Veatch, Engineers.

5. P. L. Doan, Tornados and Tornado Effect Considerations for Nuclear Power Plant Structures Including the Spent Fuel, United Engineers and Constructors.

6. C. V. Moore, Design of Barricades for Hazardous Pressure Systems, Nuclear Engineering and Design, 1967.

7. Design of Structures to Resist the Effects of Atomic Weapons, U. S. Army Corps of Engineers.

8. Ammann and Whitney, Industrial Engineering Study to Establish Safety Design Criteria for Use in Engineering of Explosive Facilities and Operations, April 1953.

8a. See Reference 1: NEDO-20969B, Section 4. E

9. See ANSI N18.2A-1975, Nuclear Safety Criteria for the Design of Stationary Pressurized Water Reactor Plants.

5. FACILITY DESIGN AND DESCRIPTION

5.1 INTRODUCTION

This chapter contains descriptive information on the buildings and other features of the plant involved in the receipt, storage or shipment of irradiated fuel. Facilities associated with fuel reprocessing are discussed only as they relate to irradiated fuel storage activities.

This information has been consolidated from documents previously submitted and part of the public record. The majority of descriptive material is based on the MFRP FSAR (NEDO-10178) with amendments and supplements, and The Safety Evaluation Report For Morris Operation Fuel Storage Expansion (NEDO-20825).

5.2 SUMMARY DESCRIPTION

Reproductions of maps and other illustrations in Chapters 1 and 3 (especially Figures 1-1, 1-2, 3-1, and 3-2) provide geographical information about the Morris Operation tract and show the boundaries of the General Electric property and the general arrangement of buildings and other site features. (See Chapter 1 for use of the terms "tract" and "site.") A more detailed layout and contour map of the site and environs is shown in Figure 5-1.

All radioactive material handling related to the fuel storage activity at Morris Operation is in facilities located within the protected area. There are no radioactive liquid effluents released to the environs and no burial of radioactive or contaminated material on the tract. The only radioactive or contaminated waste materials leaving the site are effluents vented through the ventilation stack or solid low-level radioactive wastes that are shipped off-site. Off-site shipments are made in accordance with applicable United States Nuclear Regulatory Commission (USNRC), United States Department of Transportation (USDOT), and other State and Federal regulations.

5.2.1 Controlled, Restricted, and Protected Areas

The entire tract owned by General Electric (Figure 1-3) is enclosed by agricultural fencing with appropriate posting and forms the controlled area (exclusion area) as described in Chapter 3. In addition, the DNPS site to the north is similarly fenced and posted and those areas to the east of the Morris Operation site occupied by the Dresden cooling lake and its inlet and outlet canals are also controlled as exclusion areas by Commonwealth Edison. The combination of these areas, supplemented by county road right-of-ways, provides adequate distances in all directions from the Morris Operation stack location in which occupancy can be controlled as required to assure protection of public health and safety.

5.2.1.1 Restricted and Protected Areas

The restricted areas, as defined in Section 20.3, 10 CFR Part 20, are within a 15-acre protected area on the northern side of the tract (Figure 5-1), enclosed by a chain link fence topped with multiple strands of barbed wire for a total fence height of 8 ft. The fence is provided with fence lighting and alarm systems for surveillance during hours of darkness and forms a protected area, as defined in Section 73.2(g), 10 CFR Part 73. As shown in Figure 5-1, facilities located within the protected area include the main building, the adjacent ventilation sand filter and equipment building, three underground vaults, the ventilation exhaust stack, the cask service facility, the utilities and service building, the shop warehouse building, the administration building, the general warehouse, and the water system well and elevated water tank. Liquid (nonradioactive) waste discharge lines are routed from the protected area to the sanitary waste treatment lagoons and the industrial waste evaporation pond located south of the protected area. The sanitary waste facilities are fenced, but are not a part of the protected area. The evaporation pond is not fenced.

5.2.1.2 Gates

Entrance to the protected area is from the east-west county road (Collins Road), which bounds the tract on the north side. Entrances for personnel, road and rail traffic are at the northwest corner of the protected area. Entry is controlled from a guard station in the foyer of the administration building which includes the personnel entrance and is adjacent to the road and rail gates. Two unmanned gates are located on the south and northeast sides of the protected area. The south gate is for construction equipment access and

The fuel storage basins and the cask unloading basin are constructed of reinforced concrete poured on bedrock with a welded stainless steel liner. The fuel storage basins are filled with demineralized water to a nominal depth of 28.5 ft. The water level may be lowered no more than 2 ft for maintenance or other purposes but at least 9 ft of water is normally maintained above the top of stored fuel. If the water level falls more than 2 ft, pump suction inlets will be exposed. There is no means of accidentally draining the basin, nor can any of the basin water systems inadvertently drain the basin (i.e., the water systems are designed with nonreversible pumps, no drainage system, etc.). Basin water level is indicated in the control room. The system includes an audible low-water alarm.

The cask handling, cask unloading, and fuel storage areas are constructed of concrete, steel, and other materials that are either nonflammable or fire-retardant. No significant amount of flammable materials is used in these areas, and other potential fire dangers (bottled gases, etc.) are seldom introduced, and then only under stringent administrative controls. No fire detection or automatic fire suppression systems are required in these areas, or in the basin pump room and its extension. Fire extinguishers are strategically located, and operation personnel are assigned and trained as a fire brigade. Further protection is provided by surveillance patrols.

Reinforced concrete in the basin walls and floors has been estimated to have a useful life of more than 100 years, and the stainless steel liner can be expected to have a useful life of more than 100 years because of the nonagressive service environment.

5.5.1.1 **Foundation and Excavation**

The basins are founded on shale bedrock (Figure 5-11). Samples of the shale have been tested at ultimate compressive strengths ranging from 6000 to 11,000 psi. Appendix B contains a site survey and foundation report prepared for MFRP construction.[13] The excavation was overexcavated and backfilled to the south of Basin 2 to facilitate expansion of basin storage capacity at some later date. All loose and disturbed rock was removed prior to concrete construction. Backfill consisted of controlled and compacted granular soils. Concrete mud mats were poured to fill any area excavated more than 4 inches deeper than required (except for the south wall of Basin 2). The basin wall structure is designed to resist pressures from backfill and soil water where overexcavations were made (south of fuel basin and waste vaults, Figure 5-12).

5.5.1.2 Concrete Structure

The floors of the storage basins were poured on bedrock and are at least 3 ft 10 in. thick, but are thicker in some areas because of the +0, -4 in. tolerance in excavation requirements. The basin floors are designed for live loads in excess of 1000 lb/ft^2. Basin walls extend 3.5 ft above grade.

Materials used for concrete construction of the basins are typical for other concrete construction on the Morris Operation site. Materials used for reinforced concrete structures were

- cement conforming to ASTM C150 typ 2;
- washed sand;
- washed and graded aggregate; and
- reinforcing steel per ASTM A15, intermediate grade.

Concrete pours had slump tests and laboratory samples taken, usually at the discharge from the truck, but at times at the point of placement - particularly on canyon containment walls. Concrete samples were taken for every pour of 100 yards or less, whenever a pour composition changed for any reason, and one per 100 yards for pours greater than 100 yards. A full-time concrete inspection program was in effect during construction.

Reinforcing steel used in the basins is intermediate strength with minimum yield strength of 40,000 psi. Structural welds that carry loads from one element or reinforcing bar to another were not used. Where required, loads were transferred from bar to bar by conventional reinforcement bar laps secured in assemblies by steel tie wires. In special cases, U-bolts were used. The only welding permitted was tack-welding the reinforcing steel to brace assemblies away from the forms or to secure imbedded items in position during the concrete pour. In most cases, assembly bracing or imbed securing was done by the use of additional reinforcing steel or structural steel tack welded to the reinforcing steel assembly. Imbeds were either welded or clamped to this additional steel. Tack welds were made no larger than necessary to produce sound, crack-free welds.

5.5.1.3 Basin Liner

The unloading and storage basin complex is completely lined with 304L stainless steel sheets placed flush against the concrete walls and floors and welded to a gridwork of stainless steel back-up members embedded in the concrete (Figure 5-13). For the unloading pit floor area, the liner is 1/4-in. thick and is placed over a 1-3/4-in. thick steel plate provided for distributing impact loads over the underlying concrete structure. Additional energy absorbing means as may be required by cask drop accident considerations for receipt of larger-sized casks will be installed.

The unloading pit shelf liner, also 1/4-in. thick, is placed directly on the concrete structure with an energy absorbing assembly placed on top of the liner (seen in Figure 1-13).

For the remainder of the storage basin complex, the floor liner is 3/16 in. thick. The walls of the unloading pit, including the shelf area, and of the transfer tunnel are lined with 11 gauge sheet. For the fuel storage basin walls, the liner is 11 gauge sheet from floor level to approximately 16 ft up the wall and is 16 gauge sheet from there to the top of the basin.

The large liner sheets (generally on the order of 6 x 16 ft) were welded continuously along each edge to the gridwork of back-up bars and also were slot welded to embedded plates at intermediate locations so that the liner is held against the concrete wall to reduce the potential for puncture damage. To faciliate fit-up and to assure high integrity, liner sheets were welded to embedded stainless steel angles at wall-to-wall and floor-to-wall joints. Also, the liner terminates on a stainless steel angle at the top of the basin. Specifications for liner installation include approved joint designs, welding procedures and welder qualification requirements. All welds were visually inspected and vacuum box tested to assure leaktightness.[14] Final verification of liner integrity was provided during basin filling.

Through May 1976, the natural heat-dissipating capacity of the atmosphere and pool structure adequately maintained the basin water temperatures at less than 44°C (111.2°F).[2] Decay heat generated by fuel in the basin is removed primarily by evaporation, with the remainder conducted through the basin walls.

5.5.3.2 Safety Evaluation

Failure of the basin cooling system is not critical to the safety of the fuel storage system. The cooling system has three independent units. Each of the two larger units has adequate capacity to dissipate the total expected heat load (6.5×10^6 Btu/hr). In the event of failure of the operational unit, the basin water could be continuously cooled by the other units while the system is being repaired.

In the event that both of the larger heat exchanger units should fail, or it was decided not to activate a carbon-steel unit, there is enough time to supply make-up water to the basin while the cooling system is repaired or replaced. If heat exchanger units were inoperative and the storage basins were full of fuel, the temperature of the basin water would slowly rise (<2°F/hr) and approach boiling in no less than 3 days and possibly longer, as determined by natural conduction and evaporation rates within the building. (As of January 1979, water temperature had always been less than 120°F.) Meanwhile, work to repair or replace the cooling system would be initiated. In addition, preparations to add make-up water to the basin would be made if that should be deemed necessary. If the superstructure covering were removed or blown away, water temperature would stabilize at about 183°F (84°C) because of increased evaporation rate from the open pool.

Potential leaks in the cooling system that could occur as a result of an accident have been analyzed and the results given in Chapter 8. It was concluded that the consequence of a leak in the system is insignificant.[19] The coolers are periodically inspected for leaks (Table 10-2). Accumulation of radioactive contaminants in the cooling system components is monitored, and the system decontaminated when required (Section 7.3.2.3).

5.5.5.4 Control Room

The central control room is located in the south gallery area intermediate level (65-ft floor elevation). The room is about 75 x 21 ft in plan, with direct stairway access to the building lobby and secondary access to the unused computer room. Principal items of control room equipment include the main process control panel across one side of the room, a control console, and various monitoring equipment. Fuel storage functions monitored in the control room are listed in Table 5-2. Although some functions are normally controlled only from the control room (e.g., basin cooler pump and fan controls and well-water pump control), the noncritical nature of all control systems permits establishing local control in case the control room becomes disabled. The control room is continuously manned, and its location in the main building permits its continued occupancy during all operations, including emergency conditions.

5.5.5.5 Laboratory Area

The intermediate level of the north gallery area houses the laboratory facilities required for fuel storage operation. Personnel access is from the corridor which spans the east end of the main building at 70-ft reference elevation. Equipment is arranged in individual areas as described below:

a. Specialized counting equipment is housed in a 130 ft^2 room located against the canyon wall. The counting room is provided with heavy concrete shielding walls and a labyrinth shielded entry door opening to the accessway described above.

b. The 630 ft^2 laboratory houses a series of fume hoods which provide for the ventilation and contamination control required for laboratory operations. The exit door leading to the outside stairway is located in the laboratory.

5.5.5.6 Process Steam Generator Room

The process steam generator, condensate cooler, surge tank, water treatment condensate pumps and other equipment are housed in a separate room. There is a service platform at the 60-ft elevation in the room for access to upper equipment levels.

which is connected to a single leak collection sump. The sump consists of a 6-inch-diameter vertical stainless steel pipe embedded in the vault wall which extends from the top of the vault to approximately 1 foot below the vault floor level. It contains a liquid level detector line and necessary piping for a 5-gpm (nominal) jet-out system. Auxiliaries for the level detection and jet-out systems, including a monitoring sample station, are located in the hydraulic equipment room of the main building. Water from the jet-out system is routed back to the cladding vault.

5.7 SUPPORTING FACILITIES

Supporting facilities are described in the following sections. As in previous sections, those functions related exclusively to fuel reprocessing are omitted or discussed only briefly.

5.7.1 Utility and Service Building

On the north side of the main building is located the single-story high-bay utility and service building (Figure 1-4). It is 71 x 50 ft in plan and is of conventional steel frame, insulated siding and roof construction on a grade level concrete foundation. The building is divided into a utility section which houses the plant utility steam system (gas-fired boiler), the demineralized water system; the primary electrical switchgear; and a personnel section containing change room, lunch room and office areas. The arrangement takes into account the normal industrial safety requirements for gas-fired steam generation facilities and for major electrical equipment. Consideration also is given to isolation of normal industrial functions and equipment from all potential sources of radioactive contamination. Utility services are not critical to the safety of fuel storage operations. Interruption of these services for short periods of time, up to several months, would have no off-site impacts as long as basin water level is maintained. Principal features are described in the following paragraphs.

5.7.1.1 Utility Section

The 1700 ft^2 utility section of the building is divided into two rooms, the larger of which houses the water demineralization and utility boiler systems. The demineralizer system begins with a carbon filter to remove organic material from water entering the demineralizers. The demineralizer consists of two parallel banks of series cation-anion units with degasification provisions between beds. It is capable of treating 25 gpm continuously or 50 gpm instantaneously from the plant utility water supply. Pumps required for operation, distribution and regeneration are located nearby and a 1000-gal demineralized water surge tank is mounted on an overhead platform in the room.

The primary unit of the utility steam system is a 25,000-lb/hr package boiler fired by natural gas which is designed to operate at 270 psig, but is normally limited to 125 psig. Auxiliaries include a platform-mounted 1200-gal condensate return tank and a 300-gal deaerator, as well as condensate return and boiler feed pumps, phosphate and hydrazine makeup and injection facilities, etc. All normal safety provisions required to assure safe operation and personnel protection and to meet all requirements of the State of Illinois boiler code are included. A separate 300 ft^2 room in the utility section houses the primary electrical distribution switchgear for the plant. Incoming power from the Commonwealth Edison distribution system is reduced to 480V prior to entry into the utility building.

5.7.1.2 Service Section

The 1800 ft^2 service section of the building contains:

a. Change room facilities with showers, lavatory and storage lockers to accommodate approximately 100 operating people.

b. Lunch room facilities (stove, sink, refrigerator, etc.) for about 25 people.

c. About 450 ft^2 of office space.

7.3.2.1 History of Radioactive Material Concentration

The history of radioactivity in the basin water is shown graphically in Figure 7-1.[2] The general trend is a gradual increase in concentration with increasing fuel loading and time, culminating in plateaus and abrupt decreases. The plateaus may be caused by a reduction in the source, or establishment of a steady-state condition between radioactive material addition and removal. The decreases are due to accelerated removal of radiocesium and radiocobalt by the use of filtration and special ion exchange material in the basin water filter.

7.3.2.2 Contaminants

The principal dissolved radioactive contaminant in the basin water has been fission product cesium with concentrations ranging up to 10^{-2} Ci/ml. A means of cesium removal has been found that makes reduction and control of this contaminant relatively simple. For example, over a 10-week period in 1974, the radiocesium concentration was reduced to one-third of that at the beginning of the period. The basin water inventory was correspondingly reduced from about 29 to 11 Ci. In 1975, during a 4-week period, the radiocesium concentration was reduced by a factor of six and the basin water inventory reduced from 14 to 2.3 Ci. At the end of the latter period, the radiocesium concentration was 0.0009 microcurie per milliliter.[2] The MPC_w for Cs-134 is 3×10^{-4} Ci/ml.

The ability to dramatically reduce the amount of activity in the basin was the result of extensive studies and tests in which an inorganic molecular sieve medium, Zeolon,[3] was used to selectively remove cesium. These tests demonstrated that Zeolon-100 could successfully be added to the Powdex system and remove about two-thirds of the radiocesium per Powdex charge. By routinely using Zeolon and adjusting Powdex replacement frequency, concentrations are effectively controlled.

In addition to radiocesium, the radionuclide contributing most significantly to basin water contamination is cobalt-60. Concentrations of this nuclide in the basin water (typically, 1×10^{-4} Ci/ml) are attributed to corrosion products on the surfaces of the fuel bundle which are released to the water, principally during fuel handling. Normal filtration and ion exchange reduces the cobalt concentrations without special effort.

As the fuel in the basin is increased from about 300 to 750 TeU, the radioactive contaminants, principally radiocesium, will tend to increase. However, with the demonstrated effectiveness of Zeolon in the filter, it is not expected that any increase will tax the existing system.

7.3.2.3 Basin Cooler Decontamination

After a period of operation, depending on the amount of new fuel received, contaminants accumulate on the inner surfaces of the cooler piping, tubes, and headers. In 1978, a chemical decontamination system was introduced which is available to reduce exposure rates under the coolers to acceptable levels.

7.3.3 Airborne Radioactive Material Sources

There are five potential sources that could release radioactive material to ventilation air, where it would be passed through the sand filter and some fraction exhausted to outside air via the stack:

a. effluent from the LAW evaporator;

b. vented gasses from shipping casks;

c. offgas from defective fuel rods in the basin;

d. decontamination activities; and

e. uranium used in MFRP testing.

Although there could be radicative material in the demisted effluent from the evaporator, the occurrence would be rare and the amount would be very small. Vented gasses from casks are exhausted to the LAW vault, and from there to the air tunnel and sand filter.

During over 6 years of fuel storage experience, there has been no evidence of gasses leaking from stored fuel. Incidental airborne contamination from decontamination activities (and fuel storage area.) could occur, although the use of special enclosures ("greenhouses") and other techniques limit such releases

For comparison, the guideline value for compliance to Appendix I of 10 CFR Part 50 is 15 mRem/yr to any organ (Regulatory Guide 1.109).

7.7.2.3 Man-Rem Calculations

Man-Rem calculations were originally done only for the estimated annual thyroid exposure because it was the maximum dose. Averages of thyroid exposures were calculated for concentric circles with radii of multiples of 10 miles. These average values were multiplied by the population within each area which gives an average annual man-thyroid-Rem. The sum of these values for each area out to a radius of 50 miles gives a total of less than four man-thyroid-Rem/yr for the period from 1970 to the year 2000. (An evaluation based on 1-year-old fuel would show an even lower impact.)

For comparison, the population exposure from normal background radiation (taken at 100 mR/yr) in the same area is about 665,000 man-Rem for 1970, to 750,000 man-Rem for the year 2000. Therefore, the radiological impact from the Morris Operation is insignificant.

7.7.3 Liquid Releases

There are no planned releases of liquid wastes from the site. Furthermore, there is no mechanism under normal operating conditions for injection of contaminated water into the waste water treatment system.

7.8 REFERENCES

1. RESSAR-41 Reference Safety Analysis Report, Vol. 6, Westinghouse, December 1973 and Amendments.

2. K. J. Eger, Operating Experience - Irradiated Fuel Storage - Morris Operation, Morris, Illinois, General Electric Company, May 1978 (NEDO-20969B).

2a. State of Illinois, Department of Public Health, Monitoring and Regulation of Nuclear Facilities in Illinois, Springfield, Illinois (1977). The report shows slightly higher levels of radioactivity in the control counties.

3. A proprietary product of the Norton Co.

4. The average of 111 Ci gross beta is based on data from 1974 through mid-1976. This "average" has decreased as 1977-1978 data has been incorporated; see NEDO-20969B, May 1978. The 111 Ci gross beta value is used in the off-site analysis.

5. Based on Morris Operation experience over more than 6 years.

6. T. Rockwell, Reactor Shielding Design Manual, VanNostrand, 1956.

7. R. O. Gumprecht, Mathematical Basis of Computer Code RIBD, June 1968 (DUN 4136).

8. Regulatory Guide 1.109, Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I, March 1976.

8. ACCIDENT SAFETY ANALYSIS

8.1 INTRODUCTION

This chapter contains an analysis of postulated accidents in terms of the cause of such events, the consequences, and the ability of the Morris Operation organization to cope with each situation.*

The function of the Morris Operation is to receive, store and ship irradiated nuclear fuel. A primary requirement of these operations is to protect the public and employees from excessive exposure to ionizing radiation, as determined by the requirements of 10 CFR 72.68. Specifically, any individual at or beyond the controlled area boundary shall not receive a dose greater than 5 Rem to the whole body or any organ from any design basis accident (i.e., those accidents described in this chapter).

8.1.1 Release Pathways

Exposure of the public and employees might result from postulated accidents, by direct radiation from the fuel, by airborne release of radioactive material, or by release of radioactive material to groundwater. These postulated events are discussed in this chapter. None of these potential releases have off-site impacts above the requirements of 10 CFR 72.68.

8.1.1.1 Direct Radiation

Exposure of the public and employees could be postulated to result from direct radiation from the fuel in storage or by release of radioactive material to the environs. Direct radiation from the fuel would occur only if the water level in the storage basin became too low to provide adequate shielding. This would pose a hazard to persons only if they were in relatively close proximity to the basin. Loss of water could result from postulated drainage or evaporation of the basin water, but only when a basin make-up water supply quantity or rate is not sufficient to keep up with the water loss. Sudden draining of water from the basin is not credible.

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*See Section 8.11 for references.

8.1.1.2 Airborne Release

Airborne release of radioactive material could be postulated to result from fuel becoming mechanically damaged sufficiently to release fission gases from within the plenum of fuel rods. Of the gases released, only Kr-85, I-129, and I-131 would be of concern.

No mechanism exists in the fuel storage environment to cause an airborne release of particulate radioactive material in quantities sufficient to cause exposures approaching the limits specified in 10 CFR 72.68. During cask operations in air (e.g., decontamination and venting) particulate releases might occur but in very small quantities, even under the most severe conditions that can be postulated. These quantities would be much too small for an off-site impact. A criticality can be postulated to occur by dropping a basket in such a way that all the fuel falls out of the basket and comes to rest in a critical array, or by fuel baskets being deformed into a critical array by a tornado-generated missile. In reality, however, the above events are only marginally possible and the results of either would be substantially less than the criteria of Part 72.68. Since the fuel assemblies are designed to operate in a light water moderated critical array, such a criticality would not cause vaporization of fuel.

8.1.1.3 Waterborne Release

Release of water containing radioactive materials can be postulated to occur from the LAW vault intrusion water sump if an inner container leak is assumed (Section 5.6.1.2). Water from this sump is normally disposed of in the on-site evaporation pond, so that an off-site release would not be likely.

Water from the storage basins can be postulated to be released due to a leak in the basin structure, permitting water to escape to the surrounding rock. A small amount of water could be released to the ground in the event of a basin water cooler leak. (Such a leak might also cause a small air release of contaminated water vapor.)

8.1.2 Accident Description/Discussion

The following sections contain discussions of various postulated accidents and estimates of the quantity of radioactive material release and projected consequences. A summary of events and the sequence of events involved in postulated direct radiation and radioactive material releases that could result in radiation exposure to the public is shown in Figure 8-1. No combination of normal and credible accident events has been developed that would result in an off-site release or direct radiation that would exceed the regulatory limits for an accident.

Based on several analyses of the accident at Three Mile Island No. 2 (TMI-2), a similar accident at DNPS would have no unmanageable effects on activities at Morris Operation. A mutual aid agreement exists between Morris Operation and DNPS; this agreement and other emergency plan implementation (10 CFR 50, Appendix E), assures that operators at Morris would receive early notification of any significant emergency at DNPS.

A release of noble gases and halogens from DNPS, similar to or greater than at TMI-2, would not affect fuel storage safety at Morris. The location and construction of the Morris Operation control room, the availability of respiratory protective masks and systems, the availability of protective clothing, and other radiological emergency preparations at Morris would minimize the impact on Morris Operation of any release from DNPS.[A1] Even if it should become necessary to temporarily evacuate Morris Operation, the slow loss of basin water by evaporation and the ease of replacement negates possible detrimental effects, and protects the public health and safety.

A simultaneous accident at Morris Operation, such as a fuel drop accident (Section 8.7), would contribute an extremely low additional dose to that from a reactor accident release, less than 0.019 mRem whole body and less than 0.096 mRem thyroid.

8.1.3 Exposure Paths

Of the possible exposure paths, only whole body exposure from external radiation and exposure through inhalation are considered credible at any off-site location. No releases have been postulated that would result in the release of material (such as I-131) to farmlands, cattle feed lots, or other sensitive areas that could result in an ingestion dose that would be more than a small fraction of the regulatory limits.

8.2 LOSS OF FUEL BASIN COOLING

The basin cooling system is not critical to safety. When the cooling system is not in service, the water make-up system can be used to replace water lost by evaporation. Even if the water make-up system is out of service, there is adequate time to repair or replace both cooling and make-up systems or to provide make-up water from alternate on-site or off-site sources. (The water make-up system includes the water well and all equipment related to the normal make-up water supply to the basin.)

A conservative approximation of the time available to provide make-up water if both the cooling system and the water make-up system were out of service has been calculated to be at least 9 days. The calculations were based on a constant heat load of 6.4×10^6 Btu/hr, which is the approximate heat load if both basins were full of fuel like that now in storage and that projected to be received. Other assumptions were as follows:

a. uniform water temperature throughout the basins;

b. ambient air at 70°F and 70% relative humidity in contact with the basin water surface; and

c. basin enclosure removed, with zero air velocity across the basin water surface (worst case).

Under these assumptions, the temperature of the basin water would slowly rise (<2°F/hr) for about 3 days and even slower thereafter (a nonlinear function of time). The maximum temperature would be about 185°F, and more than 39,000 ft^3 of water would have to evaporate before the tops of the fuel bundles would be exposed. This would require more than 9 days.

The probability of excessively high radiation dose rates resulting from loss of fuel basin cooling is clearly quite small in view of the ample time for repairs to be made and for water to be added from any of several sources.

8.3 DRAINAGE OF FUEL BASINS

There are no piping penetrations which, if open, could drain the fuel storage basins and there are no potential paths for siphoning water from the basin. Therefore, to inadvertently drain water from the basin the basin liner must be penetrated. Because the basin structure is below grade and because of the low permeability of the surrounding rock (except for the overburden) and high level of upper strata groundwater, leakage (even if it were undetected) would not uncover the fuel (Appendix A.13).

8.3.1 Basin Liner Rupture Experience

An accident occurred in June 1972 that resulted in the rupture of the basin liner and demonstrated the ability of the Morris Operation to withstand and recover from such an incident. No excessive exposure to ionizing radiation was experienced by site personnel or the general public as a result of the incident and no groundwater contamination above background levels was detected. The impact on the environment was so slight as to be unmeasurable.

Difficulties encountered during handling of an empty IF-100 shipping cask resulted in puncturing the liner of the cask unloading pit. Basin water entered the space between the liner and the structural concrete wall with some seepage into portions of the canyon in the main building. No special action was necessary to assure the safety of site personnel. The timing and sequence of events were as follows.

June 12, 1972 -

1120 hr	Model IF-100 irradiated fuel shipping container Serial No. 470033 was tipped while attempting to disengage a jammed lifting yoke and came to rest against the south wall of the unloading pit.

1130 hr	Alarms in the basin leak detection sump indicated an inflow of water and it was determined that the metal lining of the cask unloading pit wall had been punctured.
Approximately 1200 hr	Programs were started to sample wells adjacent to the main building and plans implemented to remove the cask from the pit and provide a temporary repair.
1230 hr	Region III Compliance Office of the USAEC, State and GE authorities were notified of the incident.

June 13, 1972 -

0700 hr	The cask was removed from the unloading basin.
1430 hr	A temporary patch was positioned over the point of puncture and the outflow of water from the basin to the liner was reduced to a flow that was handled by the jet-out system (approximately 15 gph compared to a normal rate of 4 gph).

June 16, 1972 -

0900 hr	Fabrication of an access chamber for permanent repair of the liner was started.
1200 hr	An additional well was drilled northeast of the building in the direction of the nearest cottages.

June 19, 1972 -

1500 hr	The temporary patch apparently failed and the leakage rate to the leak detection system increased rapidly, exceeding the jet-out capacity of the system.
1900 hr	The temporary patch was successfully replaced. The leakage rate was determined to be approximately 15 gph.

June 21, 1972 -

1200 hr	Decontamination, inspection, repair and modification of the tipped cask was completed.

June 24, 1972 -

2230 hr	The temporary patch was removed and the access chamber lowered into the unloading basin. The liner was successfully repaired by welding a stainless steel plate over the damaged area.

The regions of the main building where basin water migrated were the extraction cell, mechanical cell, and equipment transfer area. Moisture was also found on the wall of the hydraulic equipment room but no other leaks were located. The air tunnel was inspected and found to be dry. The amount of water that seeped into the process cells was not recorded. Water was periodically pumped from the cells. Pathways for the leakage were observed to be around pipes that penetrate cell walls and through construction joints. Water also leaked around the seams of the cell wall cladding into the mechanical cell.

8.3.1.1 Leakage Disposition

Water loss was carefully monitored from the time the breach occurred at approximately 1120 on June 12 until the temporary patch was in place at about 1430 on June 13. Overall loss of water during this period was about 2700 gal. Of this amount, approximately 400 gal were accounted for through evaporation and 500 gal through a normal basin filter medium change. Another approximately 900 gal were jetted to the LAW vault from the leak detection system. The remaining 900 gal were unaccounted for. With the basin water activity at about 6×10^{-4} µCi/ml, the unaccounted for water contained about 2 mCi total activity. The average of samples taken from the basin during this period showed Cs-134 to be 2×10^{-4} µCi/ml, Cs-137 3.4×10^{-4} µCi/ml and Co-60 2×10^{-5} µCi/ml.

During the 4-hour period on June 19 when the first temporary patch failed and was replaced, approximately 200 gal of basin water containing less than 1.0 mCi was unaccounted for. During the 6-hour period when the second temporary patch was removed and the permanent repair was accomplished, approximately 1400 gal of water with contamination of approximately 3 mCi was unaccounted for.

The total unaccounted-for leakage during the repair period was approximately 2500 gal. The disposition of this water, containing an estimated 6 mCi (primarily Cs-134 and Cs-137), is not known with certainty. It is assumed that most, if not all of this water remained within the confines of the structure and is contained in minute fissures or flaws in the concrete of storage basins and process cells. If this water did leak out of the structure, its probable disposition can be explained as follows:

> During construction of the facility, explosives were used to excavate the rock formation for the deep structures. This blasting fractured rock formations immediately adjacent to the deep structures. Water accumulates to some degree in the fractured rock. Perched water also collects from precipitation at various levels in these formations. The fraction of precipitation that enters the perched water zones is not known. However, a small fraction is sufficient to cause a large amount of dilution of any leakage from the basins. For example, approximately 6.3 million gallons of precipitation falls on the protected area in an

average year (~33 in. annual average rainfall over an approximate 550-ft x 550-ft area). If 10% of this rain entered the perched water reservoirs and if the 2500 gallons of unaccounted-for water is assumed to have leaked from the structure and uniformly mixed with the perched water, the dilution factor would be approximately 250. Tests indicate that there is no significant connection between the perched water formation and the aquifers supplying water for domestic or agricultural purposes. These aquifers are located far below the perched water zones and if contaminated water did leak from the structure, it is unlikely that it would ever migrate to the lower aquifers. It is most probable that the basin water would be captured in the perched water zones, becoming more diluted and gradually dispersing. There are no known water wells in the area that tap perched water zones (other than Morris Operation and DNPS sample wells).

8.3.1.2 Monitoring Program Results

Immediately after the incident, three wells were monitored for radioactivity. An additional well was drilled 100 ft northeast of the fluorine building to determine if any radioactive material was migrating toward the inhabited cottage area.

The wells were not pumped before taking a sample. Consequently, samples were taken from stagnant pools. The wells were sampled once a day from June 12 to June 21, 1972. Afterwards, through August 14, the wells were sampled twice a week and, currently, sampling is done once every 2 weeks. In addition, the main water well for the plant has been sampled several times since the incident. The analyses of all samples taken indicate no activity above background levels (<0.5 cpm/ml).

8.3.1.3 Conclusions

Recovery from the incident was rapid and successful. The liner was repaired by welding a stainless steel plate over the damage area. Corrective actions to avoid similar problems were promptly initiated and included:

8.11 REFERENCES

A1. According to recent studies in the U.S. and abroad, significant evidence has accumulated to indicate that the consequences of a hypothetical fuel melting accident may be less than currently predicted by at least one or two orders of magnitude; see staff reports, Appendices E, F, and G, **Report of the President's Commission on the Accident at Three Mile Island.**

1. C. V. Moore, **Design of Barricades for Hazardous Pressure Systems**, Nuclear Engineering and Design (1967).

2. Sandia Laboratories, **Full-Scale Tornado-Missile Impact Tests**, July 1977 Electric Power Research Institute Report No. EPRI NP-440.

3. See Subsection 5.6.3, **Design and Analysis Report of the IF-300 Shipping Cask**, GE Document NEDO-10084-1, Docket 70-1220.

4. N. R. Horton, W. A. Williams, and J. W. Holtzelaw, **Analytical Methods for Evaluating the Radiological Aspects of the General Electric Boiling Water Reactor**, March 1969 (APED-5756).

5. RESSAR-41, April 1974.

6. **Attenuation in Water of Radiation from the Bulk Shielding Reactor: Measurements of the Gamma-Ray Dose Rate, Fast-Neutron Dose Rate and Thermal Neutron Flux**, July 8, 1958 (ORNL-2518).

9.2.3.6 Senior Engineer - Licensing and Radiological Safety

The Senior Engineer - Licensing and Radiological Safety reports to the Manager - Morris Operation and is responsible for coordinating site regulatory matters with local, State, and Federal regulatory agencies, and directing the site environmental program activities. The incumbent reviews facility and operating procedure changes to determine the need for a nuclear safety review and reviews fuel data to assure conformance with criteria for fuel storage.

9.2.3.7 Plant Safety Committee

In addition to the organization shown in Figure 9-2, a plant safety committee is established within the Morris Operation. Plant Safety Committee members include: Manager - Plant Operations; Manager - Plant Engineering and Maintenance; Manager - Quality Assurance and Safeguards; Plant Safety Supervisor; and Senior Engineer - Licensing and Radiological Safety, who serves as the committee secretary. The Manager - Morris Operation normally will be a member of the committee. However, at his discretion, when items of particular significance are being considered (e.g., in the evaluation of a major operational safety matters and development of recommended changes in facilities or procedures affecting safety margins), he serves as chairman of the committee.

The Plant Safety Committee exercises jurisdiction over those matters having radiological or nuclear safety implications, with review and approval authority.

9.2.3.8 Trained and Certified Personnel

General Electric has, and will maintain at its Morris Operation, an adequate complement of trained and certified personnel to operate the facility.

9.3 TRAINING PROGRAMS

To provide and maintain a flexible, well-qualified work force for safe and efficient operation, a comprehensive training program has been implemented. Training includes:

a. Orientation and Indoctrination

b. Radiation and Industrial Safety

c. Security/Safeguards

d. Emergency Brigade Training

e. Quality Assurance

f. Basic Plant Facilities and Organization

g. Fuel Receiving and Storage Operations

h. Utilities and Operating Systems

These training programs are adapted from the programs originally prepared for fuel reprocessing operations and are believed to be more comprehensive than would normally be required for fuel storage functions, only.

The amount of training and retraining each individual receives is directly related to his function. All personnel are provided general orientation courses which include description of the Morris Operation and its functions, plant safety considerations, secu[illegible] requirements, and emergency plans and general procedures. E

9.3.1 Operator Qualification, Training, and Certification

All personnel assigned duties involving operation of systems and equipment directly related to movement of casks, loading or unloading of casks, movement of fuel, operation of basin water cooling or cleanup systems, radioactive waste management operations, and other activities in the cask receiving and fuel storage areas, including operations supervisory personnel, shall be trained, tested, and certified by General Electric as qualified to perform specified duties under a program approved by the USNRC.

9.4 NORMAL OPERATIONS

9.4.1 Plant Procedures

Plant procedures are discussed by category in the following paragraphs. Systems and equipment requiring personnel certified for specific functions may be operated by noncertified personnel only if under the direct visual supervision of an individual trained and certified for the specific operation.

9.4.1.1 Morris Operation Instructions (MOI's)

A system of specific written instructions provides guidance and direction for performance of Morris Operation activities. The instructions provide for proper safety, quality, and functional considerations in the planning and implementation of plant activities, including administration, licensing, plant engineering and maintenance, materials, operations, quality assurance, safeguards, safety, field services and transportation.

9.4.1.2 Standard Operating Procedures (SOP's)

Operation of Morris Operation facilities are in accordance with a system of Standard Operating Procedures designed to provide detailed guidance and control for all anticipated conditions. Individual procedures are prepared by the Plant Operations Unit and approved by the Plant Safety Committee before being implemented. The Plant Operations Unit is authorized to modify standard procedures on an interim basis as required to cover specific conditions arising during operations. Standard Operating Procedures are modified only after due consideration of the safety implications of the change. Operating activities are monitored on a shift-by-shift basis by the supervisory staff for compliance with Standard Operating Procedures.

9.4.1.3 Safety Manual

To provide the necessary control of work involving ionizing radiation and radioactive materials a system of radiation protection standards has been developed and documented in the Safety Manual. The Manager - Quality Assurance and Safeguards is responsible for the overall administration of the requirements set forth in the Safety Manual. Deviation from the established requirements may be required from time to time. These may be on a planned basis, under special operating conditions, or there may be deviations required by emergencies. Planned deviations must have prior approval of the Manager - Quality Assurance and Safeguards or his delegated representative. Emergency deviations must be reported promptly to the Operation Supervisor on duty who, in turn, notifies the Manager - Quality Assurance and Safeguards.

9.4.1.4 Special Work Procedures

Special work procedures for cases involving nonstandard operations include modifications to standard operating procedures and supplemental operating instructions, prepared for interim use on a controlled basis and based on specific evaluation of safety implications. There are definite time limits on such special authorizations during which off-standard conditions are to be corrected or established requirements revised. Special work procedures are approved by Quality Assurance and Safeguards, Plant Operations, and the unit performing the work.

9.4.1.5 Regulated Work Procedures

An essential element of the systems for control of plant safety is the requirement that formal authorization be provided for all operating, maintenance or repair activities which involve potentially hazardous conditions, i.e., work in radiation or contaminated areas. The Regulated Work Procedure system is designed to assure that such work is accomplished in a safe and efficient manner in accordance with the standards and requirements set forth in the Safety Manual.

Regulated Work Procedures document prescribed requirements and limits for special work to be observed prior to beginning each task. Responsibility for the procedural system is assigned to the Manager - Quality Assurance and Safeguards, including provisions for shift-by-shift monitoring of activities for compliance with control requirements, and maintenance of necessary records of such activities. Regulated Work Procedures are approved by the Plant Safety Committee.

9.4.1.6 Equipment Maintenance Programs

A Work Request System is employed at the Morris Operation for initiating requests for maintenance, preventive maintenance repairs, modifications, alterations and new installations. Work Requests are reviewed by Plant Engineering and Maintenance, Plant Operations, and Quality Assurance and Safeguards for conformance to plant procedures and instructions. Equipment maintenance is performed in accordance with manufacturer's recommended practices and operating experience. Overall responsibility for equipment maintenance is assigned to the Manager - Plant Engineering and Maintenance. Assistance is provided by other plant operating components, as required, to assure that safety and operability criteria are correctly interpreted and performance capability maintained.

9.4.2 Records and Reports

Complete files of activities relating to plant safety are accumulated to demonstrate the adequacy of design and construction safety considerations and to assure consistent application of safety principles and objectives to plant operation and maintenance.

9.4.2.1 Record Retention

Documented records of plant safety assurance activities are maintained to demonstrate that control requirements have been met, including the procedural system documentation and compliance records noted in the preceding paragraphs; environmental monitoring program reports; personnel exposure data and regulatory activity files.

9.4.3 Facility Modifications

Major modifications of Morris Operation facilities (those related to nuclear safety) are subjected to a comprehensive evaluation and analysis in accordance with SFSO procedures, which provide a formal program for design review and quality assurance. Minor modifications and tests and experiments are performed under provisions of Section 9.4.4.

9.4.3.1 Safety Evaluation and Project Planning

When a major modification or project is proposed, a study of the concept develops technical criteria and preliminary specifications, as well as other data necessary for a preliminary safety evaluation (1, Figure 9-3). This evaluation is performed by a function within SFSO (Licensing and Transportation) that is separated from organizational components directly involved in the proposed project activity. Engineering data and recommendations from other SFSO components are considered in this evaluation, including recommendations from the Plant Safety Committee.

The evaluation determines the need for licensing action, as well as special studies or other evaluation of the proposed activity.

The technical criteria, safety evaluation, and other data (such as incoming fuel scheduling, manpower availability, etc.) form the basis of a project plan developed by Fuel Storage Projects and coordinated with the Morris Operation. In some cases, the project will be executed at Morris Operation without further participation by Fuel Storage Projects. The plan is presented to management of SFSO and NEPD for approval. When all administrative and technical requirements have been satisfied, a project authorization is issued by Manager - SFSO.

9.4.3.2 Project Design Activity

Nuclear safety related and major design projects are conducted by Fuel Storage Projects, with support furnished by Morris Operation for those requirements that can best be satisfied at that location. Design activity (2, Figure 9-3) results in established functional classifications, specifications, drawings, and other documentation, all subject to an intensive review. Each document is reviewed by all appropriate organizations within SFSO, including Morris Operation, with requirements that each organization approve the document prior to issue. The various features of the design are also subject to engineering reviews, including design verification reviews. Throughout the design activities, Quality Assurance Programs personnel monitor and check compliance with the Quality Assurance Plan, especially the inspection and monitoring of vendor and contractor activities.

9.4.3.3 Licensing Activity

Depending upon the content and nature of the project, Licensing and Transportation may provide an environmental report, final safety analysis report, and special safety studies (3, Figure 9-3). Special safety studies may be requested by Fuel Storage Projects, by Quality Assurance Programs or by other management including Manager - Morris Operation. Management and personnel at Morris Operation provide contributions to licensing activities, especially in health physics and environmental fields.

Licensing activities continue as necessary to obtain regulatory approval of changes or modifications where required.

9.4.3.4 Project Completion

In the case of a major project, a Fuel Projects Engineer will be assigned the project responsibility for construction, installation, testing, startup, and related activities (4, Figure 9-3). The Manager - Morris Operation retains full responsibility for the safety of all other activities involving receipt, transfer, or storage of nuclear fuel or other radioactive materials, including operation of the facility during modification.

The Morris Operation will furnish supporting services, liaison with local government agencies, etc., as may be required. The project and site management teams coordinate activities during project execution to achieve mutual goals in accomplishing both project and operational activities. Plant Procedures for the new facility or function are developed and implemented as described in Section 9.4.

Upon completion of startup and turnover operations, all project documentation is completed and filed (both Morris and San Jose sites), and responsibility for the new facility or function assumed by Morris Operation.

9.4.3.5 Audits and Reviews

Policies and resulting requirements established for Morris Operation require periodic audit and review of the various aspects of fuel storage activity. General topics for audit include:

- Nuclear criticality safety
- Radiation protection
- Physical security
- Emergency plans
- Environmental protection
- Quality

Internal audits are conducted by Morris Operation management in safeguards, criticality, and radiation safety. Formal audits and reviews are conducted by teams from other Nuclear Energy Group and SFSO components in accordance with established Group and SFSO Policies and Procedures.

9.4.4 Changes, Tests, and Experiments

Changes in the facilities described in this report or procedures described in this report, and tests or experiments not described in this report related to receipt, storage, and transfer of spent fuel, may be performed without prior approval of the Nuclear Regulatory Commission provided that such changes, tests, and experiments do not involve significant unreviewed nuclear safety or environmental issues, nor require a change in Technical Specifications or other license conditions. These activities are conducted under provisions of 10 CFR 72.35.

Implementation of such changes, tests, and experiments is accomplished as directed by applicable procedures. In general, the procedures require an appropriate analysis and evaluation, with concurrence in proposed activity by appropriate Morris Operation and SFSO staff functions, and license amendment activity when appropriate.

9.5 EMERGENCY PLANS

9.5.1 Purpose and Scope

Emergency plans are established and personnel are trained in emergency procedures so that effective actions can be taken under the stress of emergency conditions. The interrelated emergency plans for Morris Operation are diagramed in Figure 9-4. The plans and procedures related to radiological emergencies are enclosed within the dashed line. (The Physical Security Plan and related provisions are not discussed in this document.)

Emergency planning at Morris Operation is related to the overall emergency planning of General Electric's Nuclear Energy Group, and radiological assistance plans of the State of Illinois and the Department of Energy. An arrangement has been established between Morris Operation and Commonwealth Edison (Dresden Nuclear Power Station) for mutual assistance in emergency situations. Likewise, emergency assistance arrangements have been made with law enforcement, medical, and other local agencies and services.[1]*

*See Section 9.7 for references.

10. OPERATION SPECIFICATIONS

In accordance with requirements of 10 CFR 72, proposed technical specifications for Morris Operation have been submitted to the USNRC. Therefore, Chapter 10 has been deleted.

11. QUALITY ASSURANCE

11.1 INTRODUCTION

The activities at Morris Operation are conducted in accordance with a quality assurance plan reviewed and accepted by the USNRC and implemented by instructions and procedures at the Morris facility. The quality assurance plan is documented as **Spent Fuel Services Operation Quality Assurance Plan** (NEDO-20776). A microfiche copy of this plan is included in this report.

11.2 QUALITY ASSURANCE HIST[illegible]

The initial design and construction of the Morris facility as a fuel reprocessing plant came under a quality assurance program developed by General Electric. During the construction period, the USAEC -- then the regulatory agency -- increased its emphasis on the specific methods of achieving quality assurance, proposing amendment of 10 CFR 50 to include Appendix B, "Quality Assurance Criteria for Nuclear Power Plants."

Before Appendix B was published, General Electric had incorporated quality assurance provisions into the over-all safety assurance program for the reprocessing plant. Except for specific requirements related to documented record accumulation, the key elements called for in the then-proposed amendment (as applicable to fuel reprocessing facilities) had been included in the General Electric program, which was documented in Supplement 3 to the "Design and Analysis Report - Midwest Fuel Recovery Plant." Construction of the facility was completed under this program.

After the decision not to operate the facility as a reprocessing plant, but to continue fuel storage operations, General Electric proposed the installation of a new fuel storage system. This system was licensed by USNRC in December 1975. The design, fabrication, and installation of this system were performed under the current quality assurance plan, which is in accordance with applicable requirements of Appendix B, 10 CFR 50.

11.3 STRUCTURES, SYSTEMS, AND COMPONENTS IMPORTANT TO SAFETY

The structures, systems, and components important to safety are listed below, with a basis for designation.

a. **Fuel storage basin - concrete walls, floors, and expansion gate.** The basin's concrete structure is a principal element in protection of stored fuel, and in the isolation of basin water from the environment.

b. **Fuel storage basin - stainless steel liner.** The liner forms a second element in fuel protection and basin water isolation, facilitating decontamination.

c. **Fuel storage system, including baskets and supporting grids.** The storage system is a principal element in protection of stored fuel.

d. **Unloading pit doorway guard.** This device is designed to prevent a loaded fuel basket from being tipped so that fuel bundles could fall into the cask unloading basin. The unloading pit doorway guard is an element in protection of fuel during movement of loaded basket.

e. **Filter cell structure.** The concrete cell, part of the basin pumproom area, provides radiation shielding to reduce occupational exposure.

A.7.5.2 Shipping and Disposal Costs

Shipping and burial cost estimates include the 1978 costs of shipping containers (nonreusable), transportation fees, and burial charges at a low-level waste disposal site. The cost estimate includes weights and volumes of materials based on past experience of the Morris Operation. The transportation costs assume that the waste will be transported to the Hanford Reservation near Richland, Washington.

Disposal of "clean" materials is not included in the costs shown in Table A.7-3 since noncontaminated items are not addressed in this plan. (See Section A.7.2.2.)

A contingency of 25% of the decommissioning cost (Table A.7-3, Tasks 1 through 4) was included in the total cost shown.

A.7.5.3 Financial Assurance

The decommissioning costs for General Electric's irradiated nuclear fuel storage facilities near Morris, Illinois, estimated to be $6,033,000, are small compared to the total assets of the General Electric Company. Therefore, it is unlikely that General Electric would be unable to meet the financial commitments generally associated with the decommissioning activities as outlined and estimated.

On April 15, 1980, Dr. Bertram Wolfe, Vice President and General Manager, Nuclear Fuels and Services Division, General Electric Company, submitted a letter to the Nuclear Regulatory Commission concerning financial arrangements for decommissioning the Morris Operation. This letter is reproduced in Figure A.7-1.

By action of the Board of Directors in meeting on April 27, 1979 (Minute #9640, April 27, 1979), a Vice President of General Electric Company may execute such an obligation on behalf of the Company. A copy of this action of the Board was attached to Dr. Wolfe's letter of April 15.

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY
175 CURTNER AVENUE
SAN JOSE, CALIFORNIA 95125

DR. BERTRAM WOLFE
VICE PRESIDENT AND GENERAL MANAGER
NUCLEAR FUEL AND SERVICES DIVISION

April 15, 1980

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

Attention: R. E. Cunningham, Director
Fuel Cycle & Material Safety

SUBJECT: FUNDS FOR DECOMMISSIONING MORRIS OPERATION
Docket No. 70-1308

Gentlemen:

General Electric's general revenues and retained earnings, as shown by the 1979 annual report, are sufficiently large that, at the time of decommissioning, General Electric will have available the resources deemed necessary to satisfy its obligation to decommission its Morris Operation near Morris, Illinois used for the interim storage of spent fuel. The decommissioning of the Morris Operation will be carried out by General Electric in accordance with then applicable federal laws and regulations.

Attached is a copy of General Electric's Board Resolution #9640 dated April 27, 1979 concerning the execution of contracts and other instruments which authorizes a Vice President of General Electric Company to sign this letter.

Sincerely,

Bertram Wolfe

Attachments

Figure A.7-1. Letter from Dr. Bertram Wolfe, Vice President and General Manager, Nuclear Fuel & Services Division, Regarding Financial Arrangements for Decommissioning Morris Operation