1.0 INTRODUCTION AND DESCRIPTION

1.1 INTRODUCTION

This document contains a consolidation of safety analysis information relating to storage of irradiated nuclear fuel in operations conducted by General Electric Company (GE or the Company) at Morris Operation (MO). Since 1989, the fuel basins at GE-MO are essentially full, and no further receipts of fuel are planned or anticipated. Fuel shipments are not expected until the DOE repository is opened.

Almost all information in this document has been previously published or otherwise made a part of the public record regarding the Midwest Fuel Recovery Plant (MFRP) or GE-MO[1]. This document presents information regarding fuel storage operations, disregarding features of the facility not applicable to fuel storage. Not all information in this document describes important to safety structures, systems and components (SSC). Support SSC are also discussed as they apply to fuel storage. Section 8, "Accident Safety Analysis", and Section 11, "Quality Assurance", detail SSC important to safety.

The Company's facility is located near Morris, Illinois, adjacent to the Dresden Nuclear Power Station (DNPS).

The GE-MO fuel storage facility includes two interconnected water-filled basins with cranes, water treatment system, and other facilities required to store irradiated fuel underwater for an indefinite period. Fuel storage equipment in the basins is designed to protect the integrity of fuel rods during seismic or meteorological events. Special procedures and isolation can be provided for storage of damaged or leaking fuel. Security measures are in effect to protect the facility against unauthorized access. Although intended for interim storage only, based on the storage system environment and aging management, nonreplaceable components (concrete basin and basin liner), allow safe storage of the fuel for extended period of time..

In December 1975, GE received a license amendment to increase fuel storage capacity[2] from about 100 TeU to 750 TeU by installation of a fuel storage system of a new design and through appropriate changes in fuel handling and support systems. This modification, designed 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

Facilities described in this report are owned and operated by General Electric Company, a corporation under the laws of the State of Connecticut, with its principal place of business at Fairfield, CT. The facility is operated through the Company's GE Nuclear Energy Division with headquarters in San Jose, California and operations in Morris, Illinois.

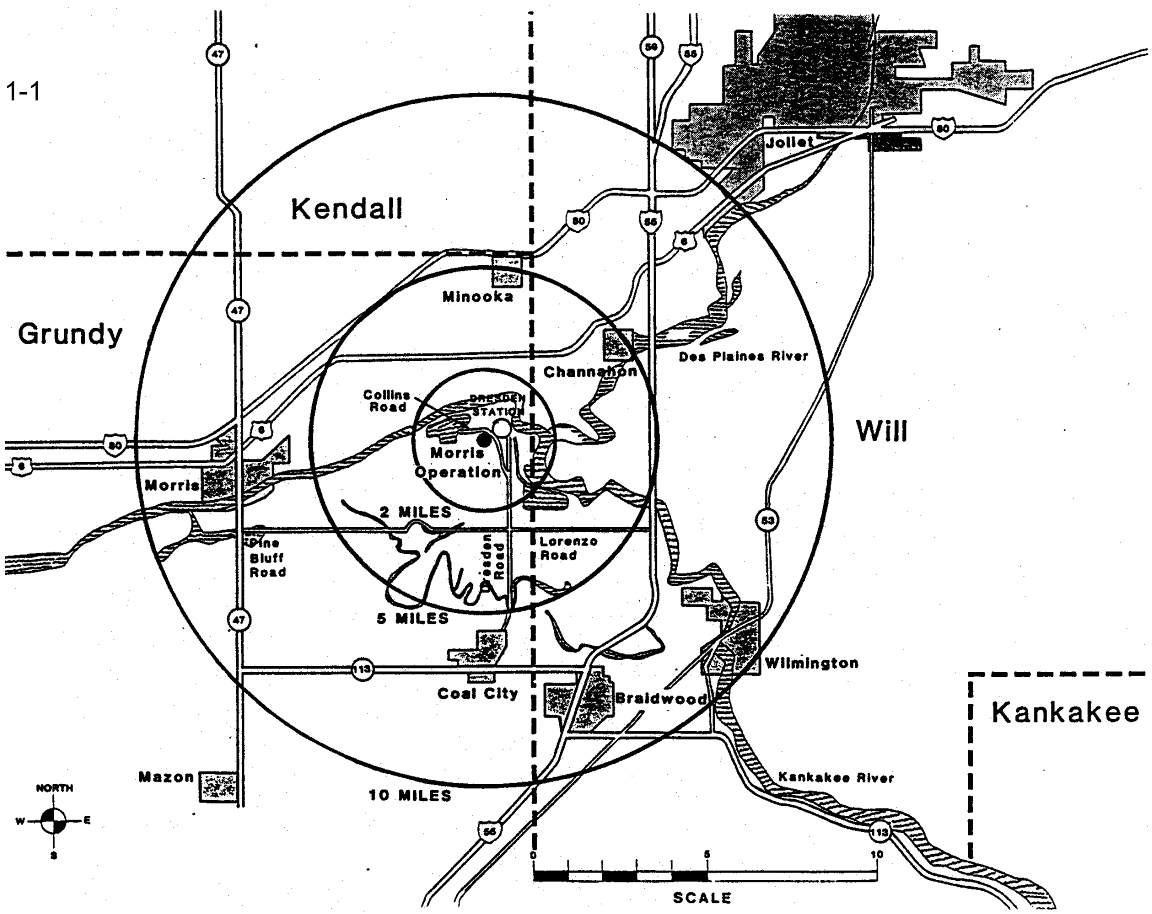
GE is a broadly diversified corporation involved in research, design, manufacturing, and marketing products and services in several fields including industrial products, technical systems and materials, consumer products, and power systems. The latter activity includes nuclear systems, equipment, fuel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

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

1.1.2 Plant Location

GE-MO facilities are located on the northern end of a rectangular tract of about 886 acres owned by the Company in Gooselake Township, Grundy County, Illinois, near the confluence of the Kankakee and Des Plaines Rivers (Figure 1-1).

Figure 1-1



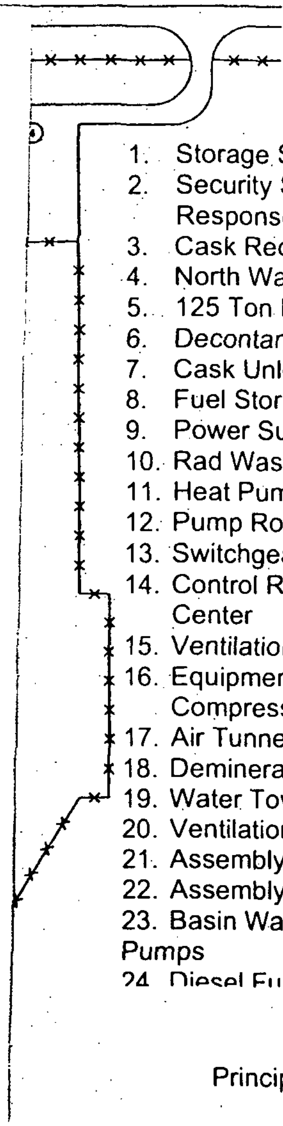
The tract (Figure 1-2) is about 15 air miles southwest of Joliet and about 50 miles southwest of the Chicago, Illinois - Gary, Indiana area. Morris, Illinois, the county seat of Grundy County is about 7 miles west of the tract. The Illinois Waterway and Kankakee River are separated from the tract to the north and east by lands owned by the Commonwealth Edison Company (CECo), the site of the Dresden Nuclear Power Station (DNPS) and related facilities, and a privately owned plot of about 50 acres. Gooselake Prairie State Park is to the west and a discontinued refractory mining operation borders the tract to the south. The GE-MO site consists of the developed area of the Company's tract, including the Owner-Controlled Area (OCA) and the protected area, and sanitary lagoons.

Figure Withheld Under 10 CFR 2.390

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 area, while the sanitary waste treatment facilities are located immediately south of the OCA. The sanitary waste facilities are also fenced.

Figure Withheld Under 10 CFR 2.390



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2. Security Station & Emergency Response Center
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5. 125 Ton Bridge Crane – Cask Handling
6. Decontamination Area
7. Cask Unloading Basin
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16. Equipment – Diesel Generator, Air Compressors, Exhaust Blowers
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19. Water Tower
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21. Assembly Area – Inside
22. Assembly Area – Outside
23. Basin Water Chiller Room & Heat Pumps
24. Diesel Fuel Tank Enclosure

Figure 1-3
Principal Facilities – Site Area

1.1.4 Fuel Type and Exposure

The design basis fuel 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. Design basis fuel was assumed to be irradiated at specific power levels of up to 40 kW/kgU, with exposure to 44,000 MWd/TeU (reactor discharge batch average), and cooled for at least 1 year after reactor shutdown prior to receipt at GE-MO.

1.1.4.1 Fuel in Storage

Irradiated fuel from PWRs and BWRs has been received and stored at GE-MO since 1972. 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 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 GE-MO facilities related to irradiated fuel storage.

1.2.1 Site Characteristics

The GE-MO site is in a developing industrial area. The terrain is typically "rolling prairie," with vestiges of long-abandoned coal strip mines. In general, the land in the area has been farmed for many years, but the GE-MO site is in an area of rocky outcroppings and thin top soil, unsuited to economical, large-scale farming of crops. Arable portions of the site outside of the OCA have been leased to local farmers and have been used for beef cattle grazing and raising crops. Both road and rail transportation services are available on the site (Figure 1-1). Rail access is via an extension of the DNPS siding from the Elgin, Joliet and Eastern Railway right-of-way to the west of the site. Road access is via county roads which connect with several state highways and provide routes to nearby communities and to interstate highways in the area. Water transportation access via the Illinois River is available through an agreement with CECo, but no docking facility is developed.

Investigations of site characteristics were made in support of the MFRP construction effort, and Morris Operation-Project I. These studies supplemented extensive information obtained in the course of DNPS development and operation. Factors significant to fuel storage activities are summarized below.

1.2.1.1 Regional and Site Meteorology

The climate of the Morris region of Illinois is typically continental, with cold winters and warm, humid summers. There are frequent short-term fluctuations in temperature, humidity, cloud cover, and wind speed and direction. Storm systems and weather fronts usually move eastward and northeastward through this area. The maximum recorded temperature for the area was 109 ^{o}F, with a minimum temperature of -22 ^{o}F, and an annual mean temperature of about 59 ^{o}F. There is a rather uniform distribution of wind direction, with the most frequent winds from the west and south at an average of 11 to 15 mph.

The most severe weather conditions experienced in the area are tornadoes. Over a 40 year period, there was an average of 4.8 tornadoes per year in Illinois, which is close to the average for all states east of the Rocky Mountains. While tornadoes have been reported near GE-MO since 1965, no damage to the site has occurred.

1.2.1.2 Geology

Exploration of the site's substructure, as well as actual excavation for facility construction confirmed the rock is sound at all depths with no evidence of active faults. All main building foundations and below-grade vault and basin structures are set in bedrock to ensure high structural integrity for these facilities.

1.2.1.3 Hydrology

Consideration has been given to subsurface water behavior in relation to operation of underground facilities, but because there is no liquid waste discharge, or storage of high activity liquid wastes at the fuel storage site, factors such as drainage patterns to water courses, soil ion-exchange capacity, etc., are not of major significance in ensuring the safety of fuel storage operation[3].

Potential flooding of the site is considered very unlikely. Site elevation at the plant location is 532.5 ft. compared with the maximum historical flood elevation of 506.4 ft. The normal pool elevation of the river as controlled by the Dresden Dam is 505 ft.

1.2.1.4 Seismology

Available references show the GE-MO site in Zone 1 (zone of minor damage) on the latest seismic probability map. In Richter's Seismic Regionalization map, the site is near the line of demarcation between an area assigned a probable maximum intensity of seven and one with a probable maximum intensity of eight of the Modified Mercalli (MM) scale. To ensure conformance with basin earthquake resistance criteria, design earthquake forces have been taken as those corresponding to a horizontal ground acceleration of 0.1G (MM7) and maximum earthquake forces at a horizontal ground acceleration of 0.2G (MM8).

1.2.1.5 Environs Summary

Distances from the plant stack to GE property boundaries are 2,265 ft. to the east, 6,512 ft. to the south and 3,100 ft. to the west. The tract boundary to the north is about 950 ft. from the stack; however, the DNPS site provides an effective boundary of about 5,950 ft. Studies of population and land usage in surrounding areas were made and reported in the course of DNPS development, during MFRP licensing, and during the GE-MO capacity expansion. Factors of specific interest are summarized below and discussed further in Section 3.

a. Industrial: On the DNPS site there are two operating nuclear power reactors situated about 0.7 miles northeast of the GE-MO stack. 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 GE-MO tract there are discontinued clay mines 1.4 miles from the stack.

b. Residential: Residences nearest to the tract are on about 50 acres directly east of the facilities (about 0.5 mile from the stack) between GE's property and the Kankakee River.

There are approximately 30 river front sites on which 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.

Total population within a 5 mile radius is estimated to be about 7,000 including summer visitors, increasing to about 9,000 by the year 2000. A population of about 49,000 reside within a 10 mile radius of the plant, and should increase to about 68,000 by the year 2000.

Population in the 5 to 20 mile radius zone, which includes the cities of Aurora and Joliet, is about 350,000. This population should increase to about 450,000 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 overall U.S. rate.

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 GE-MO tract. This natural prairie preserve of about 1,800 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 GE. Since purchase of the original tract, which then totaled 1,380 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 was sold to the A. P. Green Refractory Company, Illinois Products Division, which was used in connection with clay mining and clay products manufacturing activities. Clay mining and manufacturing was discontinued and the land sold to a private party. A parcel to the north and east was sold to the CECo for construction of canals to a cooling lake for DNPS reactors. Currently, GE property totals about 886 acres.

1.2.2 Facility Descriptions

Site facilities as they exist today are the result of using original buildings, where possible, and rearranging or adding new buildings, where necessary.

1.2.2.1 Main Building

The main building (also known as the process building) is a massive structure of reinforced concrete, about 204 ft. by 78 ft. in plan, and about 88 ft. above grade. 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.

1.2.2.1.1 Fuel Storage Areas

Fuel storage operation areas include (Figure 1-3):

a. Cask receiving area (3)
b. Decontamination area (6)
c. Cask unloading basin (7)
d. Fuel storage basins 1 and 2 (8)
e. Low level waste evaporator (15)
f. CAS/SAS (was Control Room)(14)
g. Basin water cleanup and cooling (11, 12)

1.2.2.2 Other Structures

Adjacent to the south wall of the main building are the underground Cladding and Low Activity Waste (LAW) vaults, which were originally part of the reprocessing plant waste system, and later part of the fuel storage system waste management facilities. The underground dry chemical vault (DCV), adjacent to the main building east wall, was used during reprocessing system testing. The Clad Vault is empty and is intended for contingency service only. The LAW Vault and the DCV are empty, connecting piping has been removed or capped, and the vaults are laid away. There are no current plans for use of the LAW Vault or DCV.

The sand filter building, a principal part of the plant ventilation system, is east of the main building. All air exhausted from the fuel storage areas and from supporting areas in the main building is passed through the sand filter, sampled, and vented to the atmosphere via the 300 ft. high stack (Item #20, Figure 1-3) located southeast of the main building. Attached to the sand filter building is the emergency equipment building (EEB) (16, Figure 1-3). Other prominent structures on the site include a utility and service building; a shop and warehouse building; the administration building; a water tower; and a cask service building.

Operation of the various facilities is described in Section 1.3. The basin areas are diagrammed in Figure 1-4.

1.2.2.3 Building Drawings

Drawings of the main building and the sand filter building are included in Appendix A.14. Elevations in these drawings are based on an arbitrarily selected reference point at 47.5 ft., which is grade elevation at the main building site. The site grade reference is 532.5 ft. above sea level, and the reference "zero" elevation is 485.0 ft. above sea level.

Figure Withheld Under 10 CFR 2.390

1.3 FUEL STORAGE OPERATIONS

1.3.1 Unloading and Storing Spent Fuel

Fuel was normally unloaded using the fuel handling crane - a crane of 5 ton capacity mounted on rails attached to columns below the cask crane rails. The unloading and storage basins are served by the basin crane - a manual control bridge crane of 7.5 ton capacity. As with other cranes, the basin crane is designed to prevent derailment under seismic conditions. The basin crane has a platform on the north side of the bridge that provides a work station with excellent viewing for the fuel handling crane operator.

1.4 SUPPORT SYSTEMS

The principal support systems are:

a. Radwaste System
b. Ventilation System
c. Basin Water Cleanup and Cooling Systems
d. Sump Monitoring and Pump-out Systems
e. Sewage Systems
f. Utility Systems, including air, water, and electricity
g. Radiation Monitoring Equipment

1.4.1 Radwaste System

The Radwaste System is split into two sub-systems identified as high and low activity. The purpose of this design is to separate highly radioactive basin filter sludge from other plant waste water such as laundry, sump waste and decon solutions. The Radwaste System for liquid waste is shown schematically in Figure 1-5a. Low activity liquid wastes consist primarily of laundry water, sump water, and decon solutions. This waste is processed through an electric evaporator.

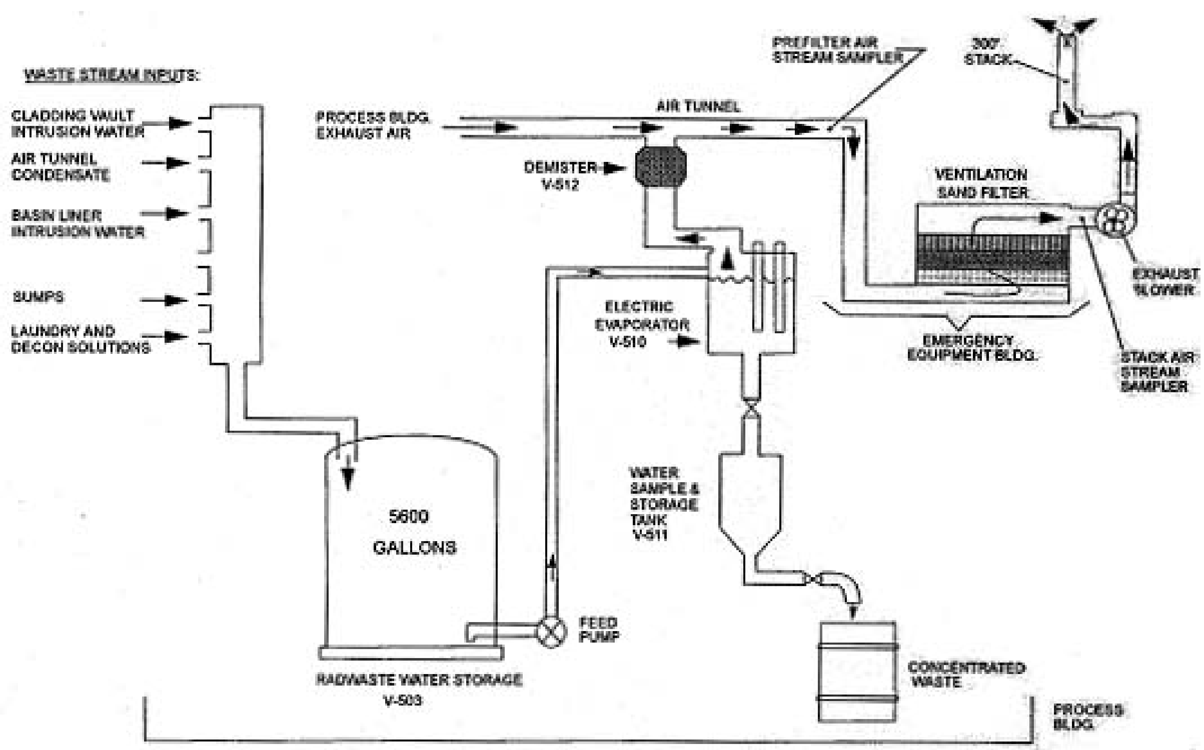

Figure 1-5a. RADWASTE SYSTEM: Low activity radwaste water streams are collected from various sources and piped to the Radwaste Water Storage Tank. Water from this tank is then pumped to an electric evaporator. Evaporator steam is demisted and exhausted via the ventilation system. Evaporator bottoms are put in barrels and shipped off site for processing.

The high activity part of the Radwaste System (Figure 1-5b) dewaters basin filter spent resins and returns the water to the basin. The dewatered filter resins and evaporator bottoms are disposed of as radwaste.

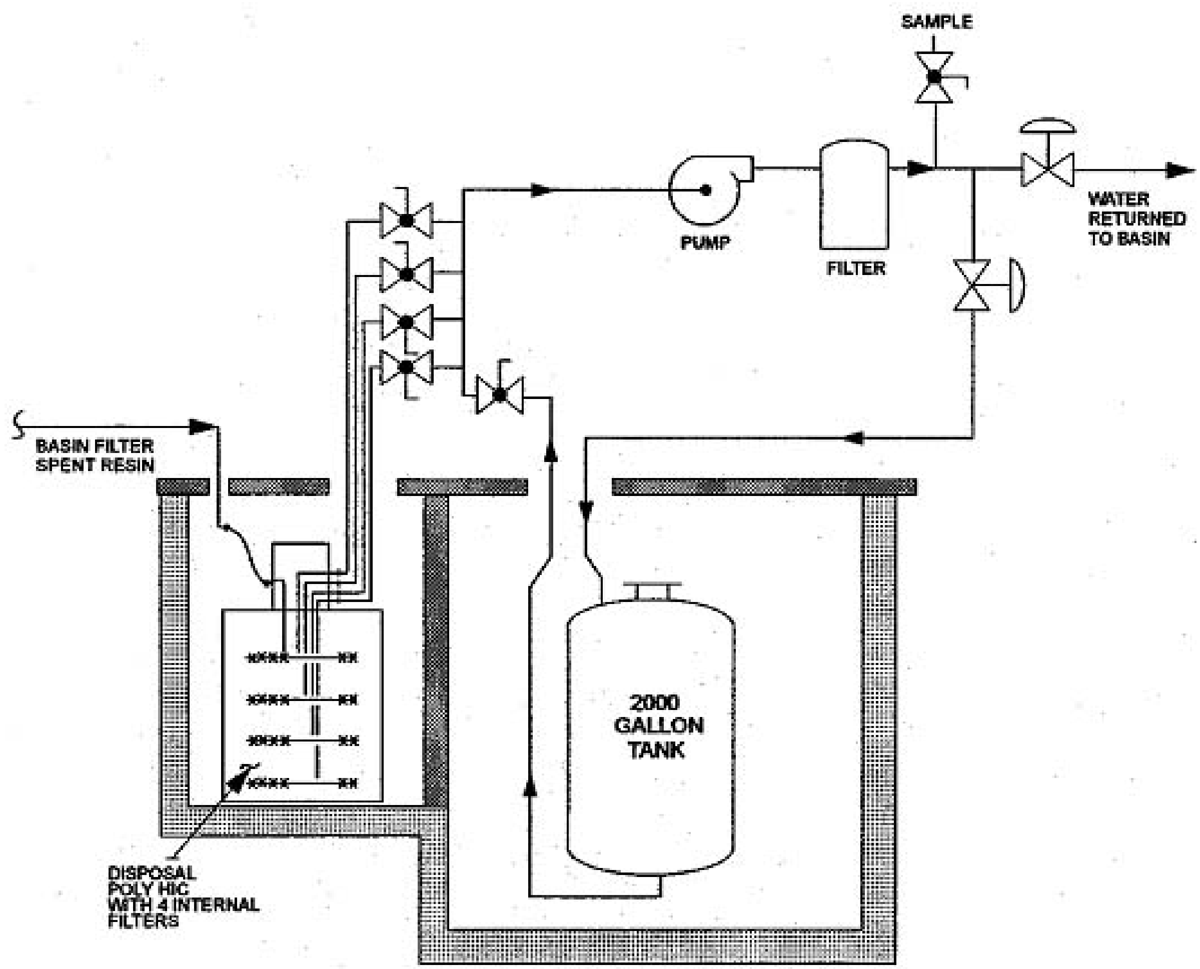

Figure 1-5b. BASIN FILTER SPENT RESIN SYSTEM: Spent resins from the Basin Filter and cask flush solutions are pumped to a shielded Poly High Integrity Container (HIC). Water is removed from the HIC, filtered and then returned to the Fuel Storage Basin. When filled, HICs are dried and shipped off site for burial.

In addition to the Radwaste System, the Cladding Vault is available to receive and hold contaminated water. This reinforced concrete vault is stainless-steel lined. The Cladding Vault is normally empty, but is maintained as a contingency if large volume water storage is required.

1.4.2 Ventilation System

A simplified diagram of the ventilation system is shown in Figure 1-6. Pressure differentials within and among connected areas ensure air flow from areas of low potential radioactive contamination (high air pressure) to areas of higher potential radioactive contamination (low air pressure).

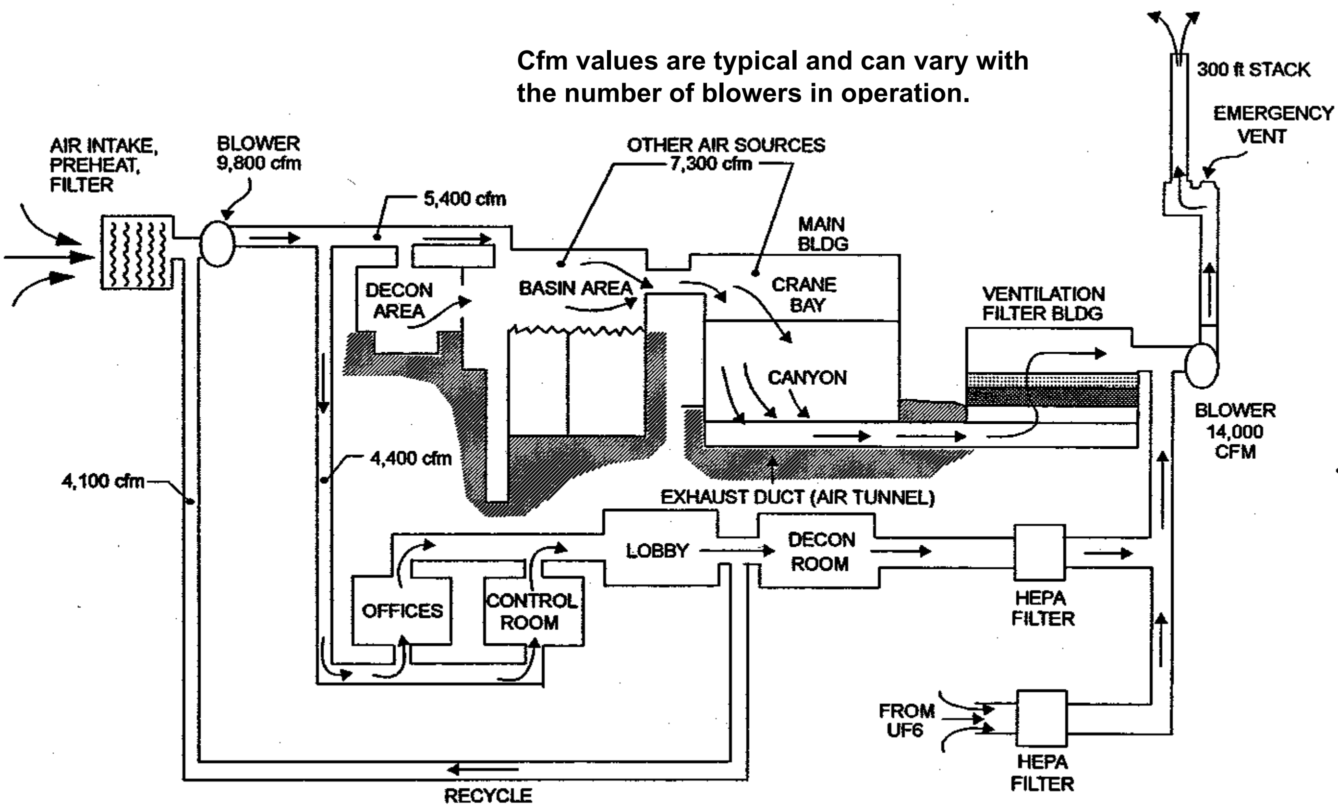

Figure 1-6. Outside air is combined with recycled air from the offices, control room and lobby and then split into two streams. One is a once through stream that passes through controlled areas to the air tunnel, through the sand filter and out the stack. The other stream ventilates the offices and is recycled with fresh incoming air. A small side-stream is diverted from this loop through a decontamination room and a filter to the stack.

Air to be passed through the sand filter flows to the air tunnel in the main building. The air tunnel provides means for draining liquids (such as condensate) to the off-gas cell sump where they are collected and pumped to the Radwaste System (Figure 1-5a and 1-5b).

1.4.3 Basin Water Cleanup and Cooling Systems

Simplified diagrams of the basin water cleanup and cooling systems are shown in Figures 1-7, 1-8, and 1-9. The filter unit is isolated in a shielded and locked room in the basin pump room. The pump room houses two 250 gpm pumps for the basin water chiller system, a 128 gpm pump for the heat pump cooling system, and a 250 gpm filter pump. Piping to the basin skimmers and water return piping is arranged to prohibit siphon action. Filter regeneration is accomplished remotely. Spent resins are pumped to the Radwaste System.

The water chiller system uses a water-to-freon chiller of stainless steel construction and rated at 1.2×10^6 Btu/hr. In addition, a separate heat pump system utilizes the waste heat from spent fuel to aid in heating personnel areas. It has a capacity of 480,000 Btu/hr.

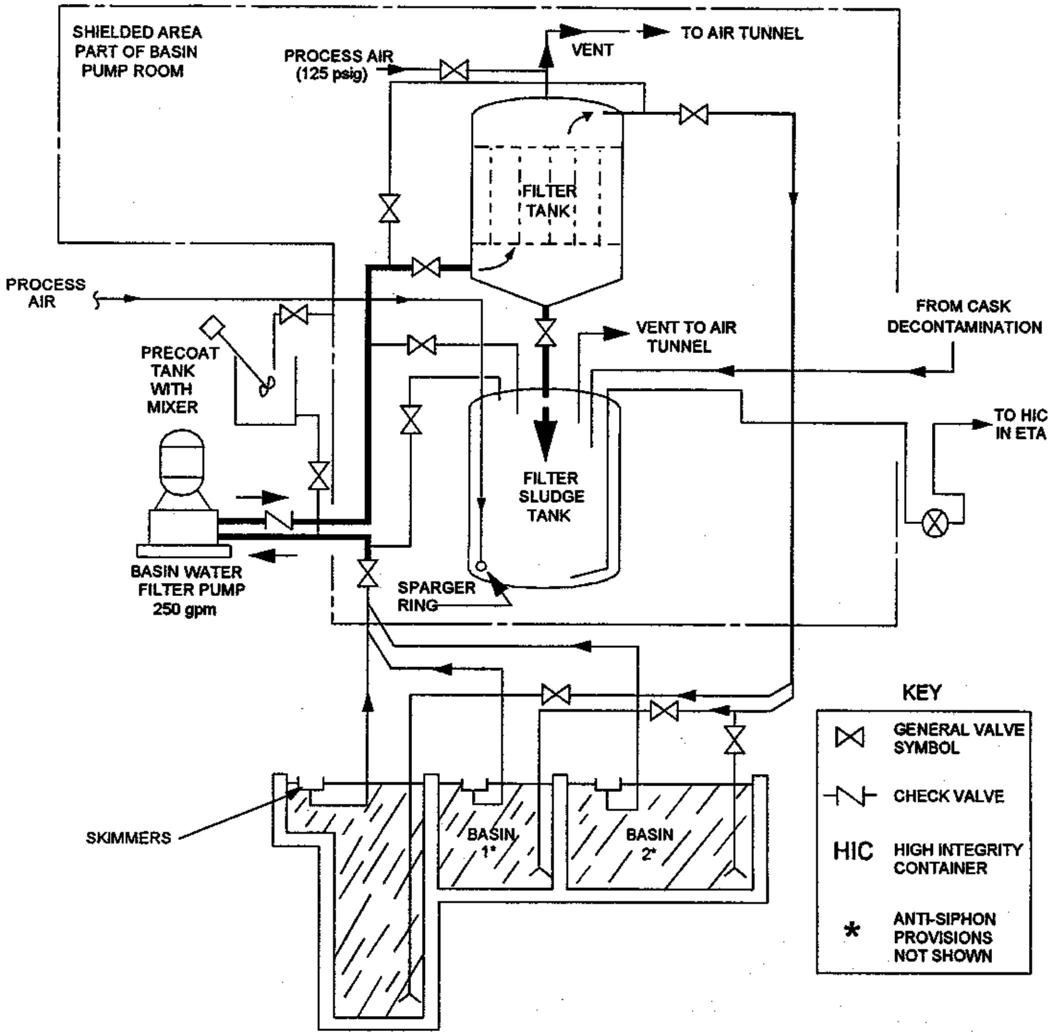

Figure 1-7. BASIN WATER CLEANUP SYSTEM: Water is continually drawn from basin skimmers at about 250 gpm, processed and returned to the basin. Filter sludge and cask decontamination water are collected in the sludge tank, then jetted to Radwaste Processing. Provisions are included for flushing tanks and precoating filters.

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Figure 1-8. <u>BASIN WATER COOLING SYSTEM:</u> Water is pumped from the basins to a three unit fin-fan cooler equipped with two fans.

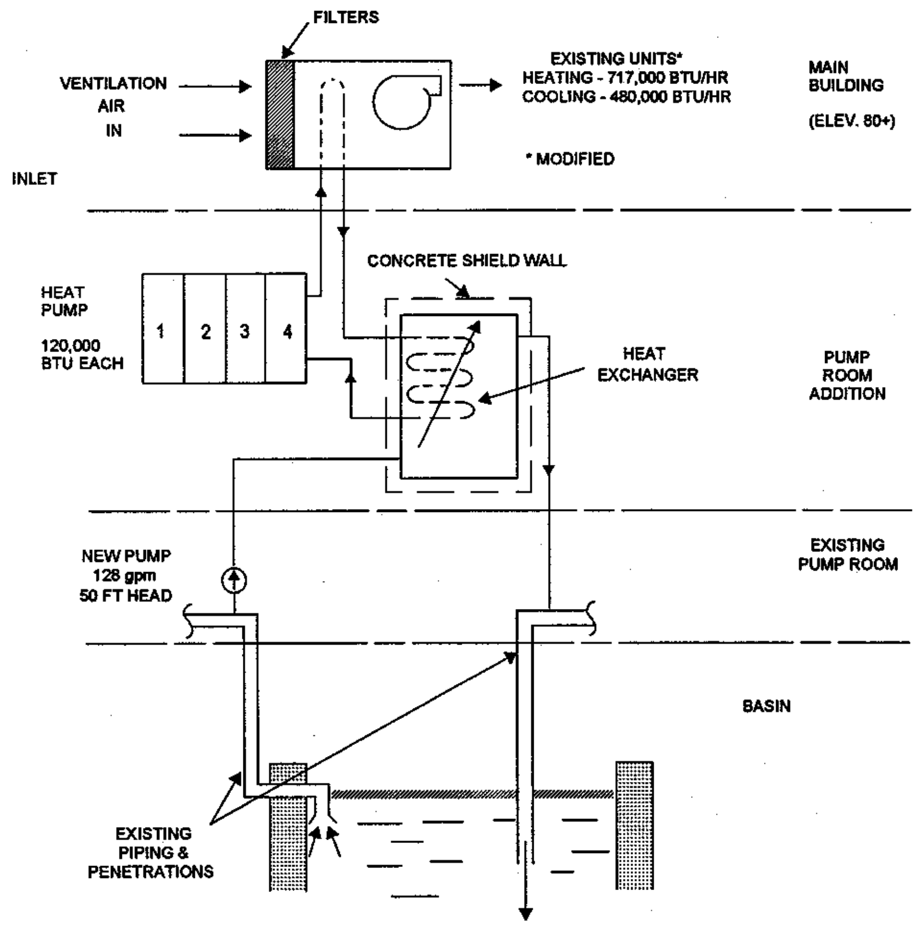

Figure 1-9. Basin Water Heat Pump Cooling System – Simplified Schematic

1.4.4 Leak Detection and Sump systems

Basic to the leak detection system is a sump that accumulates leakage water as well as intrusion water (water entering from surrounding rock). A simplified schematic of the leak detection and empty-out system for the fuel storage basins is shown in Figure 1-10. The sump is emptied using a combination of an air lift and an air operated diaphragm pump. Provisions are included to sample sump water. All vaults are equipped with similar systems utilizing electric pumps in place of air lifts.

Figure Withheld Under 10 CFR 2.390

VALVE

Figure 1-10. LEAK DETECTION, EMPTY-OUT AND SAMPLING SYSTEM: Sumps are provided in several locations to collect leakage or other runoff. Water detection, empty-out and, in some cases, sampling and monitoring facilities are provided. This schematic shows fuel basin liner leak detection and empty-out system in simplified form.

1.4.5 Sewage systems

No sewage is discharged from the GE-MO site. Sanitary wastes are piped to the sanitary lagoons. A simplified schematic of the sanitary sewage systems is depicted in Figure 1-11.

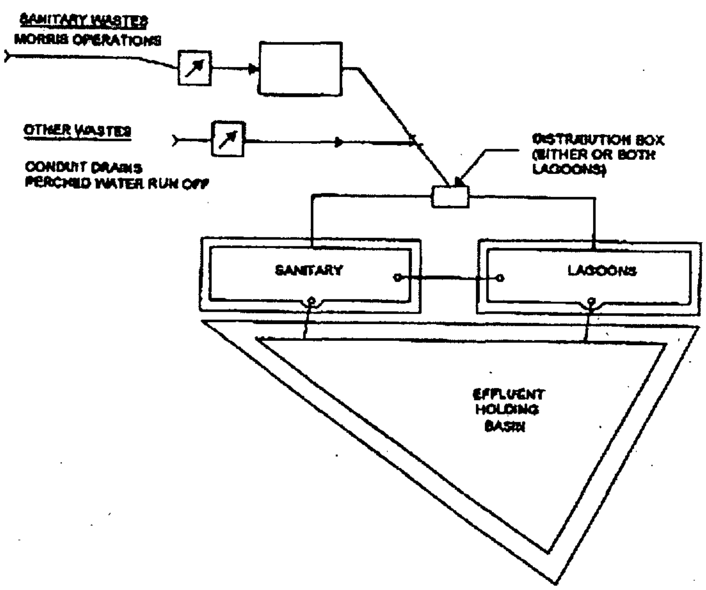

Figure 1-11. SEWAGE SYSTEMS: No liquid effluent is discharged off-site; only rain runoff is drained by open ditch, eventually discharging to the river. Holding basin retains lagoon effluent.

1.4.6 Energy Systems

There are two energy sources on site: the electrical system and the natural gas service.

a. Electrical: Electrical power is furnished by Commonwealth Edison Company (CECo) via two 34,000-volt lines. Distribution facilities are located in and near the utility service building (13, Figure 1-3). Principal loads at GE-MO are crane operation, ventilation system, control and instrumentation, and auxiliary systems and equipment.

   Although interruption of electrical power would not result in unsafe conditions, secondary power sources (originally intended as emergency sources for reprocessing activity) are provided to ensure continuing operation of electrical equipment during power outages.

1.5 RADIOLOGICAL AND OTHER MONITORING

GE-MO monitors gaseous and liquid (ground water and surface water) effluent from the Morris Operation OCA boundary.

Within the GE-MO facility, sampling and laboratory analyses supplement the constant air and other monitoring devices to ensure a safe environment for employees and to detect trends or events.

1.6 EMERGENCY PROVISIONS

The GE-MO Emergency Plan (NEDO 31955) describes actions to be taken during emergency situations. Structures and systems at Morris supporting emergency action such as law enforcement, medical, fire, or other emergency services are identified. Assistance agreements exist with appropriate local agencies.

1.7 REFERENCES

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

2. Storage capacity expressed in terms of metric tons of uranium (TeU) as contained in LWR fuel rods.

3. See Chapter 8.