UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

MAR 17 1994

DOCKET: 70-36

LICENSEE: Combustion Engineering
Hematite, Missouri

SUBJECT: ENVIRONMENTAL ASSESSMENT FOR SNM-33 LICENSE RENEWAL

## Introduction

By letter dated November 22, 1989, Combustion Engineering (CE) requested renewal of its Special Nuclear Material License, SNM-33 (Ref. 1). Additional environmental information was submitted by CE letters dated October 11, December 16, 1991, and December 10, 1993 (Refs. 2, 3 and 4).

This environmental assessment (EA) has been prepared by the staff of the U.S. Nuclear Regulatory Commission in accordance with the National Environmental Policy Act of 1969, NRC regulations (10 CFR Part 51), and Council on Environmental Quality regulations (40 CFR Parts 1500-1508). The regulations define an EA as a concise public document which serves to briefly provide sufficient evidence and analysis for determining whether an Environmental Impact Statement or a Finding of No Significant Impact is necessary and which includes a brief discussion of the need for the proposed action, alternatives to and environmental impacts from the proposed action, and a list of agencies and persons contacted in preparing the EA.

Descriptions of the affected environment and the surrounding area have been discussed in previous documents issued in November 1982 (Ref. 5) and October 1981 (Ref. 6), and to the extent the information in these documents remains unchanged, it will not be repeated. This EA will discuss current plant operations, environmental impacts from plant operations, plant effluent monitoring, and environmental monitoring.

## Proposed Action

The proposed action is the renewal of License SNM-33, allowing CE to continue manufacturing low-enriched nuclear fuel for 10 years. The current license authorizes CE to receive, possess, use, and transfer special nuclear material in accordance with 10 CFR Part 70 and source material in accordance with 10 CFR Part 40. This license also allows CE to deliver radioactive material to a carrier for transportation in accordance with 10 CFR Part 71. CE produces low-enriched (≤5 percent U-235) ceramic nuclear fuel for light-water cooled reactors.

## Need for the Proposed Action

The proposed action is needed so CE can continue to produce low-enriched nuclear fuel pellets which will ultimately be used by commercial nuclear power plants to produce electricity. Since CE is one of only a few facilities that manufacture nuclear fuel in this country, there remains a need for the fuel by the nuclear power industry.

## Alternatives Including the Proposed Action

The alternatives are to renew the license as requested or deny the license renewal. The impacts from the alternative of the proposed action will be discussed in this document.

To deny renewal of the operating license would mean that CE would have to cease operations and begin decontamination and decommissioning activities at the site. This alternative would only be considered if there were public health and safety issues that could not be resolved to the satisfaction of the NRC. While terminating licensed activities at CE may create a minimal positive effect on the immediate environment, any environmental impact would then be transferred to the other fuel fabrication facilities that would have to increase operations to replace the fuel that CE would have produced.

## Background and Site Operations

The facility was built by Mallinckrodt Chemical Works to manufacture high- and low-enriched $UO_2$. The operating license was issued by the Atomic Energy Commission in March 1956. United Nuclear took control of the license and facility in 1961 and in 1970, entered into a joint venture with Gulf United Nuclear to run the plant. On August 21, 1974, the operating license was transferred from Gulf United Nuclear to CE. CE is authorized to produce only low-enriched $UO_2$. Since CE took control, the license has been renewed twice, on March 31, 1977, and December 30, 1983, for 5-year periods.

The facility is located approximately 35 miles (56 km) south of St. Louis, on 154 acres in Jefferson County, Missouri, near the town of Hematite (Figure 1). Licensed activities are conducted in a 6-acre, controlled access area near the center of the site. The site is 3/4 of a mile (1.2 km) northeast of Hematite (Figure 2). Festus/Crystal City, located 3-1/2 miles (5.6 km) east of the site, is the nearest town of significant size with a 1990 population estimate of 12,193. Based on the 1990 population census, the population estimate for the 5-mile (8 km) radius around the plant is 22,800 and for the 50-mile (80 km) radius is 2,275,011.

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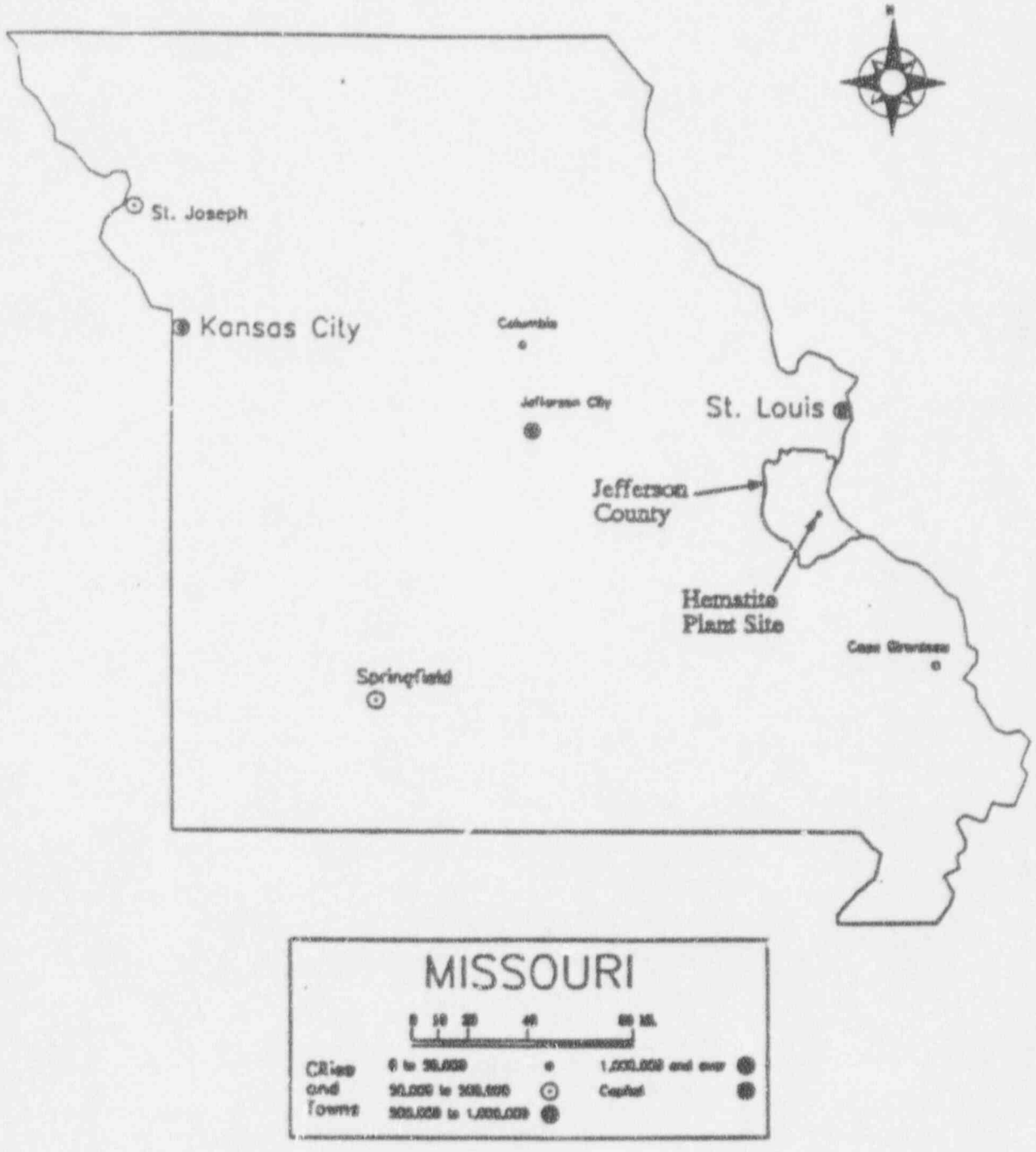
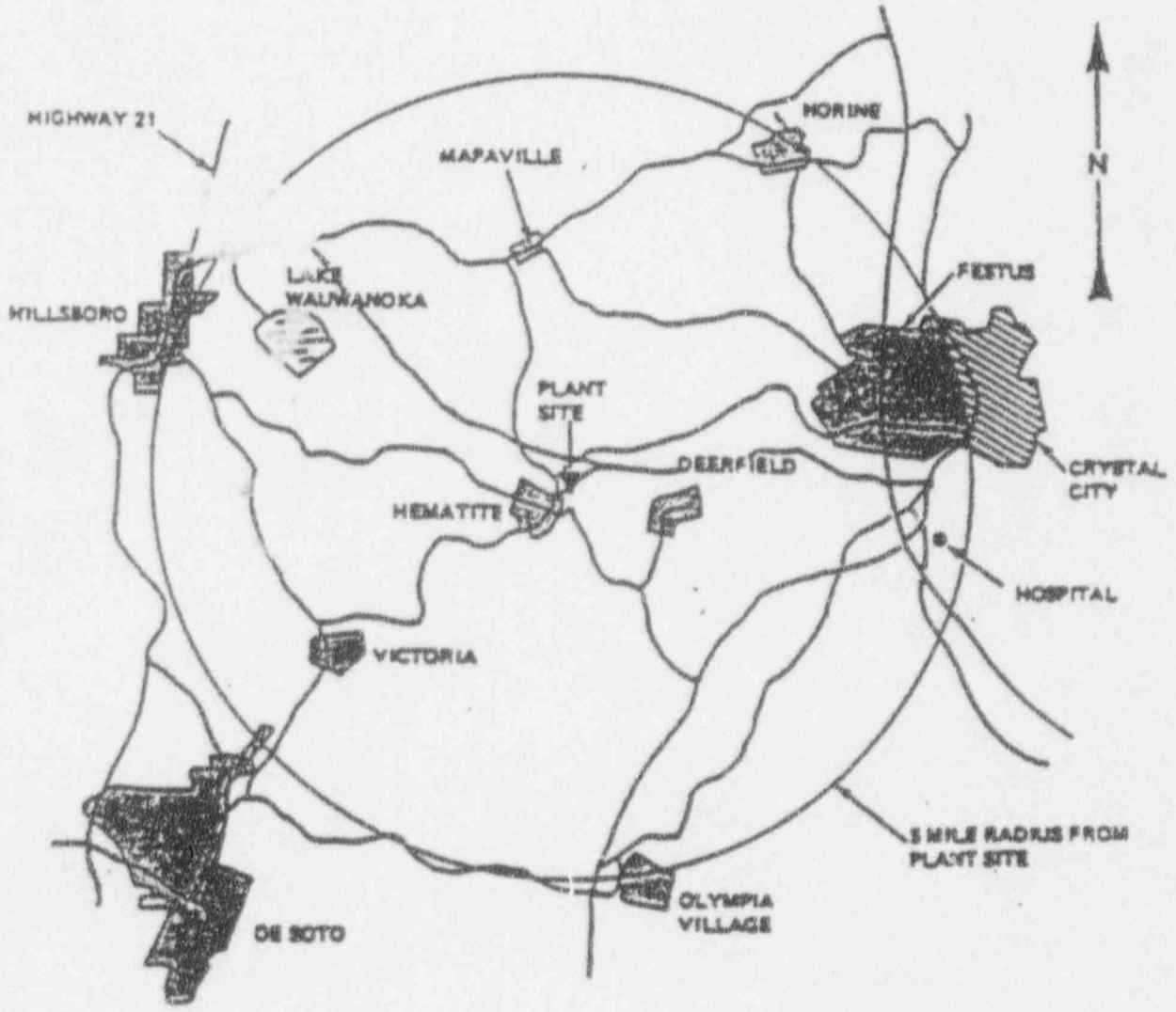



HEMATITE PLANT SITE LOCATION WITHIN THE STATE OF MISSOURI

Figure 1




AREA WITHIN 5 MILE RADIUS OF PLANT SITE

Figure 2

The $UF_6$ feed material is received in solid form in 2.5-ton cylinders from the Department of Energy enrichment plants. As needed, the cylinders are heated in steam chests to vaporize the $UF_6$. The $UF_6$ gas is piped through insulated lines to the first fluidized bed reactor where it reacts with dry steam to form uranyl fluoride ($UO_2F_2$) and hydrogen fluoride gas (HF). The $UO_2F_2$ particulates move to a second and third reactor, where they are pyrohydrolyzed in a reducing atmosphere of dissociated ammonia to remove residual fluoride and reduce the $UO_2F_2$ to $UO_2$ powder. The gaseous HF and excess steam from the first fluidized bed reactor exit the reactor through porous metal filters and, with the offgases from the second and third reactors, are routed to dry scrubbers filled with calcium carbonate (limestone rock chips) to remove most of the gaseous HF prior to discharge to the atmosphere.

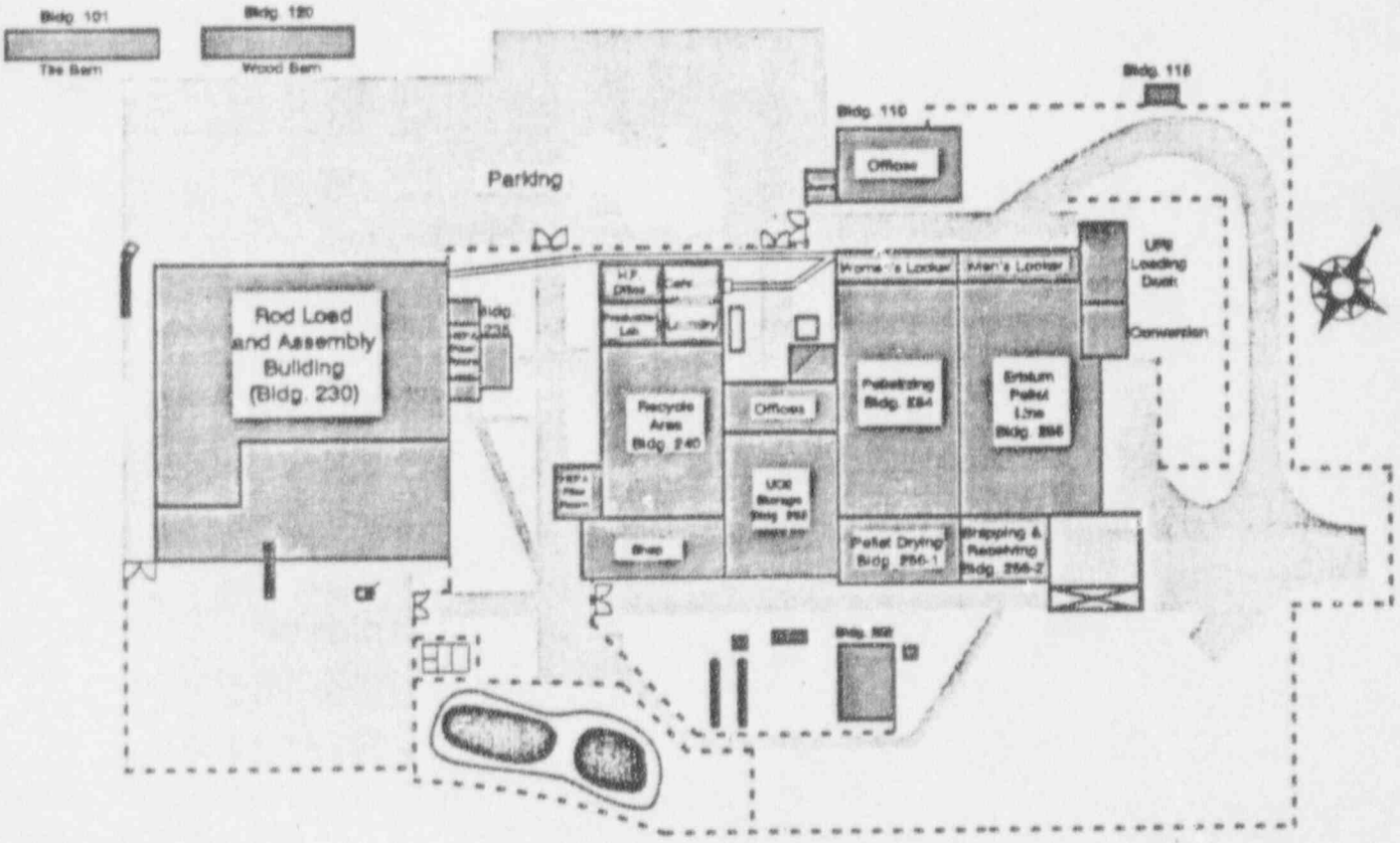
The $UO_2$ powder from the third reactor is cooled and pneumatically transferred to storage vessels. The powder is withdrawn from the storage vessels into a fluid energy mill, where the $UO_2$ for recycle can be added. The $UO_2$ is then transferred to blenders and withdrawn for pelletizing or for shipment.

To fabricate pellets, blended powder is aggregated using either an organic binder and a suitable solvent or a dry powder slugging press. The agglomerated powder is granulated to provide a consistent press feed and then pressed into pellets. The "green" pellets are processed through a dewaxing furnace to remove additives and then through a sintering furnace, where the pellets densify and achieve their desired characteristics. The sintered pellets are sized using a centerless grinder, dried, inspected, and packaged for shipment.

In 1988, a revitalization project was started for CE's facilities in Hematite, Missouri and Windsor, Connecticut. Prior to revitalization, the $UO_2$ powder produced in Hematite was shipped to Windsor for fabrication into pellets and assembly into fuel rods and fuel assemblies. After revitalization, the $UO_2$ powder was fabricated into pellets at Hematite and then shipped to Windsor for manufacture into fuel rods and assemblies.

Activities associated with the revitalization program at Hematite included expanding the fenced manufacturing area from 4-1/2 acres to 6 acres and decontaminating and demolishing two older manufacturing buildings to build a larger manufacturing building. With the new manufacturing area built, all major plant buildings adjoin one-another, which reduces the potential to track contamination to the outside (Figure 3).

The soil beneath the two buildings demolished as part of the revitalization project was found to be contaminated with uranium. Remedial work was done to remove and therefore reduce the levels of uranium contamination in the area. Since the site was not being released for unrestricted use and further excavation of the soil would have endangered the footings of an adjoining structure, the NRC granted approval to backfill the area with spent limestone and proceed with construction of the new manufacturing area. At the request of the NRC, CE has installed a ground water monitoring well, designated as the south vault well, to determine if there is any impact to the environment from




Location and Identification of Buildings and Facilities on
Combustion Engineering's Hematite Plant Site

Figure 3

the contaminated soil or the spent limestone. Results from the south vault well sampling are discussed in the groundwater section of this assessment. The record indicating the level of uranium in the soil is to be maintained in the decommissioning files. The area shall be decontaminated to unrestricted release levels when the facility is decommissioned.

On May 12, 1993, the NRC approved an amendment to license SNM-33 authorizing the consolidation of all of CE's nuclear fuel manufacturing activities to the Hematite facility. Consolidation involved relocating all nuclear fuel rod and assembly loading activities being performed at CE's Windsor, Connecticut, facility to Hematite. Modifications made to the Hematite site to accommodate the consolidation included increasing the fenced work area by approximately 2 acres, constructing a new rod and bundle assembly manufacturing building, and modifying a portion of the existing warehouse to include new pellet drying facilities.

## Effluent Monitoring

### Radiological Effluents

Effluents from the various processes are produced in gaseous, liquid, and solid forms. The effluents may contain small quantities of the uranium isotopes, U-234, U-235, and U-238. Small amounts of fluoride may also be released in the gaseous or liquid effluents. The requirements of the Operational Effluents Monitoring Program are described in Table 1.

TABLE 1
EFFLUENT MONITORING PROGRAM

| SAMPLE MEDIUM | SAMPLE POINTS | COLLECTION & ANALYSIS FREQUENCY | SAMPLE TYPE | ACTION LEVEL |
|---|---|---|---|---|
| AIR | Exhaust Stacks[1] | Continuous & analyze weekly | Particulate | Two week average MPC |
| | Conversion offgas stack[2] | Continuous & analyze weekly | Gaseous & Particulate | |
| LIQUID | Site Dam[3] | Continuous & analyze weekly | Composite | Above 10 percent MPC |
| | Sewage Treatment Outfall[3] | Weekly | Grab | Above 10 percent MPC |

[1] Analysis required - Gross alpha
[2] Analysis required - Fluoride and gross alpha
[3] Analysis required - Gross alpha and beta

**Airborne**

Air effluents from process areas and process equipment involving uranium in a dispersible form are subject to air filtering prior to release to the atmosphere. Stack samples from the process areas are continuously collected on a particulate filter while the process is in operation, with the filters being changed weekly. However, effluents from a new waste stream will be sampled more frequently until effective control is assured. The sample filters are analyzed for gross alpha levels after suitable delay for the decay of the naturally occurring radon daughter products. The results of the exhaust stacks are added together to determine the total gross alpha released from the site. The lower limit of detection for the instrument used to analyze the sample shall be no more than 5 percent of the values specified in 10 CFR Part 20, Appendix B, Table II, Column 1, Concentrations in Air and Water Above Natural Background. The locations of the exhaust stacks are shown in Figure 4.

The CE control limit for gross alpha activity in the exhaust air effluents released from the site is $4 \times 10^{-12}$ uCi/cc, averaged over a 2-week period. An additional control limit of 150 uCi per calendar quarter has been instituted for total plant exhaust stack effluents.

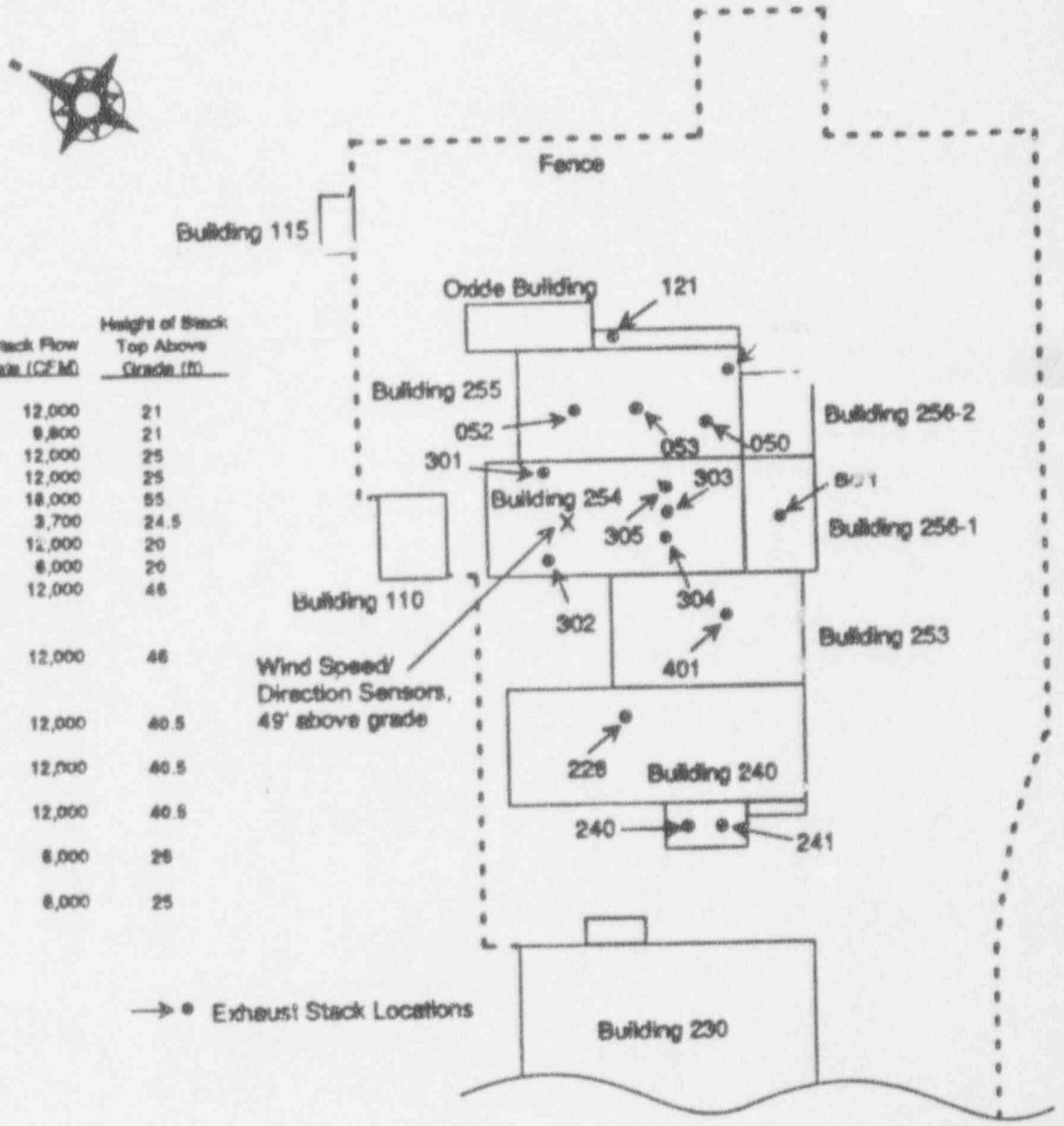
The stack monitoring data for 1982 through September 1993 demonstrates that the levels of gross alpha activity released from the site do not exceed the limits specified in 10 CFR Part 20, Appendix B, Table II, Column 1.

The oxide plant dry scrubbers are also sampled to determine the level of fluoride being emitted from the stack. Fluoride is the major non-radioactive material released from the site as a result of plant operations. There are no State or Federal regulations in place limiting the amount of fluoride discharged to the atmosphere. From 1982 through 1993, the total fluoride released to the atmosphere ranged from 8,500 to 41,300 pounds (3,855 to 18,730 kilograms).

**Liquid**

There are no planned releases of radioactive liquid wastes from routine production processes. Radioactive liquid wastes are generated from mop and cleanup water, the wet recovery process, grinder coolants, and scrubber solution but are not released as liquid effluents. Liquids with low-uranium content, such as mop water, cleanup water, and grinder coolant water, are collected and then evaporated to recover the uranium. Liquids with higher uranium content are processed to recover the uranium, usually by precipitation and filtration. Process filtrates, including wet recovery system filtrate and spent scrubber solutions, are routed to a calibrated tank, mixed, sampled, and the filtrates are then evaporated, solidified with concrete, and packaged for shipment to a licensed burial site.

| Stack No. | Identification | Stack Flow Rate (CFM) | Height of Stack Top Above Grade (ft) |
|---|---|---|---|
| B050 | Pellet Plant West System | 12,000 | 21 |
| B051 | Pellet Plant East System | 9,800 | 21 |
| B052 | Bldg. 255 Pelletizing Area | 12,000 | 25 |
| B053 | Bldg. 255 Furnace Area | 12,000 | 25 |
| B121 | Oxide Building | 18,000 | 55 |
| B226 | Red Room Dry Side | 3,700 | 24.5 |
| B240 | Red Room Wet Side | 14,000 | 20 |
| B241 | Green Room - Incinerator | 6,000 | 20 |
| B301 | Bldg. 254 East Pellet Line, Powder Preparation, Pressing | 12,000 | 46 |
| B302 | Bldg. 254 East Pellet Line, Powder Preparation, Pressing | 12,000 | 46 |
| B303 | Bldg. 254 East Pellet Line, Furnace Area | 12,000 | 40.5 |
| B304 | Bldg. 254 West Pellet Line, Furnace Area | 12,000 | 40.5 |
| B305 | Bldg. 254 Grinders, Pellet Loading | 12,000 | 40.5 |
| B401 | Bldg. 253 Recycle Loading | 6,000 | 26 |
| B501 | Bldg. 256 Pellet Drying Area | 6,000 | 25 |




Exhaust Stack Locations

Figure 4

A potential source of radioactive liquid waste is from the laundry and sink and shower areas. The laundry water is filtered and sampled prior to discharge to the sanitary sewer system. The water from change room sinks and showers is also discharged through the sanitary waste system. Effluents from the sanitary waste system enter the site creek immediately below the site pond dam. A grab sample of the water is taken each week and analyzed for gross alpha and beta activities. The control limits for liquid effluents are $3.1 \times 10^{-5}$ mCi/ml for alpha and $2.0 \times 10^{-5}$ mCi/ml for beta. The lower limit of detection for these samples is less than 5 percent of 10 CFR Part 20, Appendix B, Table II, Column 2, limits.

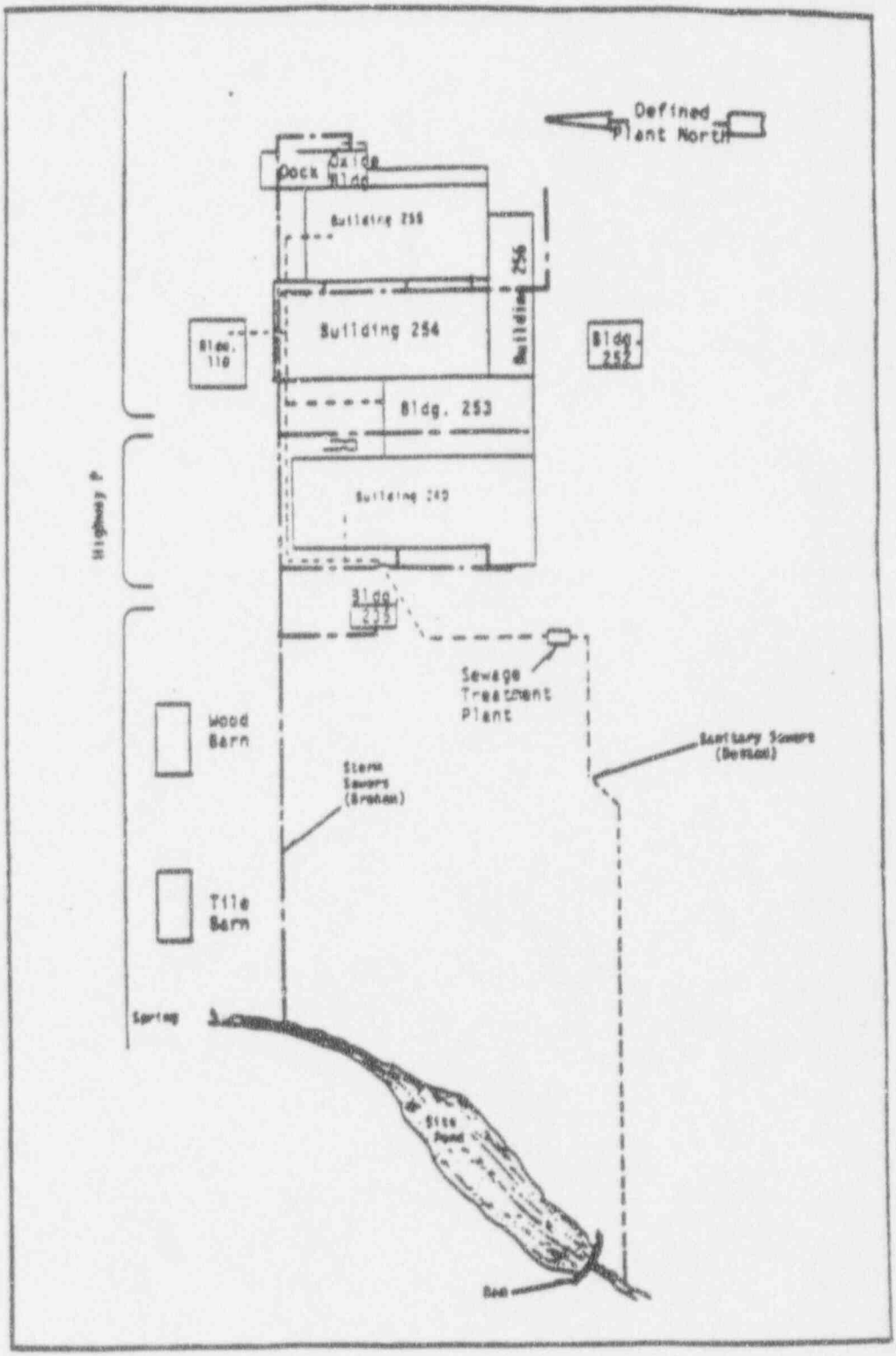
The chemistry laboratory, which discharges to the storm drain system, is another potential source of radioactive liquid effluents. While analytical residues are recycled to recover the uranium and therefore do not contribute to the effluents, as the laboratory glassware is cleaned, small amounts of liquids wash down the sinks and are discharged to the storm drain system. The storm drain system discharges into the site pond which overflows to form the site creek. The overflow is sampled weekly and analyzed for gross alpha and beta. The control limits for these samples are $3.0 \times 10^{-6}$ mCi/ml for alpha and $2.0 \times 10^{-6}$ mCi/ml for beta. The lower limit of detection is less than 5 percent of 10 CFR Part 20, Appendix B, Table II, Column 2, limits. The sanitary and industrial waste flowpaths from the plant are shown in Figure 5.

Liquid effluent sample data for 1982 through September 1993 was reviewed and indicates that the results are a small fraction of the values set forth in 10 CFR Part 20, Appendix B, Table II, Column 2.

The sediment in the vicinity of the two liquid discharge areas is not routinely sampled and analyzed. The staff recommends that the sediment in the vicinity of the liquid discharge areas be sampled annually to determine if there is any reconcentration of radioactivity in the sediment.

In compliance with the Federal Water Pollution Control Act and the Missouri Clean Water Law, the State of Missouri, Department of Natural Resources, issued authorization to discharge under the National Pollutant Discharge Elimination System (NPDES). The current NPDES permit was issued on December 11, 1992, and will expire on September 21, 1997.

The staff recommends that the licensee notify the NRC if the conditions of the NPDES permit are violated or if the permit is amended or revoked.




**Sanitary and Industrial Waste Line Flows**

Figure 5

Water samples collected at the site pond overflow sample location are also analyzed for fluoride concentration. During the period of review, the NPDES permit limit for the concentration of fluoride in the sample was 2.0 milligrams per liter. The fluoride data from the samples collected is less than the value permitted by the NPDES permit.

**Solid Waste**

Solid wastes which are potentially contaminated are generated throughout the controlled area. These wastes consist mostly of rags, papers, packaging materials, worn-out shop clothing, equipment parts, and other miscellaneous materials that result from plant operations. After passive assay (gamma counting) to determine the U-235 content, combustible wastes are incinerated. Non-combustible wastes are compacted in 55-gallon drums or packaged in metal boxes for shipment to a licensed low-level burial site. Bulky items with low levels of surface contamination are placed directly into the metal boxes.

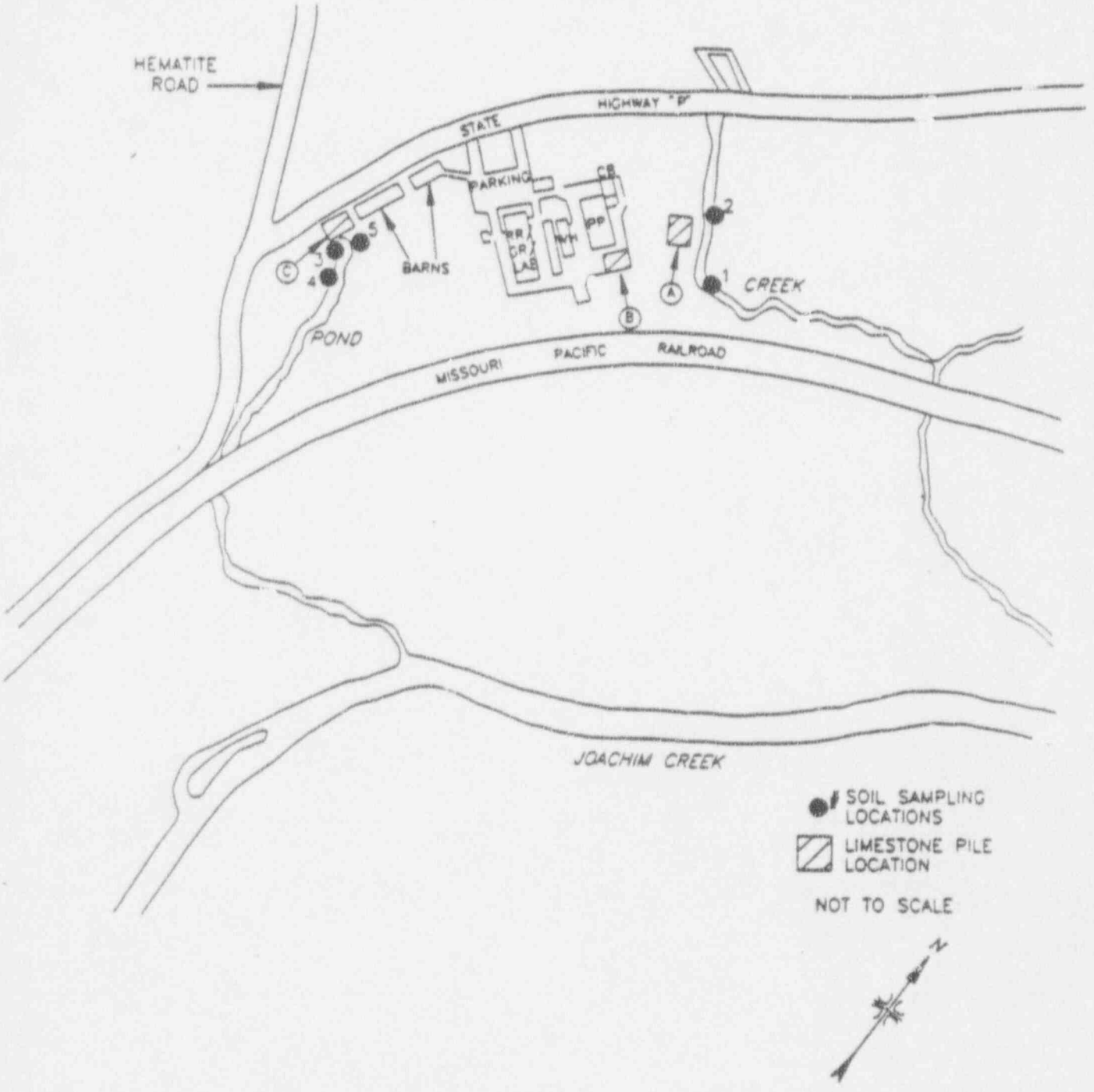
Two gas-fired incinerators are used to reduce the volume of combustible wastes that would otherwise be shipped to a licensed burial site. The incinerators also supplement the oxidation/reduction furnaces used to reduce wastes containing recoverable quantities of uranium. The incinerators are equipped with wet scrubber systems to clean the off-gas prior to routing to the exhaust stacks.

**Spent Limestone**

CE has requested the unrestricted release of spent limestone for use as fill material. Spent limestone is the limestone rock chips that have been partially converted to calcium fluoride when gaseous HF and excess steam pass through the dry scrubbers. After the spent limestone is removed from the scrubbers, it is monitored for gross alpha and beta activities. The spent limestone is currently located onsite in three piles, designated as Piles A, B, and C (Figure 6).

In the past, spent limestone with no measurable alpha activity and with beta levels less than five times background has been approved for use as fill material at Piles A and C. Limestone with alpha levels less than 1,000 dpm/100cm$^2$ is located at Pile B, an intermediate storage pile located within the fenced work area. If the alpha levels are greater than 1,000 dpm/100cm$^2$, the limestone is packaged and shipped to a licensed low-level burial site for disposal.

When the operating license was last renewed (1983), CE was required to implement a monitoring program to determine if there was any environmental impact from using spent limestone as fill material. The results of the spent limestone monitoring program conducted by CE indicated that the total uranium




Locations of Spent Limestone Piles

Figure 6

content in the piles of spent limestone was less than the NRC Branch Technical Position (Ref. 7) guideline of 30 pCi/gram and that there was no significant buildup of uranium in the soil in the vicinity of the fill material areas (Ref. 8).

At the request of the NRC, the Environmental Survey and Site Assessment Program (ESSAP) of Oak Ridge Associated Universities (ORAU), conducted two confirmatory radiological surveys of the spent limestone piles and surrounding areas. The first survey, conducted in August 1989, measured the level of uranium in the soil in the vicinity of limestone Piles A and C. Exposure rate measurements taken at contact and one meter from the ground surface around the two limestones piles were within the range previously determined as background for this region of Missouri. The total uranium content identified in the soil samples collected around the two piles ranged from 3.4 pCi/gram at the creek bed north of Pile A to 150 pCi/gram below the retaining wall near Pile C (Ref. 9).

ESSAP conducted the second survey in November 1990 to obtain sufficient data to evaluate the radiological status of the limestone piles (Ref. 10). This survey concluded that Piles A and C have total uranium concentrations less than 30 pCi/gram, which is within federal guidelines (Ref. 7). However, the total uranium concentration in Pile B exceeded the federal guideline of 30 pCi/gram.

The staff recommends that CE be allowed to use spent limestone, with an average total uranium concentration less then 30 pCi/gram, as fill material onsite. Spent limestone containing an average total uranium concentration greater than 30 pCi/gram should be disposed of as low-level waste.

By letter dated August 9, 1991, CE submitted a report describing a new procedure for sampling spent limestone as it is unloaded from the dry scrubbers. The new sampling procedure is the result of a study conducted by CE to determine if there is a significant statistical difference in the results of the spent limestone samples taken at different elevations from the dry scrubber. The study concluded that there is no significant statistical difference between the samples, and therefore, a sample from any location is representative of the activity of the spent limestone rock within the scrubber. The staff has reviewed the data from the study and agrees with the conclusion that the sampling procedure will adequately assess the uranium content of the spent limestone.

Environmental Monitoring

The purpose of the facility's environmental monitoring program is to determine if operations are having an impact on the environment surrounding the plant. Air, soil, vegetation, surface water, and ground water samples are collected from various locations on or near the plant site. The environmental samples are collected and analyzed as shown in Table 2.

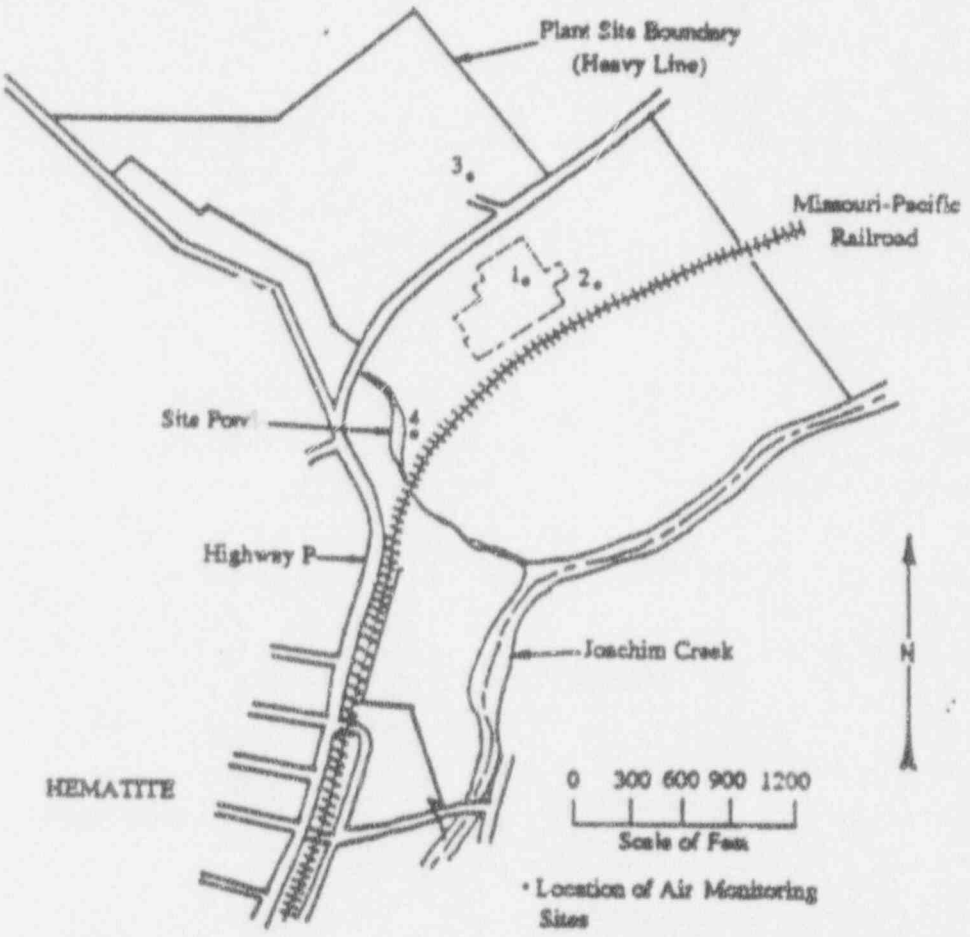
TABLE 2
ENVIRONMENTAL MONITORING PROGRAM

| SAMPLE MEDIUM | SAMPLE POINTS | COLLECTION & ANALYSIS FREQUENCY | SAMPLE TYPE |
|---|---|---|---|
| Air[1] | 3 Onsite Remote | Continuous & analyze monthly | Particulate |
| Surface Water[2] | Joachim Creek Above & below Site Creek Outfall | Monthly | Grab |
| | Joachim and Site Creek Confluence | Quarterly | Grab |
| Ground Water[2] | Plant Well | Monthly | Grab |
| | Offsite Well (Hematite) | Quarterly | Grab |
| | 3 Evaporation Pond Wells | Monthly | Grab |
| | South Vault Well | Monthly | Grab |
| | 4 Burial Ground Wells | Monthly | Grab |
| Soil[2] | 4 Locations Surrounding Plant | Quarterly | Grab |
| Vegetation[3] | 4 Locations Surrounding Plant | Quarterly | Grab |

[1] Analysis required - Gross alpha
[2] Analysis required - Gross alpha and beta
[3] Analysis required - Fluoride, gross alpha, and beta

**Air**

Air particulate samples are collected at three locations (designated as east, west, and southeast) on CE's property but outside of the fenced work area. The air samplers run continuously with the sample being collected on a particulate filter. This filter is changed weekly and analyzed for gross alpha levels. The locations of the sampling points are indicated in Figure 7.




| Sample No. | Table No. | Description |
|---|---|---|
| 1 | 13-1 | Stack Monitor |
| 2 | 13-2 | Environmental - Offsite Southeast |
| 3 | 13-2 | Environmental - Offsite East |
| 4 | 13-2 | Environmental - Offsite West |

LOCATIONS OF AIR MONITORING SITES

Figure 7

While the east and west sampling locations have been in service for many years, the southeast sampler was placed in service in February 1990, as a result of findings from an NRC inspection team that was sent to the site to investigate an unplanned release of $UF_6$ that occurred on August 28, 1989 (Ref. 11).

A review of the data from the three air sampling locations for 1982 through September 1993 indicates that the gross alpha and beta levels are a small fraction of values allowed by 10 CFR Part 20, Appendix B, Table II, Column 1.

**Soil**

Soil samples are collected quarterly from four locations surrounding the plant. These samples are analyzed for gross alpha and beta levels. The sampling locations are indicated in Figure 8.

A review of the soil sampling data for 1982 through September 1993 demonstrates that there is no indication of uranium accumulating or concentrating at any of the sampling locations. The annual average alpha levels are well below the recommended federal guideline of 30 pCi/gm (Ref. 7).

**Vegetation**

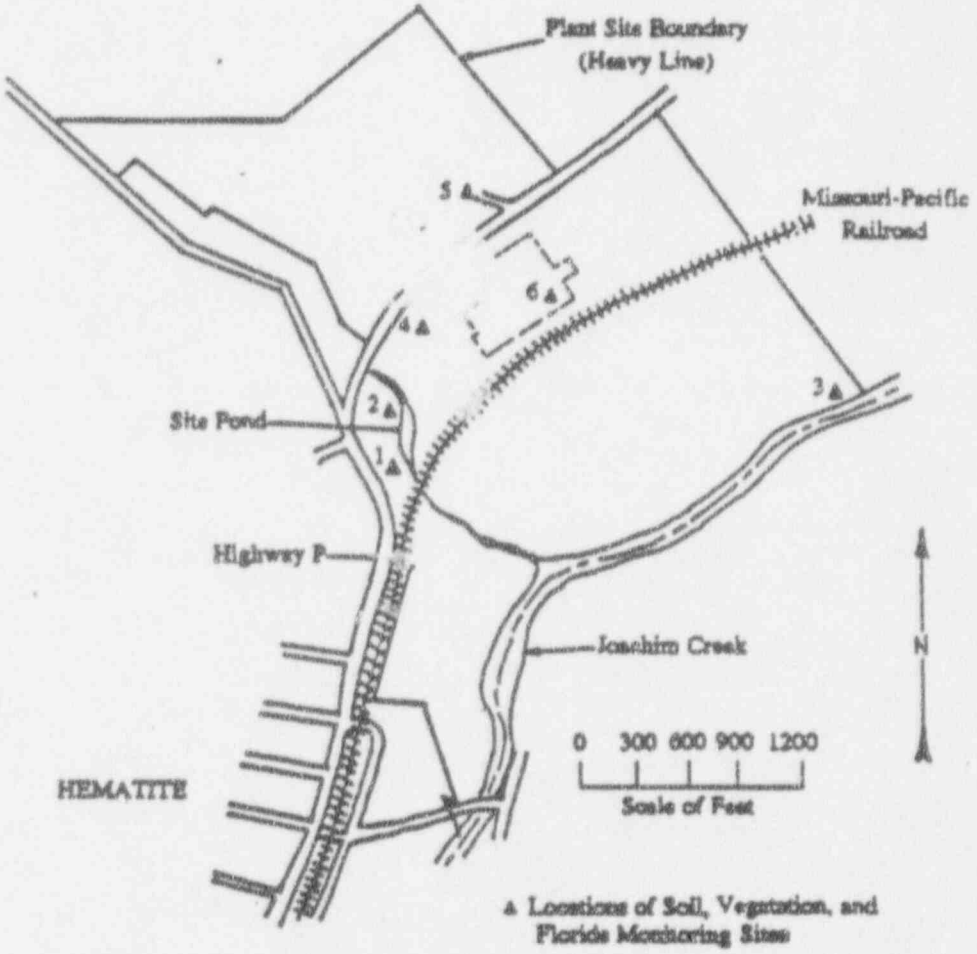
Vegetation samples are collected at four locations surrounding the plant. These four locations are at or near the soil sampling locations. The samples are collected quarterly and analyzed for gross alpha and beta levels and fluoride levels. Vegetation samples are collected at the locations designated in Figure 8.

The vegetation data reviewed for 1982 through September 1993 indicates that there is no accumulation of uranium in the vegetation surrounding the plant.

**Surface Water**

Surface water samples are collected monthly from one location upstream and one location downstream of the Joachim Creek and site creek confluence. A surface water sample is also collected quarterly at the confluence of Joachim and the site creeks. All samples are analyzed for gross alpha and beta levels. Surface water samples are collected at the locations indicated in Figure 9.

A review of the sample data for 1982 through September 1993 indicated that there is no statistical difference in gross alpha or beta activities between the upstream and downstream sample locations on the Joachim Creek or at the

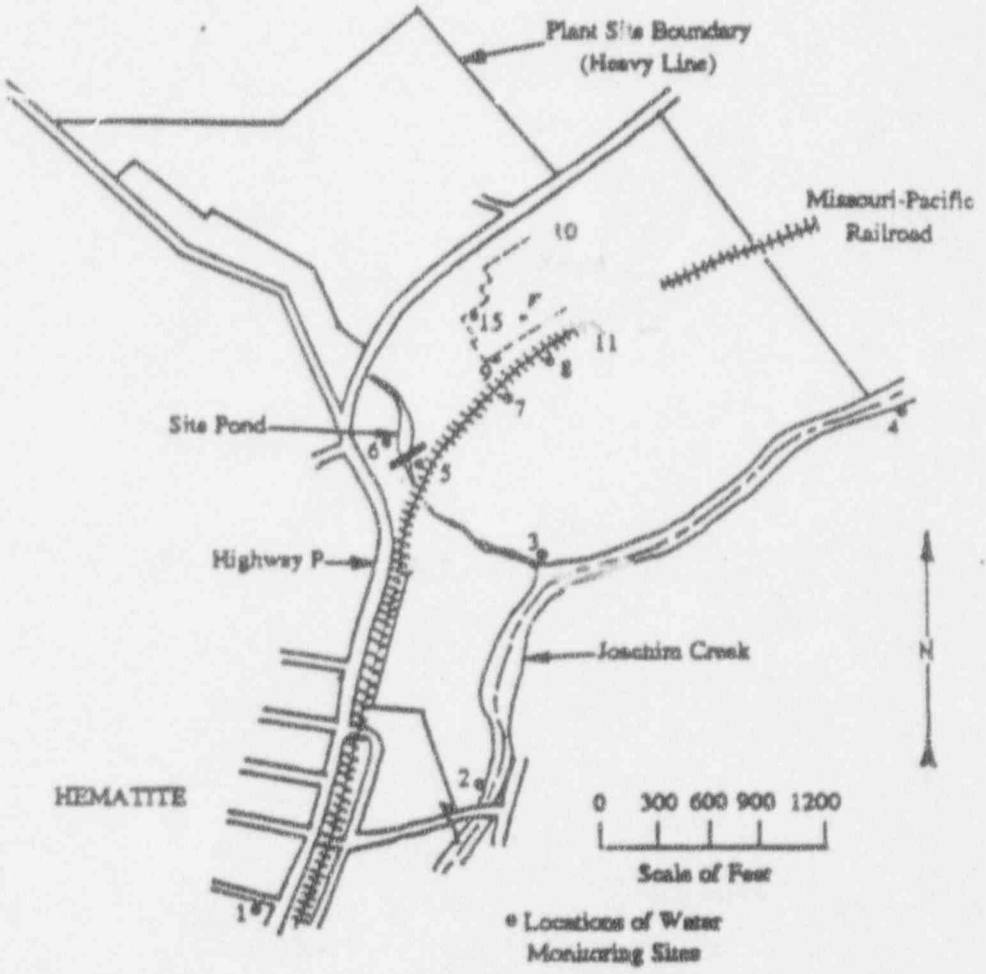



▲ Locations of Soil, Vegetation, and Floride Monitoring Sites

| Sample No. | Table No. | Description | Sample No. | Table No. | Description |
|---|---|---|---|---|---|
| 1 | 13-15 | Soil - Station #14 | 4 | 13-15 | Soil - Station #15 |
| | 13-16 | Vegetation - Station #14 | | 13-16 | Vegetation - Station #15 |
| | 13-19 | Fluoride - Station #14 | | 13-19 | Fluoride - Station #15 |
| 2 | 13-18 | Site Dam Overflow - Fluoride | 5 | 13-15 | Soil - Station #13 |
| 3 | 13-15 | Soil - Station #12 | | 13-16 | Vegetation - Station #13 |
| | 13-16 | Vegetation - Station #12 | | 13-19 | Fluoride - Station #13 |
| | 13-16 | Fluoride - Station #12 | 6 | 13-17 | Fluoride - Background |

LOCATIONS OF SOIL/VEGETATION/FLUORIDE MONITORING SITES

Figure 8




| Sample No. | Table No. | Description | Sample No. | Table No. | Description |
|---|---|---|---|---|---|
| 1 | 13-6 | Hematite Well | 9 | 13-7 | Retention Pond Well-North |
| 2 | 13-4 | Joachim Creek - Upstream | 10 | 13-11 | South Vault Well |
| 3 | 13-6 | Joachim Creek - Confluence | 11 | 13-13 | Burial Ground Well #4 |
| 4 | 13-6 | Joachim Creek - Down Stream | 12 | 13-12 | Burial Ground Well #1 |
| 5 | 13-14 | Sewage Outfall | 13 | 13-13 | Burial Ground Well #3 |
| 6 | 13-3 | Site Dam Overflow | 14 | 13-12 | Burial Ground Well #2 |
| 7 | 13-9 | Retention Pond Well-Southwest | 15 | 13-10 | Site Well |
| 8 | 13-8 | Retention Pond Well-Southeast | | | |

LOCATIONS OF WATER MONITORING SITES

Figure 9

Joachim and site creek confluence. The surface water sample results are a small fraction of the amount permitted by 10 CFR Part 20, Appendix B, Table II, Column 2.

**Ground Water**

Ground water is collected from several sampling wells onsite, including the plant well, and from one private well in the town of Hematite, 0.7 miles southwest of the CE site. The purpose of the ground water sampling program is to determine if site activities, the burial site, or evaporation ponds are having an impact on the ground water. The ground water from the site are collected monthly and analyzed for gross alpha and beta activities. The well in Hematite is sampled quarterly and analyzed for gross alpha and beta activities. The ground water sample locations are shown in Figure 9.

The sample data for 1982 through September 1993 was reviewed for the private and plant wells. The gross alpha level in both wells is less than the limit of 15 pCi/l in the National Primary Drinking Water Regulations (40 CFR Section 141.15). The beta activity to the total body or any internal organ is limited by 40 CFR Section 141.16 to an annual dose of 4 mrem. Calculating the total body dose equivalent using the maximum annual average beta activity from the sample data results in a dose equivalent of 0.006 mrem/year from the plant well and 0.009 mrem/year from the private well.

In late 1990, the south vault ground water sampling well was drilled to determine if the contaminated soil and the spent limestone beneath the manufacturing areas were having an impact on the ground water. Sampling of this well began in January 1991, and a review of the data from January 1991 through September 1993 indicates there has been no migration of contamination into the groundwater.

By letter dated April 11, 1990 (Ref. 12), CE submitted for NRC review and approval its plan for monitoring possible migration of radioactive material from the burial site, evaporation ponds, and the limestone fill areas. In response to NRC's request, CE submitted additional information on its ground water monitoring program by letter dated September 21, 1990 (Ref. 13). This ground water sampling program appears to be adequate for identifying ground water contamination from the migration of radioactive material.

**Evaporation Ponds**

In 1958, two evaporation ponds (also referred to as retention ponds) were dug in the southwest corner of the site's fenced work area. The ponds were originally installed to receive filtrate from the low-enriched ammonium diuranate conversion facility but were also used by previous owners for the disposal of both high- and low-enriched recovery waste liquids. After CE took control of the facility in 1974, only low-enriched liquid wastes from scrap

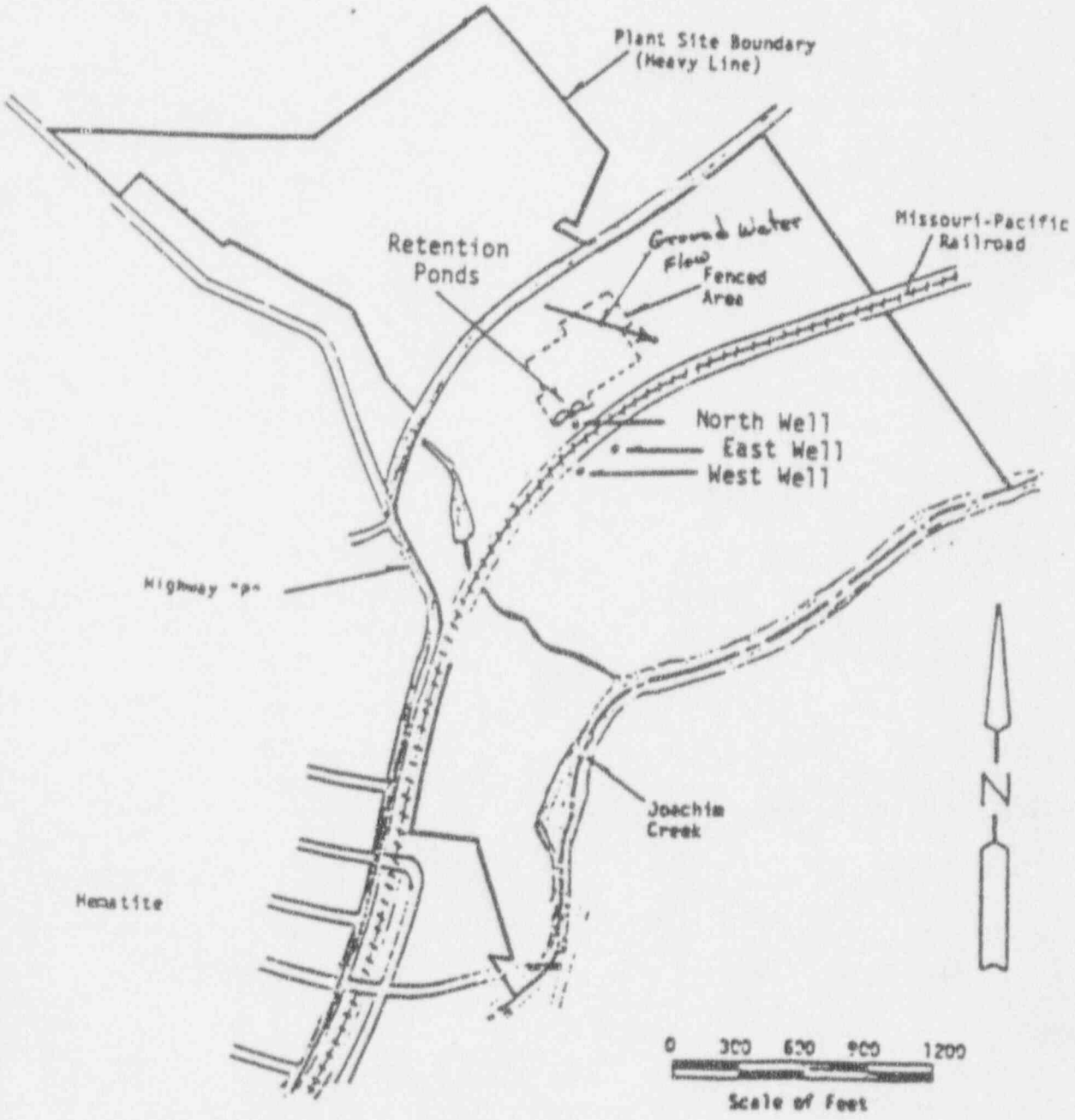
recovery processes were discharged to the ponds. All discharges to the two ponds were stopped in September 1978.

The two ponds were lined by a 6-inch layer of 3-inch diameter rocks under a 4-inch layer of 1/2-inch diameter rocks. The resulting reservoir was 2 1/2 feet deep with a 1 1/2 foot high berm around the ponds. The size of the primary pond was 30 by 45 feet. The secondary pond was 30 by 85 feet. The two ponds were separated by a distance of 12 feet.

Radioactive liquid wastes were discharged into the primary pond where insoluble uranium-bearing precipitates and other solids were allowe settle. As additional liquids were added, the overflow from the pr... d flowed through a pipe into the secondary pond. Sludge accumulation i... secondary pond was minimal because of the small amount of solids brought over from the primary pond in the overflow.

In the fall of 1976, ground water monitoring wells were dug near the ponds to monitor for any migration of contaminants from the ponds. The wells were located and constructed based on recommendations provided by a geologist from the Missouri Department of Natural Resources. Sampling data from these wells was reviewed for 1982 through September 1993 and while the level of beta activity in the north sampling well is elevated from that of the plant well, it is significantly less than the values allowed by Appendix B, Table II, Column 2, of 10 CFR Part 20. The alpha activity detected from these wells is also less than the levels permitted by Appendix B, Table II, Column 2, of 10 CFR Part 20. The locations of the wells are shown in Figure 10.

Decommissioning of the primary pond began in October 1979 and in June 1982 for the secondary pond. During the last license renewal, a condition was incorporated into the license that required CE to submit for NRC review and approval a decommissioning plan for the ponds. In May 1984, CE submitted a plan that included forced evaporation of the pond liquids, removal of the bottom sludge and rock lining, and decontamination of the remaining soil to established criteria (Ref. 14). The plan was approved with the condition that the average residual contamination in each pond should not exceed either 250 pCi of insoluble uranium or 100 pCi or soluble uranium per dry gram of soil. Decommissioning activities included draining the liquids from the ponds and then removing large quantities of rock and uranium contaminated sludge from the two ponds. In an attempt to decontaminate the soil under the ponds, over 2600 cubic feet of contaminated soil was removed from the primary pond and approximately 1200 cubic feet from the secondary pond. Decontamination activities were conducted until 1988 when major renovations of the facility were started.




Locations of Sampling Wells for Evaporation Ponds

Figure 10

After the contaminated soil was removed, CE conducted radiological surveys of the ponds. The survey report indicated that while the average residual contamination in each pond was less than the target of 250 pCi/gram of soil, there were areas which exceeded the 250 pCi/gram and therefore further decontamination was necessary (Ref. 15). To complete decommissioning activities, the staff recommends the following:

1. A radiological survey of the two ponds should be conducted to determine the level of residual contamination.

2. Areas identified in this survey that exceed the 250 pCi/gram level should be decontaminated to less than 250 pCi/grams.

3. From the survey results, the source term from each pond should be determined and the dose to an individual from the ground water pathway should be calculated and shown to be less than or equal to 4 mRem/yr.

4. The need for additional ground water monitoring wells in the vicinity of the ponds should be evaluated.

**Burial Site**

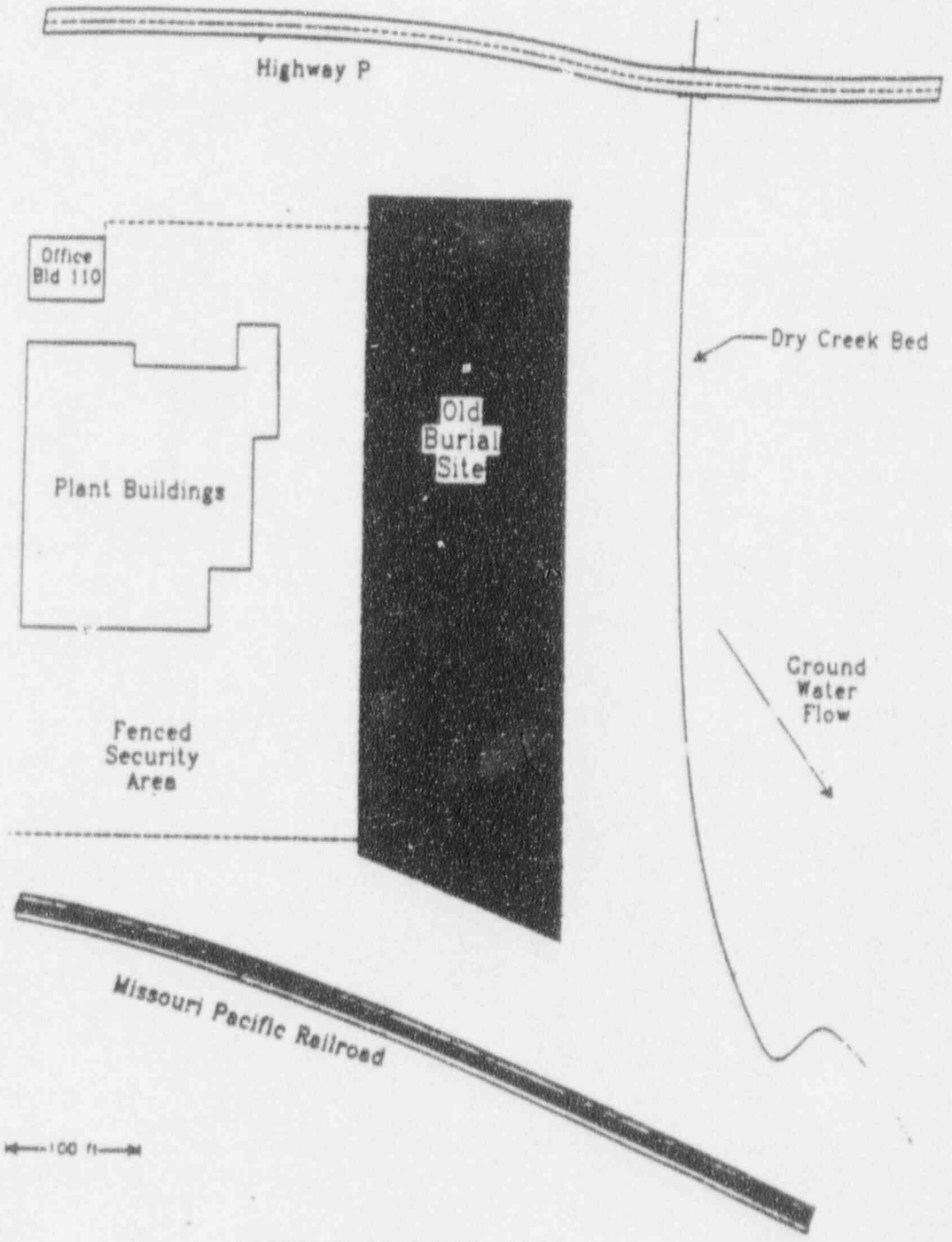
During the late 1950s and early 1960s, under the direction of Mallinckrodt and later United Nuclear, material contaminated with uranium was buried on the property, east of the facility's fenceline. The burials were made in accordance with Atomic Energy Commission regulations in place at that time. The location of the burial site is shown in Figure 11.

The burial site consists of 40 pits. Each pit is approximately 20 by 40 feet by 12 feet deep. Individual pits were not marked, but some can be found now because of ground settling. The pits were not lined nor capped with special materials but were covered with 3 to 5 feet of fill dirt.

Most of the material buried was contaminated combustibles such as paper, plastic, and wood items. However, small pieces of equipment, metal pipes, and buckets were also buried. It is suspected that a pickup truck may also be buried in one of the pits.

Plant records indicate that approximately 27 kilograms or about 60 mCi of U-235 were buried. The total amount of U-234 and U-238 buried is unknown because the buried materials were only assayed for U-235 There is also the possibility that some thorium was buried because work with thorium fuel had been performed during the time the burial site was active.

Radiation Management Corporation (RMC), under contract to the NRC, performed a detailed radiological evaluation of the burial site in the spring and summer of 1982 (Ref. 16). The purpose of the evaluation was to define the




LOCATION OF BURIAL SITE

Figure 11

radiological conditions of the burial site and to determine if radioactive material had migrated from the burial pits into the surrounding environment.

The conclusions from this evaluation were that while uranium had been buried in the pits adjacent to the plant, there has been no adverse impact to the surrounding environment from the buried material.

Four ground water monitoring wells are sampled monthly to determine if the radionuclides buried in the pits are migrating. Sampling of three of the wells began in January 1990. A fourth well was installed in 1990, with sampling beginning in November 1990. The well sample data from January 1990 through September 1993 was reviewed. The gross alpha activities from the four wells and the gross beta activities from wells 1, 2, and 3 are essentially background levels and would seem to indicate little to no impact from the burial site. However, the gross beta activity from well 4 ranges from 300 pCi/l to 2,300 pCi/l, indicating that there has been impact to the ground water from some source. The limit set in Appendix B, Table II, Column 2, of 10 CFR Part 20, for unidentified beta activity in water is 3,000 pCi/l. The staff recommends that an investigation be conducted to determine the source of the contamination to burial site well 4 and to identify the contaminants in the ground water.

Radiological Impacts from the Proposed Action

Dose to the Maximally Exposed Individual

The effective whole body dose for the maximally exposed individual is 3.31E-02 mrem/year. The critical organ for this exposure would be the lungs, with a dose of 1.90E-01 mrem/year. The contribution from each pathway to the total effective dose is given in Table 3.

TABLE 3
PATHWAY CONTRIBUTION TO TOTAL EFFECTIVE DOSE

| PATHWAY | DOSE (mrem) |
|---|---|
| Inhalation | 3.20E-02 |
| Air Immersion | 7.99E-09 |
| Surface Exposure | 6.98E-05 |
| Food Ingestion | 5.78E-05 |

The maximally exposed individual is the nearest resident who is located 950 feet (290 m), west-northwest of the plant site. The exposure pathways

involved with this dose assessment include inhalation, air immersion, surface exposure, and food ingestion. The food ingestion pathway is further broken down into produce, leafy vegetables, milk, and meat pathways. The dose assessment is very conservative since it assumes that the food products are produced and consumed by those who live at the nearest residence. The stack effluent data used to calculate the dose is from 1989 which had the highest total activity released for the period evaluated.

The annual dose received by the nearest resident is below the federal dose limits set forth in 10 CFR Part 20 and 40 CFR Part 190, 500 mrem/year and 25 rem/year, respectively.

Accidents

Both radiological and nonradiological accidents could occur at the CE facility. The types of credible accidents that could occur at this facility include a $UF_6$ release, fire, criticality accident, spill, and transportation (Ref. 17). Additionally, the impact from natural phenomena, such as floods, tornadoes, and earthquakes has been assessed. The maximum credible accident has been determined to be a release of $UF_6$, but it has been concluded that no detectable radiation injury to the offsite public would occur. The impacts from these accidents have been analyzed and described in earlier assessments (Refs. 5 and 6). Since the consequences of the credible accidents have not changed, an analysis of the accidents is not repeated in this document.

Decommissioning

At the end of its operating life, the plant will be decontaminated to the levels where the ground and buildings can be released for unrestricted use. The site and buildings will be decontaminated in accordance with "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material," dated April 1993, as referenced in Safety Condition S-4 of the existing License SNM-33.

Agencies and Persons Contacted

Staff utilized the application dated November 22, 1989, and additional information dated October 11, and December 16, 1991, and December 10, 1993. Staff toured the CE facility on August 18 and 19, 1990. The Region III inspector and CE staff were consulted in preparing this document. The staff also contacted personnel from the State of Missouri, Department of Natural Resources, Air Pollution Control Program.

Summary

The staff concludes that the impact to the environment and to human health and safety from manufacturing nuclear fuel at this site has been minimal.

Results of the environmental monitoring program indicate no significant impact to the environment as a result of site operations. Liquid and airborne effluents released to the environment are well below all regulatory limits. The total whole body dose received by the maximally exposed individual is below federal limits.

Accordingly, the staff has determined that the following recommendations should be incorporated as license conditions when the renewal license is issued:

e sediment in the vicinity of the liquid discharge areas should be pled annually to determine if there is any reconcentration of dioactivity in the sediment.

(2) The licensee should notify the NRC if the conditions of the NPDES permit are violated or if the permit is amended or revoked.

(3) Spent limestone with an average total uranium concentration less then 30 pCi/gram is permitted to be used as fill material onsite. Spent limestone containing an average total uranium concentration greater than 30 pCi/gram should be disposed of as low-level waste.

(4) To complete decommissioning activities, radiological surveys of the two ponds should be conducted to determine the level of residual contamination remaining. Areas identified that exceed the 250 pCi/gram level should be decontaminated to less than 250 pCi/grams. The source term for each pond should be determined and the dose to an individual from the ground water pathway should be calculated. The need for additional ground water monitoring wells in the vicinity of the ponds should be evaluated.

(5) An investigation shall be conducted to determine the source of the contamination to burial site well 4 and to identify the contaminants in the ground water.

Principal Contributor:
Elaine Keegan

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