R3/02#4 06/1975

CE POWER SYSTEMS

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ROUTE 21-A
HEMATITE, MISSOURI 63047

ENVIRONMENTAL IMPACT INFORMATION
COMBUSTION ENGINEERING, INC.
HEMATITE, MISSOURI PLANT SITE

NRC License No. SNM-33

Docket No. 70-36

June, 1975

1110

ENVIRONMENTAL IMPACT INFORMATION

COMBUSTION ENGINEERING, INC.

HEMATITE FACILITY

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Section I

1. BACKGROUND INFORMATION ON THE COMPANY

1.1 Scope of Company Business

Combustion Engineering is a diversified corporation providing a variety of energy related products, systems and engineering services worldwide to electric utility, petroleum, petrochemical, metallurgical and other industrial markets.

C-E provides a broad range of energy equipment including fossil fueled and nuclear steam generating systems, petroleum and gas production processing equipment, refractories, minerals, pollution control systems, screening equipment, building products, tempered safety glass, nuclear components, and designs petroleum, chemical and petrochemical process facilities.

Comprised of the four major operating groups noted below, C-E operates over 100 plants and offices in North America, and has an equal number of overseas subsidiaries, licensees and affiliates.

Power Systems Group

Power Systems was the cornerstone of the original Combustion Engineering organization and is now the company's largest operating unit. The group's activities are almost totally related to the market for energy equipment and, more important, to the worldwide growth in electric power consumption.

The group designs and manufactures fossil and nuclear fueled steam supply systems, nuclear fuel and components, heavy pressure vessels, air quality control and water treatment equipment for the electric utility industry, and industrial steam generators and marine boilers.

Engineering Group

The engineering group is comprised of three divisions: C-E Lummus, C-E Crest and C-E Reliance. The group has a broad international involvement in the design, engineering and construction supervision of projects in the chemical, petrochemical, petroleum, metallurgical and other process industries.

C-E Lummus is a leader in energy related and chemical process technology and through its extensive research programs has developed many significant processes now used on a worldwide commercial basis. The most significant of these is Lummus' ethylene process which is used to produce about half of the world's supply of important basic petrochemicals.

C-E Crest is a leading consultant and engineering organization on the technology of oil and gas field development. C-E Crest provides conceptual engineering, design and project management technology relating to the development of crude oil and natural gas. Its customers include the world's major oil and gas producers, such as Gulf, Exxon, Mobil and major consortia groups.

C-E Reliance offers total engineering capabilities in coal handling systems, from the mine through preparation to storage and loading. These systems have been designed and engineered for major coal companies and large utility companies. In addition to coal handling, C-E Reliance has also been engaged by utility companies to provide engineering service on ventilation and pollution problems.

Process Equipment Group

This group includes C-E Natco, C-E Invalco, C-E Air Preheater and C-E Raymond/Bartlett-Snow. The group manufactures and markets a wide range of energy-related products including oil and gas production processing equipment, heat exchangers and pollution control equipment.

C-E Natco is the leading designer and manufacturer of production processing systems and leading petroleum producers around the world depend on them to condition and process crude well fluids for sale and transportation.

C-E Invalco engineers, manufacturers and markets valves, instruments and controls for the oil, gas and chemical processing industries. Products include flow control devices, electronic level controls, stream analyzers, pressure switches and microvalves.

C-E Air Preheater is the world's leading manufacturer of rotary heat exchangers for energy recovery. Air preheaters are applied to electric utility and industrial steam generating plants, oil refining furnaces, glass and chemical processes, and marine propulsion systems.

C-E Raymond/Bartlett-Snow has more than 80 years' experience in the design and manufacture of process equipment. Major product lines include various types of pulverizers including roller mills and bowl mill systems, mechanical separators, and material handling systems.

Industrial Products Group

This group includes C-E Tec, C-E Glass and C-E Refractories.

C-E Tec provides a full range of services in the architectural, engineering and planning disciplines with recognized special competency in such subspecialities as environmental engineering, resource recovery and disposal of solid waste, railroad urbanology, transportation systems, urban design and housing systems.

C-E Glass provides a wide range of glass products to both the industrial and residential housing industries.

C-E Refractories produces high temperature industrial ceramic materials for lining furnaces and other heat processing and auxiliary equipment used by the steel, primary and secondary aluminum, glass making, foundry, petrochemical, rock products and utility industries.

1.2 Location of Company

Combustion's corporate headquarters are located in Stamford, Connecticut. The regular mailing address is

900 Long Ridge Road
Stamford, Connecticut 06902

Combustion's four major operating groups are headquartered in the following locations:

Major Operating Group	Regular Mailing Address
Power Systems Group	1000 Prospect Hill Road Windsor, Connecticut 06095
Engineering Group	1515 Broad Street Bloomfield, New Jersey 07003
Process Equipment Group	P.O. Box 1710 Tulsa, Oklahoma 74101
Industrial Products Group	900 Long Ridge Road Stamford, Connecticut 06902

Combustion's nuclear activities are concentrated in one of the four major operating groups; specifically, the Power Systems Group. Within this operating group are two divisions, Nuclear Power Systems Division and Power System Products Division, both of which manufacture nuclear products and related components. Identification of the division, location of the manufacturing plants and products produced at the plant are indicated below:

Division	Plant and Product
Nuclear Power Systems Division	Nuclear Fuel Manufacturing Windsor, Connecticut Low Enriched Uranium Fuel (<3.5% U-235) and related nuclear components (Nonradioactive)

Nuclear Power Systems Division	Nuclear Laboratories Facility Windsor, Connecticut Development work on low enriched uranium fuel (<3.5% U-235)
Nuclear Power Systems Division	Nuclear Fuel Manufacturing Hematite, Missouri Low Enriched Uranium Fuel (<4.1% U-235)
Nuclear Power Systems Division	C-E Avery Portsmouth, New Hampshire Internal and Structurals (Nonradioactive)
Power Systems Products Division	Nuclear Products Manufacturing Chattanooga, Tennessee Pressure Vessels, Steam Generators and Related Components (Nonradioactive)

1.3 Organizational Structure

Production work on nuclear fuel at C-E is carried out by Nuclear Fuel Manufacturing - Windsor (NFM-W) and Nuclear Fuel Manufacturing - Hematite (NFM-H). Nonproduction work on nuclear fuel at C-E is carried out by the nuclear laboratories facility located on the Windsor site.

The Nuclear Fuel Manufacturing - Windsor (NFM-W) production plant is a low enrichment (<3.5% U-235) UO_2 fabrication operation where powder is pelletized, pellets are loaded into rods which are then assembled into fuel bundles.

The Nuclear Fuel Manufacturing - Hematite (NFM-H) production plant is a low enriched (<4.1% U-235) UO_2 fabrication operation where UF_6 is converted to powder and the powder is further processed into fuel pellets.

The nuclear laboratories facility carries out nonproduction operations such as fuel pellet preparation on a laboratory scale, standard chemical analysis, metallurgical analysis, etc. All radioactive operations utilize low enriched uranium (<3.5% U-235).

Organizational information for the Nuclear Fuel Manufacturing-Hematite facility is detailed in the following paragraphs. Organizational information for the Nuclear Fuel Manufacturing-Windsor facility and the nuclear laboratories are presented in the environmental impact information report for those facilities, which was submitted separately.

1.3.1 Nuclear Fuel Manufacturing - Hematite

The Plant Manager reports to the General Manager - Nuclear Fuel Manufacturing, and is responsible for the accountability, nuclear criticality safety, industrial safety, radiological safety and environmental/monitoring related to all special nuclear material received at the Hematite facility. The Plant Manager assures compliance with the requirements and limitations set forth in the license application and pertinent regulations during all phases of the manufacturing operation.

In this position, the Plant Manager has delegated to the Production Superintendent, the Engineering Supervisor and the Production and Materials Control Supervisor responsibility to assure that all operations involving nuclear materials have been analyzed to establish the required safety limits and controls. Changes proposed by these individuals are formally described and submitted to the Nuclear and Industrial Safety and Nuclear Materials Management Supervisor for review and approval.

Section 2

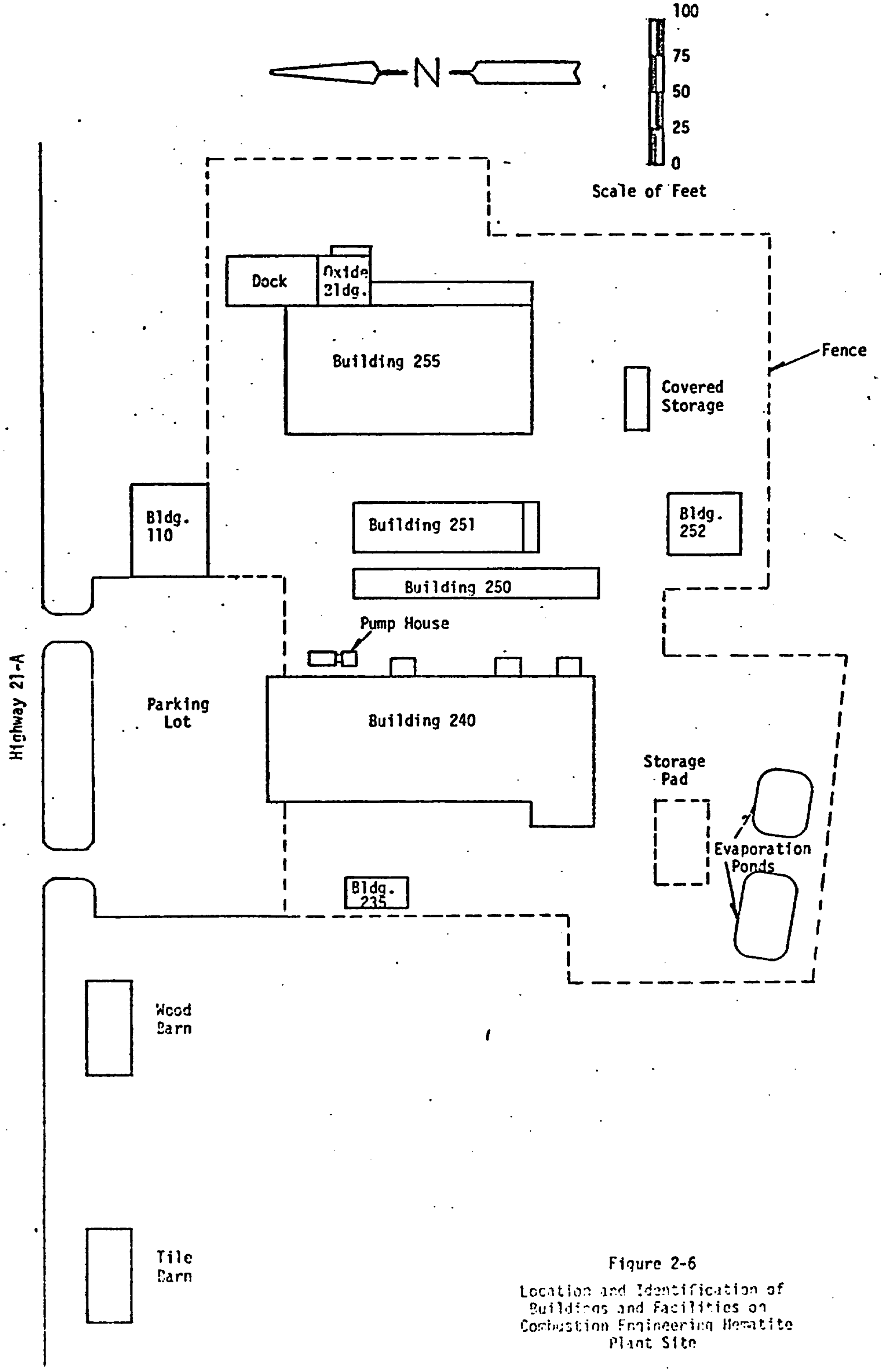

Figure 2-6

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

2. THE SITE

2.1 Location of the Plant

The C-E Hematite site is located in Jefferson County, Missouri, approximately 35 miles south of the city of St. Louis. The location of Jefferson County within the State of Missouri is shown in Figure 2-1. The site consists of 5 adjacent tracts totaling about 152 acres.

Figure 2-2 shows the location of the site within Jefferson County and transportation access to major highways. Jefferson County is predominantly rural and is characterized by rolling hills with many sizeable woodland tracts. An expanded section of the region within 5 miles of the site is shown in Figure 2-3. Small towns and settlements within 5 miles of the plant site are identified.

Figure 2-4 shows an elevated view of the C-E Hematite site. Figure 2-5 shows the boundaries of the site with respect to the town area of Hematite, an unincorporated settlement about three-quarters of a mile southwest of the plant.

2.2 Regional Demography

Jefferson County is sparsely populated with 50% of the land area classified as forest, 39% as productive farming such as grain and hay, and approximately 11% as urban, suburban, commercial and unused or undeveloped. For the total of Jefferson County, the 1970 population density is 158 people per square mile. There are approximately 60 manufacturing establishments in Jefferson County.

Festus-Crystal City, Missouri, is the nearest town of any size, being 3.5 miles east of the site and having a population of 10,699 people, based on the 1970 U.S. census. As shown in Figure 2-3, the eleven towns and unincorporated settlements of Hematite, Deerfield, Victoria, Mapaville, DeSoto, Hillsboro, Olympia Village, Horine, Festus, Crystal City and Lake Wauwanoka are wholly or partly within 5 miles of the C-E site. Hematite is the nearest town to the site, and has a population of about 225 people.

Population, distance and direction of the towns from the C-E plant site are given in Table 2-1. Other residential development has primarily been single-family homes located intermittently along the area roads.

2.3 Land Use

Figure 2-6 shows the buildings and facilities presently located on the C-E Hematite Site. Table 2-2 lists the structures by building number, building name and present utilization. Also listed is the total square footage of each.

All manufacturing operations are conducted within the fenced area located on the center site tract. The fenced area, parking lot and barns occupy about 5 acres. The remainder of the 16 acre center tract is a grassy area which is kept mowed, as is the two acre West tract. The North, East and South tracts, totaling 134 acres, remain undisturbed. Thus only about 3% of the site is being utilized, while the remaining 97% consists of woodlands, water bodies, streams and open spaces.

2.4 Meteorology

General meteorological characteristics of the Hematite site are similar to those of St. Louis, the nearest U.S. Weather Bureau recording station. St. Louis is located at the confluence of two major rivers and near the geographical center of the United States. To the south is the warm, moist air of the Gulf of Mexico, and to the north in Canada is a region of cold air masses. The alternate invasion of the St. Louis area by air masses from these sources, and the conflict along frontal zones where they come together, produce a variety of weather conditions.

Winters are brisk, but seldom severe. Snowfall has averaged less than 20 inches per Winter season since 1930. Maximum temperatures are as cold as 32° or lower less than 20 to 25 days in most years. Summers are warm with maximum temperature of 90° or higher an average of 35 to 40 days per year. The normal average annual precipitation is about 36 inches. The three Winter months are the driest, the Spring months are wettest and there are extended periods without appreciable rainfall from the middle of the Summer into the Fall.

2.5 Geology

The 240-260 million year old Mississippian rock system of the far northeastern portion of Jefferson County gradually changes to the 440-470 million year old Cambian system of the southwestern portion of the

County. The southwestern corner of Jefferson County is primarily dolomite (magnesium limestone), with sandstone and chert (angular fragments of quartz) present in various quantities. A massive sandstone ridge runs across the County and is used for glass manufacturing and building purposes. Some deposits of marble are also present in the County.

The site topsoil of the northern tract, beginning at the ridge just northward of Highway 21A, is Tilsit Silt Loam. The fenced manufacturing area is situated on the fertile alluvial Union Silt Loam of the Joachim Creek bottomland.

2.6 Company Plans for Future Site Modifications

No modifications are presently planned for alteration of the present C-E site boundary shown in Figure 2-5. Any expansion presently under consideration would take place within the fenced manufacturing area on the central site tract.

Plans presently under study are the addition of scrap recovery and purification capacity in 1976, and increase of pellet production capacity in 1978. These proposed increases in capacity would be accomplished by using space now available in existing plant structures.

A plan is also being evaluated for expansion of uranium oxide production capacity in 1978. This plan involves an addition to an existing building to house the new equipment.

The above proposed expansions would provide the capacity necessary to satisfy projected production schedules until the end of this decade. Necessity for further expansion of oxide and pellet production capacity is anticipated in 1980. Total encroachment of new facilities on available site land would still be minimal.

Table 2-1

Towns and Settlements within 5-Mile Radius of C-E Hematite Plant Site

Town[1]	General Direction From Site	Distance (Miles) From Site	Population[2]
Crystal City	E	4.5	3678
Deerfield*	E	1.5	100
DeSoto	SW	5.0	6150
Festus	E	3.5	7021
Hematite*	SW	0.5	225
Hillsboro	NW	5.0	759
Horine*	NE	5.0	350
Lake Wauwanoka*	NW	3.5	200
Mapaville*	N	3.5	50
Olympia Village*	S	5.0	150
Victoria	SW	3.0	100

[1] Towns marked with an asterisk are unincorporated settlements with no established town limits.

[2] Based on 1970 U.S. Census data, or estimated for unincorporated settlements.

Table 2-2

Buildings and Facilities on the C-E Hematite Site

Building No.	Building Name	Present Utilization	Square Footage
101	Tile Barn	Emergency Center and Equipment Storage	4,860
---	Pump House	Site Water Supply	64
110	New Office Building	Guard Station and Offices	3,000
120	Wood Barn	Equipment Storage	2,700
---	Oxide Building and Dock	UF_6 to UO_2 Conversion	2,821
235	West Vault	Natural and Depleted Uranium Storage	740
240	240-1	Offices and Cafeteria	18,365
	240-2 and 3	Recycle and Recovery Area	
	240-4	Laboratory and Maintenance Shop	
250	Boiler Room/Warehouse	Steam Supply and Storage	3,180
251	Warehouse	Shipping and Receiving and Storage	3,520
252	South Vault	Radioactive Waste Storage	2,050
255	Pellet Plant	Fuel Pellet Fabrication, UO_2 Storage and Laundry	13,363
		Total	54,663 (1.25 acres)

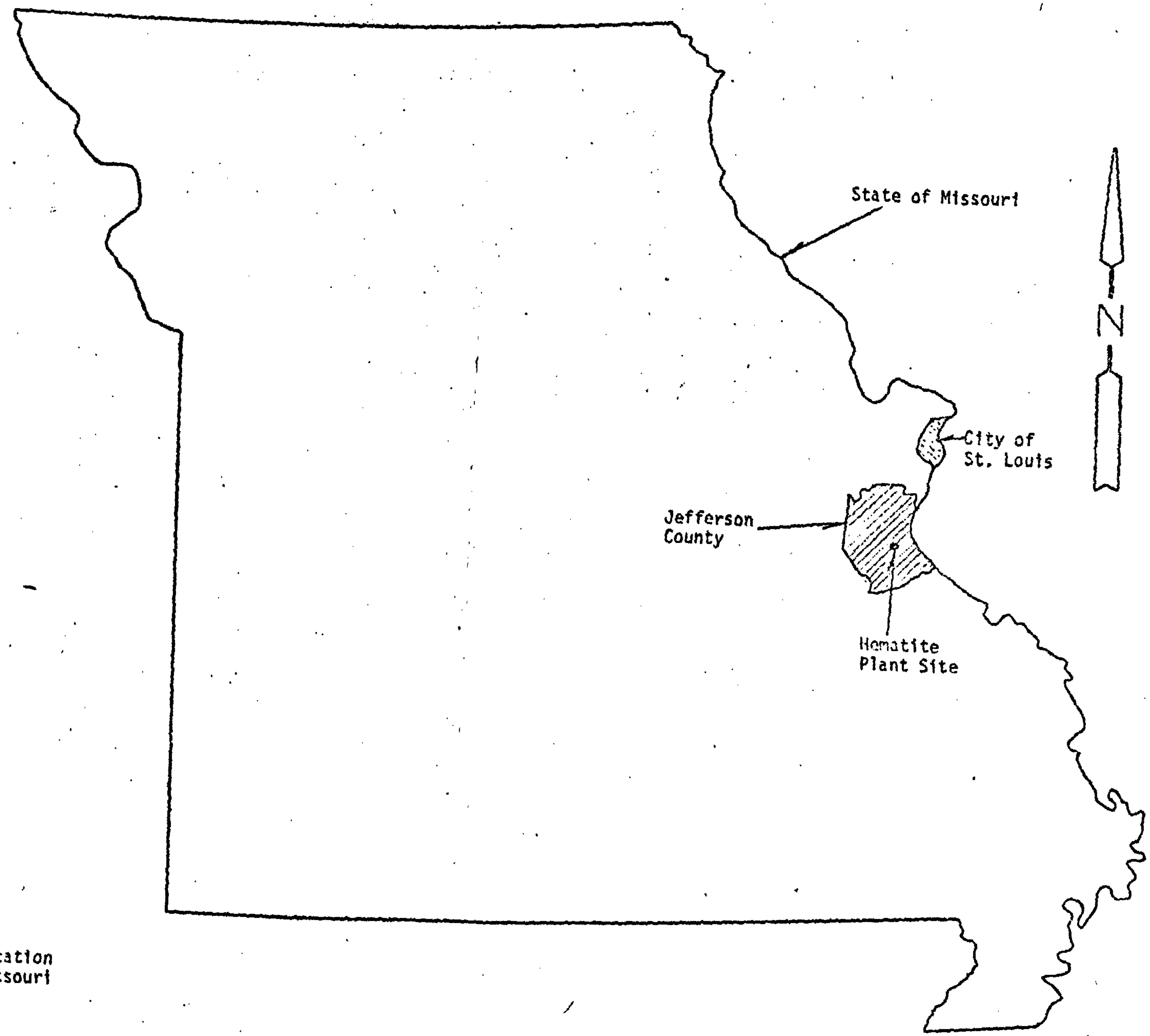

Figure 2-1

Hematite Plant Site Location
Within the State of Missouri

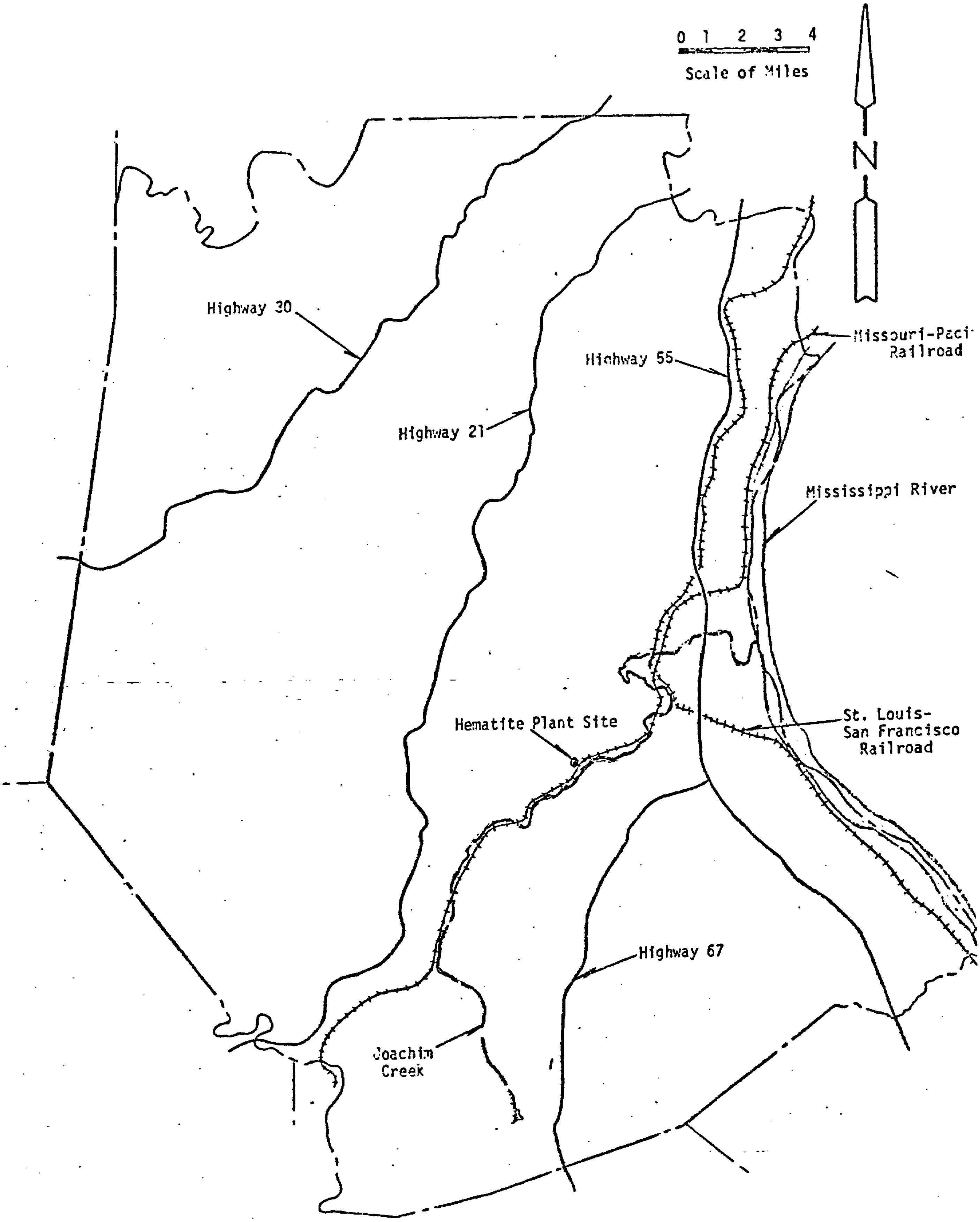

Figure 2-2

Hematite Plant Site Location Within Jefferson County and Major Transportation Links

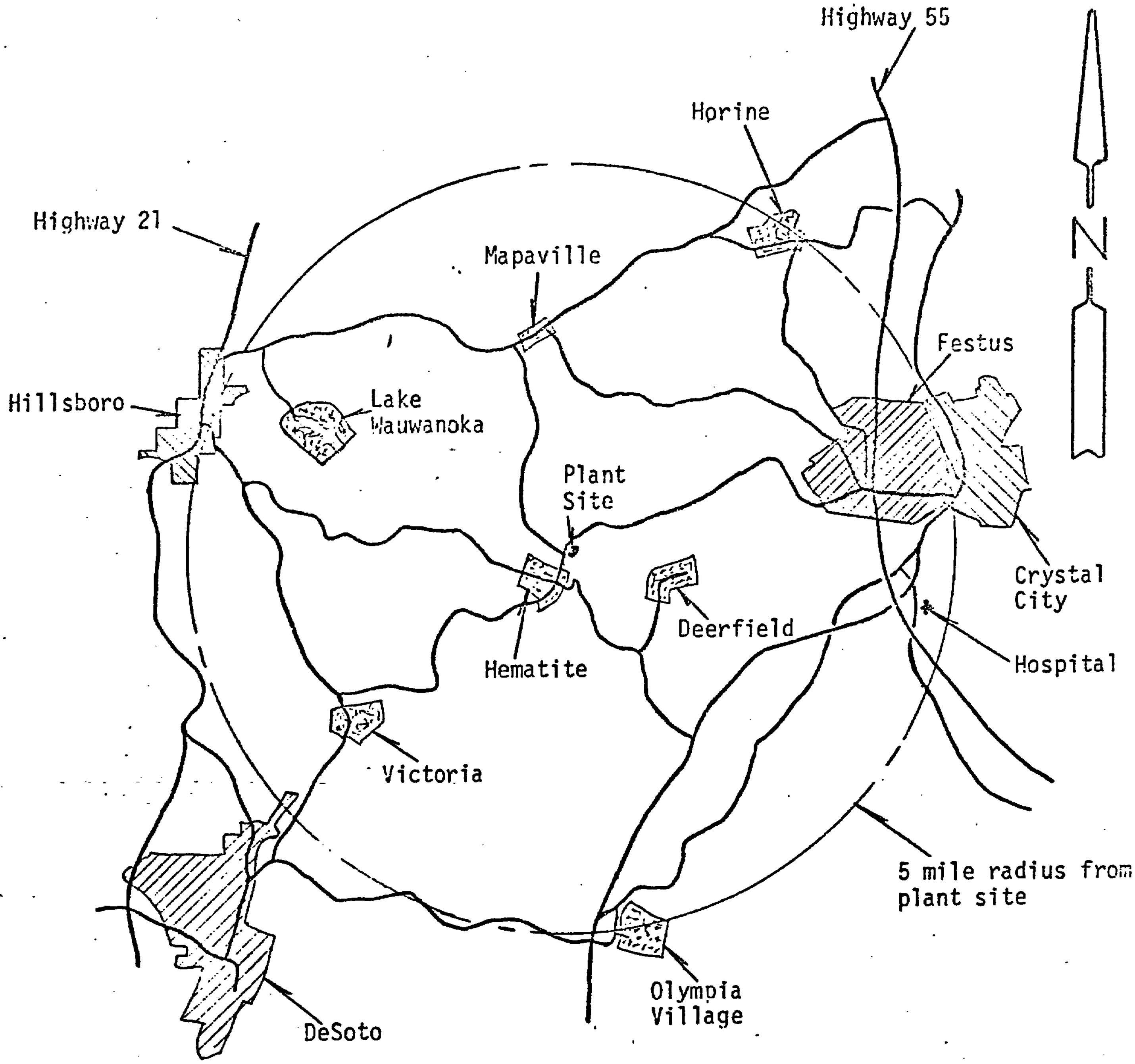

Figure 2-3

Area Within 5 Mile Radius of Combustion Engineering Plant Site

Figure 2-4
Aerial View of the C-E Hematite Site

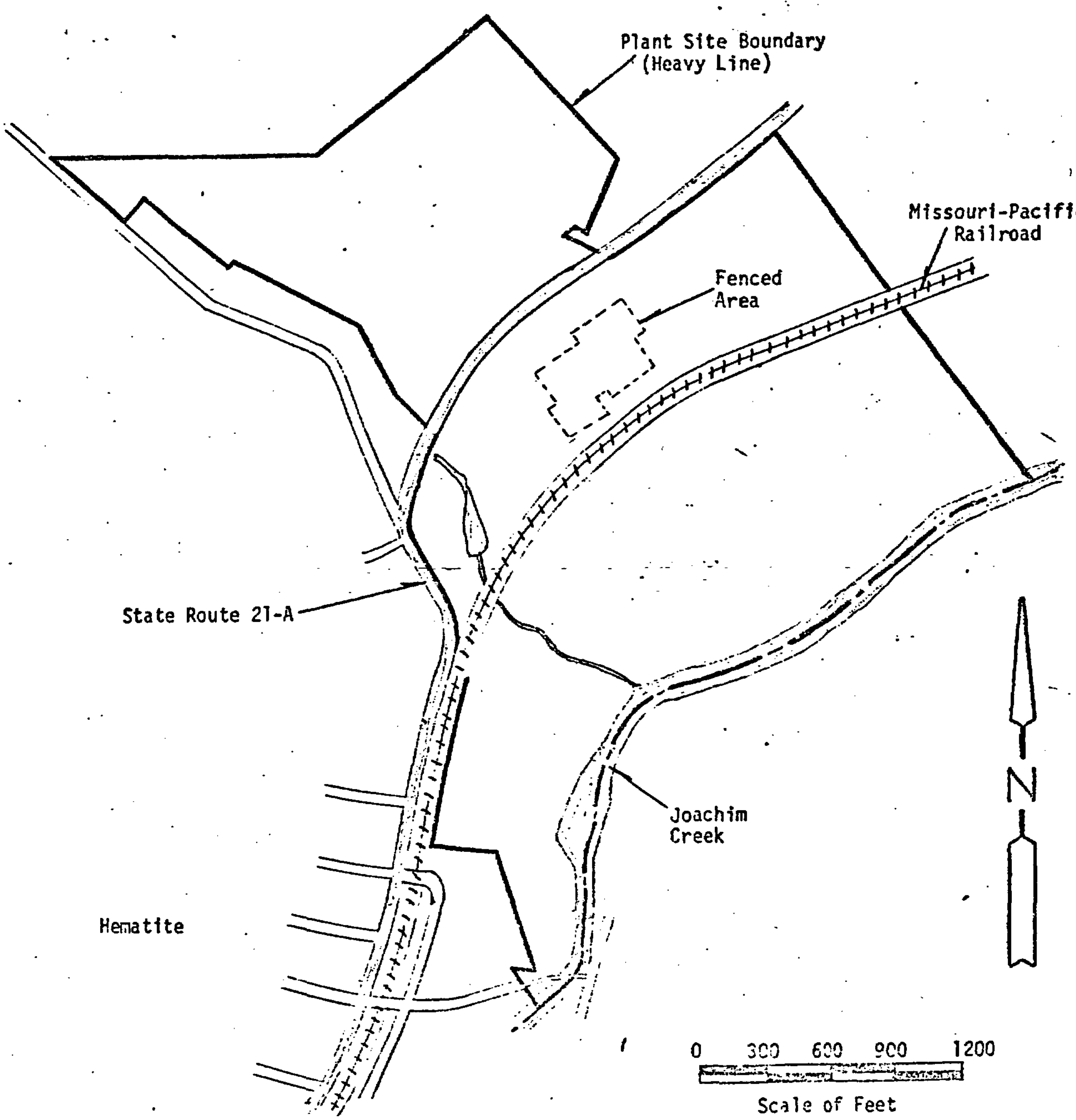

Figure 2-5

Site Boundaries and Location
With Respect to the Town of Hematite

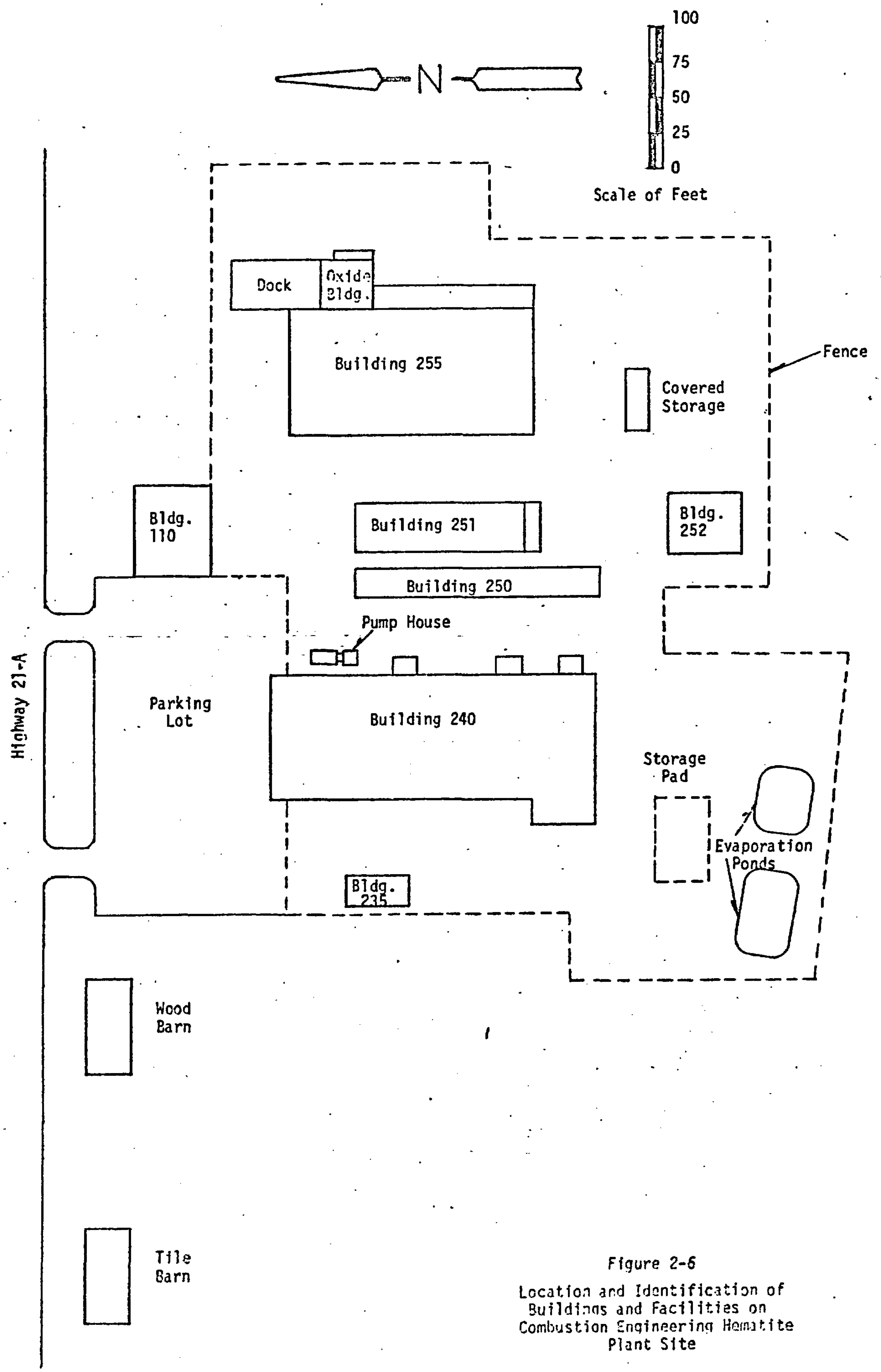

Figure 2-6

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

Section 3

3. SITE WATER SUPPLY, WATER UTILIZATION, AND DISPOSAL OF RESULTING EFFLUENT STREAMS

3.1 Site Water Supply

Water used on the C-E Hematite site is supplied by a well located on site property. On the average day, some 71,000 gallons of water are taken from the site well. Withdrawal of this amount of water has no adverse effect on the water table, as it represents a very small portion of the available supply. Artesian conditions prevail throughout most of the Mississippi River alluvial and adjoining bedrock aquifiers. The site well is artesian and there is also a spring located on the property.

3.2 Utilization of Water

Water is stored in a 5,000 gallon tank and distributed as needed within the plant, primarily to Building Nos. 255 and 240. Volume of water utilized for various purposes is indicated in Table 3-1. Categories of water utilization are discussed below.

3.2.1 Process Water

Water is used for general cleaning purposes in all areas of the plant. Radioactive waste water from cleaning of uranium residues in the manufacturing area is evaporated in a special hood to recover the uranium. Nonradioactive waste water is discharged to either the industrial or the sanitary waste systems.

Some process water is consumed in the process of converting uranium hexaflouride (UF_6) to uranium dioxide (UO_2).

3.2.1 Process Water (continued)

Other water is lost as steam used to maintain process temperatures or in heat tracing of process lines. Steam condensate is collected and discharged to the industrial waste system, or returned as boiler feed water.

Water is also used in a wet scrubber system and for washing and processing UF_6 cylinder heels. This water is tested prior to discharge to evaporation ponds located within the fenced plant area.

3.2.2 Equipment Cooling Water

Water is used in the normal operation of the facility for cooling equipment. This is the largest category of water usage on the C-E Hematite site. Equipment cooling water is essentially unchanged in both physical and chemical quality before it is discharged to the industrial waste system. Some cooling systems are recirculatory, with only evaporative losses.

3.2.3 Water for Sanitary Purposes

Water is used to service wash sinks, toilets and showers in Building Nos. 210, 240 and 255. Sanitary waste water is collected and discharged directly to the sanitary sewer system.

3.3 Disposal of Discharged Effluents

Table 3-1 indicates the type and volume of waste water effluents generated under normal conditions. Disposal of each type of discharged effluent is handled in the following manner.

3.3.1 Sanitary Waste Water Effluent

Sanitary wastes from Building Nos. 110, 240 and 255 flow into sanitary waste lines which are routed to the site septic tank. The originating points of the effluents are shown in Figure 3-2 along with the path that the wastes follow to the septic tank.

Most solids settle in the primary septic tank chamber and are digested by bacterial action. The primary septic tank chamber overflows into a dosing chamber and a float-controlled pump discharges the overflow to a sand trickling filter. The sand filter removes most of the remaining suspended solids and also reduces the BOD (Biochemical Oxygen Demand) of the effluent stream.

After passing through the sand filter, the effluent is routed to the site creek which discharges into Joachim Creek at the southern site boundary.

3.3.2 Industrial Waste Water Effluent

Industrial waste water is discharged directly to the site pond via the industrial and storm drain lines. This waste water is mostly unchanged in both physical and chemical quality and receives no treatment. The industrial effluent contains no solid wastes. The originating points, including storm drains, of industrial waste water are shown in Figure 3-1 along with the route followed by the drain lines to the site pond.

3.3.3 Radiological Waste Water Effluent

Radiological liquid wastes which contain uranium are generated in Building Nos. 240 and 255 as floor mop water and cleanup water. This water is evaporated in a special hood to recover the uranium.

Radiological liquid wastes from the wet scrubber system and UF_6 cylinder heel washing and processing operations in Building 240 are discharged to evaporation ponds located within the fenced plant area. This waste water is tested prior to discharge to determine that uranium concentrations are below acceptable levels.

Other radiological wastes, containing only small quantities of uranium are generated by the laundry, cleaning of glassware in the laboratory, and the sinks and showers in the change room. The laundry and laboratory effluents are discharged to the industrial waste system and the change room liquid wastes are routed to the sanitary waste system.

Table 3-2 summarizes the results of the laundry water monitoring program. Sample collection and analysis is discussed in Section 5.1.1.

TABLE 3-1

WATER UTILIZATION AND EFFLUENT WASTE STREAMS

Water Utilization in gpd	
Process Water	25,600
Equipment Cooling Water	44,000
Water for Sanitary Purposes	1,400
Type and Volume of Effluents in gpd	
Industrial Waste Water	64,000
Sanitary Waste Water	1,400
Radiological Waste Water	
a. Discharged to Industrial System	3,500[1]
b. Discharged to Sanitary System	1,000[2]
c. Discharged to Retention Ponds	100

[1] Mostly deionized water from laboratory with no contamination.

[2] Mostly water from showers with only trace quantities of uranium.

Table 3-2

C-E Hematite, Radioactivity Analyses, Laundry Water - December 1974 - May 1975

Month	Washer Number	Cycle	Highest Weekly Sample ($X10^{-5}$ μCi/ml)	Average Concentration ($X10^{-5}$ μCi/ml)	Total Monthly Discharge (μCi)
Dec.	1	Wash	0.62	0.38	32.6
	1	Rinse	1.30	0.53	
	2	Wash	1.02	0.35	
	2	Rinse	0.19	0.08	
Jan.	1	Wash	1.14	0.53	81.1
	1	Rinse	0.49	0.28	
	2	Wash	0.16	0.13	
	2	Rinse	0.43	0.18	
Feb.	1	Wash	0.44	0.22	12.7
	1	Rinse	0.32	0.11	
	2	Wash	0.10	0.06	
	2	Rinse	0.05	0.03	
Mar.	1	Wash	0.16	0.11	8.3
	1	Rinse	0.11	0.07	
	2	Wash	0.13	0.06	
	2	Rinse	0.10	0.06	
Apr.	1	Wash	0.26	0.17	24.1
	1	Rinse	0.80	0.32	
	2	Wash	0.66	0.37	
	2	Rinse	1.78	0.48	
May	1	Wash	0.83	0.47	28.4
	1	Rinse	0.44	0.22	
	2	Wash	0.88	0.34	
	2	Rinse	0.33	0.24	

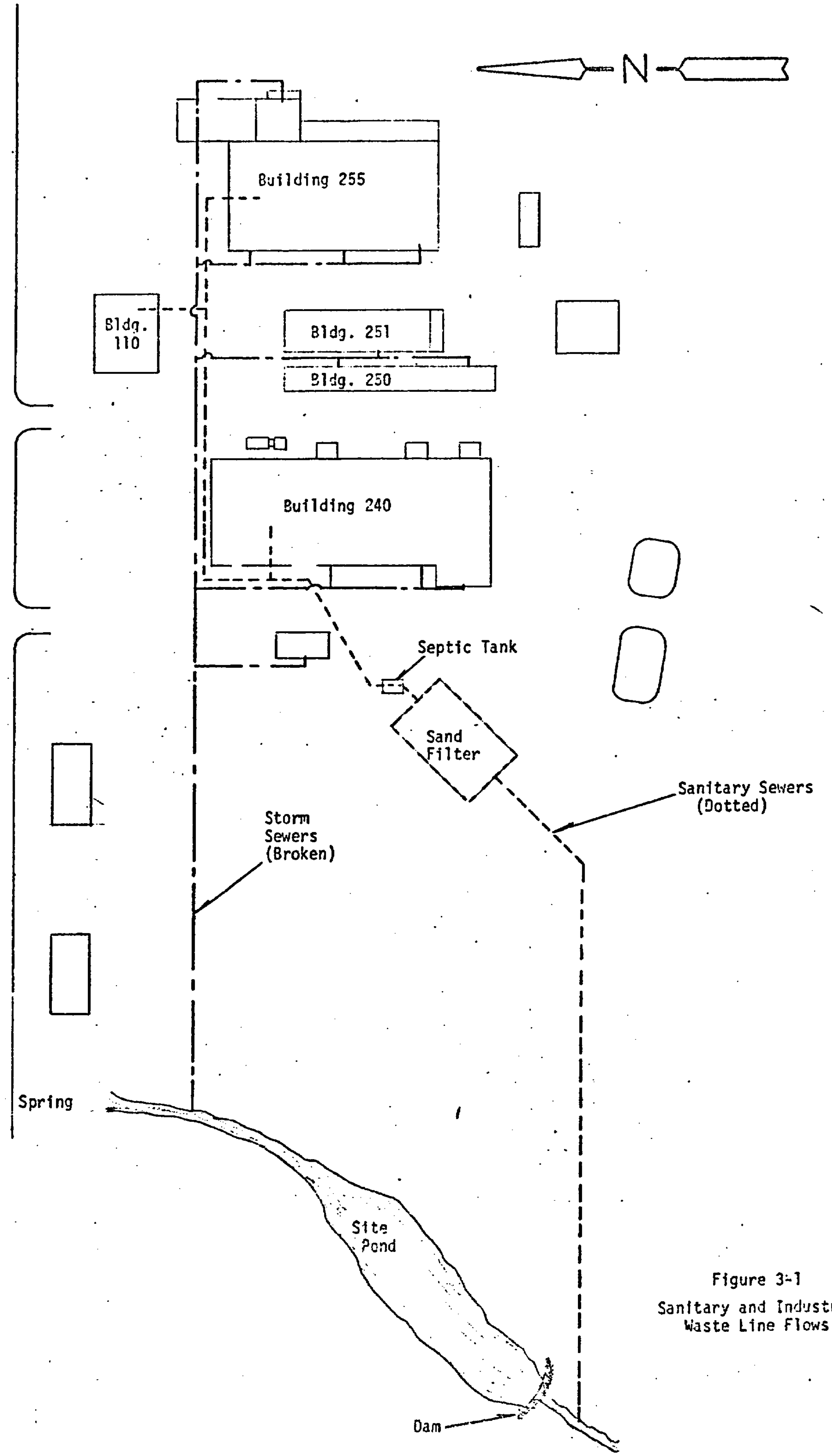

Figure 3-1

Sanitary and Industrial Waste Line Flows

Section 4

4. THE PLANT

4.1 Plant History

The Hematite facility was built in 1956 by Mallinckrodt Chemical Works to produce both high and low enriched uranium compounds from UF_6. It was the first plant built for the commercial production of nuclear reactor fuel. In 1958, the plant was expanded to provide production capacity for low enriched UO_2 fuel pellets and high enriched uranium metal.

Plant ownership was transferred to United Nuclear Corporation in 1961 when Mallinckrodt, Olin-Matheson and Nuclear Development Associates combined their nuclear operations. Naval reactor fuel production capability was added in 1963. In 1971 the plant was sold to the Gulf Oil Company as part of the divesture of United Nuclear Corporation's commercial operations.

Combustion Engineering obtained the Hematite facility from Gulf in May 1974. All operations involving high enriched uranium were closed and then decontaminated. Cleanup, refurbishing and testing was conducted from May 1974 until startup with low enriched uranium in September 1974.

4.2 General Description of Site Facilities Handling Low Enriched Uranium (<4.1% U-235)

4.2.1 Oxide Plant

The Oxide Plant (Powder Production Area) is a four-level building, 31' x 36', that has concrete flooring, corrugated plas-steel siding, and a metal roof. This building is an addendum to the original Building 255 and opens directly into the pelletizing facility. The Oxide Building is approximately 50' in height. Adjoining the Oxide Plant is a 31' x 55' dock area that has a concrete floor and a metal roof.

4.2.2 Pellet Plant, Building 255

Building 255 measures 83' wide x 161' long and is 17' high. This building has concrete flooring, concrete block walls, and a concrete-on-metal roof. The Pellet Production area utilizes a portion of this building approximately 83' wide by 83' long. The remainder of the building is used for offices, storeroom, workbreak area, UO_2 product storage in sealed containers, and the site laundry.

4.2.3 Recycle/Recovery and Laboratory, Building 240

Building 240 is 83' wide x 215' long and is 16' high. The building has concrete flooring, exterior concrete block walls with windows, and a concrete-on-metal roof. About 6000 square feet of the area is utilized for uranium recycle and recovery operations with the remainder of the building used as office area, clothing change and locker rooms, showers, maintenance shop, and laboratory space.

The Quality Control Laboratory is located in the southwest corner of Building 240. An area of approximately 2500 square feet is utilized for testing of the chemical and physical properties of uranium oxide, pellets and other materials.

4.2.4 Warehouse, Building 251

Building 251 is used for in-process storage of uranium compounds. The building is 32' wide x 110' long and is a prefabricated steel structure with galvanized metal walls and roof and concrete flooring. Shipping and Receiving quarters are also housed in this building.

4.3 Description of Operations

The C-E Hematite plant contains equipment for conversion of low enriched uranium, up to 4.1 percent U-235 in the form of uranium hexafluoride (UF_6), to uranium dioxide (UO_2) powder suitable for pressing into reactor fuel pellets. The Hematite facility also contains equipment to convert the UO_2 powder into finished fuel pellets, suitable for encapsulating in fuel rods. Shipments of uranium dioxide powder and pellets are made from the Hematite plant to the C-E Nuclear Fuel Manufacturing (NFM-W) facility in Windsor,Connecticut.

The NFM-W plant contains equipment to manufacture fuel rod and fuel bundle hardware, finished uranium dioxide fuel pellets suitable for encapsulating in fuel rods, and completed fuel rods. The completed fuel rods are assembled into fuel bundles which are then shipped to the customer's nuclear reactor site.

A description of manufacturing processes used at C-E Hematite to convert UF_6 to UO_2 powder and finished fuel pellets is given below.

4.3.1 Chemical Processing

Operations involving chemical processing include conversion of UF_6 to UO_2, the recycle of scrap product, and the recovery of uranium from UF_6 cylinder "heels".

The conversion of UF_6 to UO_2 utilizes a fluidized bed process. UF_6, enriched in the U-235 isotope up to 4.1%, is received in 2.5-ton, 30-inch diameter cylinders, each contained within a protective shipping fixture. A cylinder is placed within a steam chamber and heated to vaporize the UF_6. Vaporized UF_6 flows through piping connected to the cylinder valve into a fluidized bed reaction vessel where it is hydrolyzed with steam to form uranyl fluoride (UO_2F_2) and hydrofluoric acid (HF). The UO_2F_2 is then subjected to a reducing atmosphere and heat to form UO_2. Offgases are filtered and channeled through dry scrubbers to remove uranium compounds and HF before release to the outside atmosphere. The UO_2 powder is cooled and pneumatically transferred to storage silos to await further processing.

Scrap product is normally prepared for recycle by heating in an air atmosphere to form U_3O_8, which is then heated in a reducing atmosphere and converted to UO_2. This oxidation-reduction operation is performed in enclosed reaction boxes located in Building 240. Offgases are passed through a wet scrubber and then filtered before release.

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Scrap product is normally prepared for recycle by heating in an air atmosphere to form U_3O_8, which is then heated in a reducing atmosphere and converted to UO_2. This oxidation-reduction operation is performed in enclosed reaction boxes located in Building 240. Offgases are passed through a wet scrubber and then filtered before release.

Recovery of the UF_6 heels, left in the cylinders after vaporization, involves introducing a small amount of water to hydrolyze the UF_6 to UO_2F_2. The UO_2F_2 is reacted with ammonia to precipitate ammonium diuranate (ADU). The ADU slurry is then pumped through a filter press to remove the ADU, and the liquid phase is quarantined to allow thorium daughter products to decay. The ADU filter cake is converted to U_3O_8 and subsequently to UO_2 in the oxidation-reduction reaction boxes described above.

4.3.2 Mechanical Processing

UO_2 powder is withdrawn from the storage silos and milled to the specified particle size. Recycle material, after meeting exacting quality standards, is added at this processing step. Milled UO_2 is pneumatically transferred to blenders for use in the Pellet Plant, or can also be packaged for shipment or storage.

4.3.3 Fuel Pellet Fabrication

The UO_2 powder is transferred from the blender to the agglomeration station and agglomerated using an organic binder and a suitable solvent. The agglomerated powder is discharged to a dryer and conveyed to a granulator where it is granulated to insure consistent press feed sizing. A lubricant is then added to prevent binding in the press die cavities and the resulting press feed is again blended.

The press feed is pressed into "green" pellets of carefully controlled size, weight, and density. The "green" pellets discharged from the presses are processed through a reducing atmosphere in a dewaxing furnace to remove the binding and lubricating material introduced prior to the pressing operation. The dewaxed pellets are then processed through the reducing atmosphere of a sintering furnace where the desired final pellet density is obtained.

After sintering, the pellets are ground to a standard diameter, dried, purity tested and inspected. Pellets passing all necessary tests are aligned on corrugated trays and packaged for shipment.

Table 4-1 summarizes the current operations performed in manufacturing UO_2 pellets and powder and the generation of effluents associated with those operations. Shown within the table are processing steps, equipment used, and type and treatment of effluents from each major process step classified as to liquid, gaseous, or solid. Other plant operations listed in Table 4-1 are regeneration of the demineralized water system, Quality Control Laboratory operations, site laundry operation, and steam boiler treatment.

4.4 Types of Radiological Effluents and Methods of Treatment and Disposal

4.4.1 Radiological Waste Water Effluent

All liquid wastes which contain uranium compounds in Building 255, including the Oxide Plant, are generated as floor mop water, laundry water, grinder coolant, cleanup water, and water from the sinks in the toilet and step-off pad areas.

Liquid wastes in Building 240 which contain uranium compounds are generated primarily by UF_6 cylinder wash processing, wet chemical analysis, cleaning of laboratory glassware, and water from the sinks and showers in the change room.

Liquid radiological wastes generated in Building 255 as centerless grinder coolant water, floor mop water and cleanup water are collected and then evaporated in a closed, filtered hood to recover the uranium. Liquid radiological wastes from the cylinder wash processing in Building 240 are collected and stored in 55 gallon drums to allow the thorium and other uranium daughters to decay to acceptable concentrations prior to discharge to the site evaporation ponds. This liquid is sampled and counted for gross alpha and beta activity. Quarantine storage is continued until the fractional MPC for alpha activity (2×10^{-5} μCi/CC) plus the fractional MPC for beta activity (3×10^{-5} μCi/CC) do not exceed unity:

$$\frac{\text{Alpha Activity}}{2 \times 10^{-5}} + \frac{\text{Beta Activity}}{3 \times 10^{-5}} < 1$$

Laboratory residues from wet chemical analyses are collected and stored for recovery of the contained uranium. Spent scrubber solution from the wet scrubber serving the oxidation-reduction and pyrohydrolysis furnaces in Building 240 is collected in a holding tank and sampled for uranium content prior to discharge to the evaporation ponds within the fenced manufacturing area.

Liquid wastes from the sinks and showers are discharged directly to the Site septic tank. Liquid wastes from the laundry and from cleaning of glassware in the laboratory are discharged to the industrial waste drains, which also carries equipment cooling water and serves as the storm drain system. The storm sewer discharges into the site pond which overflows to form the site creek. The overflow is continuously proportionately sampled and analyzed for gross alpha and beta activity.

The site creek discharges into Joachim Creek at the southern site boundary. Joachim Creek ultimately discharges into the Mississippi River.

4.4.2 Radiological Airborne Waste Effluent

Airborne radiological wastes are discharged from the Oxide Building as a result of the UF_6 to UO_2 conversion process, and from Building 255 as a result of the UO_2 pellet fabrication processes. As shown in Figure 4-1 there are eight release points of airborne radioactive materials from the Oxide Building. Offgases from the UF_6 to UO_2F_2 conversion process pass through two sets of porous metal filters and are then routed through dry scrubbers. The dry scrubbers are filled with limestone which reacts with hydrofluoric acid in the filtered offgases to form calcium fluoride.

Process ventilation air from the Oxide Building is passed through single absolute filters (99.97% efficient for removal of 0.3 micron particles) and vented through exhaust stacks to the atmosphere. Continuous sampling is provided for each exhaust stack.

Process ventilation air from the Pellet Plant, Building 255, is exhausted through two new manifold systems which were installed in May, 1975. These new consolidated systems replaced 15 individual exhaust stacks. Each system contains two banks of absolute filters and two banks of prefilters. Prefilters are also located near the ventilated equipment to preserve the effectiveness and longevity of the final filters in the consolidated exhaust systems. The final filters are equipped with pressure differential measuring devices to detect filter loading. The three exhaust points shown in Figure 4-1 are continuously monitored whenever operations involving dusting or potential release of radioactive material are in progress.

Air borne radiological wastes released from Building 240 are generated as a result of cylinder heel wash processing and the oxidation-reduction and pyrohydrolysis processing of recycle material. Ventilation air from the cylinder heel process equipment is exhausted through a single absolute filter and continuously sampled. The offgases from oxidation-reduction and pyrohydrolysis boxes are routed through a wet scrubber using a potassium hydroxide solution to remove hydrofluoric acid, and then through a single absolute filter and continuously sampled.

All stacks used for exhausting of radioactive effluents are equipped with continuous samplers, with the exception of laboratory fume hoods handling wet chemicals and two of the three room air exhausts for the Pellet Plant dewaxing and sintering furnace area. All stacks have single or double absolute filters except for the laboratory fume hoods, the Pellet Plant furnace area and Oxide Building room air exhaust, and the Oxide Building offgas exhaust which has other filtration and scrubbers as discussed above.

Table 4-2 summarizes the analytical results of the exhaust stack monitoring program. Exhaust stack sample collection and counting is described in Section 5.1.2.

Exhaust stacks have the following flow rates:

Stack Number	Identification	Ft^3 /Min.
017	255 Roof Exhaust	8,900
050	255 West Manifold	13,000
051	255 East Manifold	9,500
101	Oxide Utility Hood	800
102	UO_2 Milling Hood	1,600
103	Filter Cleanout Hood	2,075
106	Oxide Main Exhaust	5,725
112	Transfer to Silos	200
113	Transfer to Blenders	200
114	Dry Scrubber Manifold	1,100
117	Oxide Roof Exhaust	8,500
231	240 Filter Press	1,600
228	240 Loading Hood	2,500
230	240 Scrubber Exhaust	100
226	240 Sample Hood	800

Locations of the stacks listed above are shown in Figure 4-1.

4.4.3 Radiological Solid Waste

Solid wastes containing uranium compounds are generated at all process steps and pieces of equipment throughout the facility controlled areas. Solid wastes consist mostly of rags, papers, packaging materials, worn out shop clothing and other miscellaneous materials generated during normal processing operations. These wastes are collected in containers located strategically throughout the facility. Full waste containers are placed in a nondestructive passive assay unit (gamma counter) to determine the U-235 content. Scrap uranium is not considered waste, as it is discrepant material which can be reprocessed.

Gamma counted solid wastes are placed in 55-gallon steel drums and then sealed for delivery to a waste disposal contractor licensed by the NRC. Bulky items with only low levels of surface contamination are placed in plastic-lined wooden boxes for delivery to the waste disposal contractor, or decontaminated. For the 9 month period since startup with enriched uranium in September, 1974, 1350 cubic feet of solid wastes containing 15,760 grams of uranium, with 475 grams of U-235, have been shipped for disposal.

In addition, 640 cubic feet of solid wastes containing 6175 kilograms of uranium depleted in the isotope U-235 was also shipped during this period. This depleted material was from startup testing in the Summer of 1974.

Solid wastes in the form of calcium fluoride and unreacted limestone are generated in the Oxide Building dry scrubbers. This material is surveyed for uranium contamination and shipped for burial by the licensed contractor if found to be contaminated. Normally, it is uncontaminated and is presently used as fill material for low areas within the fenced manufacturing area.

Solid waste in the form of lime is generated in Building 240 by the process of adding lime to the ADU filtrate to fix residual uranium in low concentrations. This lime will be discharged with the filtrate to the site holding ponds when the thorium concentration has decayed to below MPC (see Section 4.4.1).

4.5 Types of Nonradiological Liquid Effluent Streams and Methods of Treatment and Disposal

Sources of nonradioactive liquid sanitary wastes are toilets, sinks, lavatories and drinking fountains. Sources of nonradioactive liquid chemical wastes are boiler treatment chemicals, laboratory chemicals, and effluent from the regeneration of the demineralized water supply system.

4.5.1 Sanitary Waste Water Effluent From Building Numbers 110, 240 and 255.

Method of treatment and disposal of this effluent is discussed in detail in Section 3.3.1.

4.5.2 Industrial Waste Water Effluent

Disposal of this effluent is discussed in Section 3.3.2.

4.5.3 Chemical Usage Resulting in Liquid and Gaseous Effluents

4.5.3.1 Ammonia (NH_3) - approximately 420,000 pounds used per year as a reducing gas in the production of UO_2 powder, pellets, and in the preparation of material for recycle. Excess hydrogen from the cracked ammonia is burned off and the resulting water vapor and nitrogen is dispersed.

4.5.3.2 Nitrogen (N_2) - approximately 500,000 pounds used per year in various processing operations. Nitrogen is an inert gas and is discharged and dispersed.

4.5.3.3 Hydrogen (H_2) - approximately 5500 pounds used per year in the production of UO_2 powder. Excess gas is burned off and dispersed.

4.5.3.4 Uranium Hexafluoride (UF_6) - approximately 750,000 pounds used per year as raw feed material in the production of UO_2 powder. Uranium is recovered as product and the effluent containing fluorine is treated with scrubbers prior to discharge.

4.5.3.5 Potassium Hydroxide (KOH) - approximately 3500 pounds used per year. This material is mixed with process water and used as wet scrubber liquor to remove hydrofluoric acid from the recycle pyrohydrolysis process effluent. The resulting potassium fluoride and potassium hydroxide solution is drained to a holding tank and sampled for uranium content prior to being discharged into the evaporation ponds located within the fenced manufacturing area.

4.5.3.6 Trichloroethane (CH_3CCl_3) - approximately 9500 pounds used per year in the UO_2 powder preparation process to prepare powder of the correct flow quality for the pellet pressing operation. Volatilized off during powder drying operation and diluted and dispersed during discharge.

4.5.3.7 Cranko (Proprietary formulation, Imperial Chemical Industries, containing butyl methacrylate, methyl methacrylate, and methyl acrylic acid) - approximately 9000 pounds per year of this material is mixed with trichloroethane in the UO_2 powder preparation process and is burned off during the pellet dewaxing operation.

4.5.3.8 Sodium Hydroxide (NaOH) - approximately 4500 pounds used per year in regeneration of demineralizer resins. The material is diluted with process water during regenerative operations and drained through the industrial waste line where it is discharged to the C-E site pond, which ultimately discharges into Joachim Creek.

Chemical measurements taken at the point of discharge of the site pond show pH levels which fall within the acceptable range specified by the Missouri Department of Natural Resources Effluent Standards.

4.5.3.9 Salt (NaCl) - approximately 7500 pounds used per year in regeneration of demineralizer resins. Disposal is the same as for sodium hydroxide.

4.5.3.10 Sulfuric Acid (H_2SO_4) - approximately 5000 pounds used per year in regeneration of demineralizer resins. Disposal is the same as for sodium hydroxide.

4.5.3.11 Hydrophobic Starch $(C_6H_{10}O_5)_x$ - approximately 1500 pounds used per year. Used in UO_2 pellet pressing operation for lubrication of pellet die cavities. Burned off during pellet dewaxing operation.

4.5.3.12 Hydrochloric Acid (HCl) - approximately 850 pounds used per year. Mixed with process water and utilized in cleaning heat exchanger tubes in the steam boiler. The spent acid is drained to the industrial waste line where it is discharged (See Section 3.3.2).

4.5.3.13 Boiler Treatment Chemicals (neutralizing, chelating and anti-corrosive compounds) - total of about 2600 pounds used per year. Mixed with process water and added to the steam boiler for treatment. Drained by steam condensate and boiler blowdown into the industrial waste line where it is discharged (See Section 3.3.2).

4.5.3.14 Detergent Solution - approximately 400 pounds used per year in site laundry. Drained through industrial waste line where it is discharged (See Section 3.3.2).

4.6 Types of Nonradiological Gaseous Effluent Streams and Methods of Treatment and Disposal

Airborne nonradioactive chemical effluents arise during UF_6 to UO_2 conversion, pellet dewaxing, and recycle pyrohydrolysis operations. Gaseous effluent waste streams from these processes are also treated as potentially contaminated with uranium compounds.

4.6.1 Waste Fume Effluent From Oxide Building

Airborne chemical wastes from the UO_2 powder production process include hydrofluoric acid, nitrogen, hydrogen, water vapor and carbon dioxide. Offgases are routed through dry scrubbers containing limestone, as discussed in Section 4.4.2. These scrubbers are between 90 and 98 percent efficient in removing fluorides. Using the average efficiency of 95%, the fluorine release rate is approximately 43 pounds per 24 hours of full-capacity operation.

4.6.2 Waste Fume Effluent From Building 255

Airborne chemical wastes from the powder preparation and pellet fabrication operations include nitrogen, hydrocarbons, carbon dioxide, water vapor and trichloroethane (TCE) vapor. Average yearly use of TCE is 9500 pounds or less than 38 pounds in any one working day (assuming 250 working days per year). This rate of discharge is well within acceptable limits for photochemically unreactive solvents.

4.6.3 Waste Fume Effluent From Building 240

Airborne chemical wastes from the oxidation-reduction, pyrohydrolysis, and cylinder heel processing operations include water vapor, hydrofluoric acid, ammonia, nitrogen, and hydrocarbons. Offgases from the reaction furnaces is routed through a wet scrubber, as described in Section 4.4.2. The only significant airborne effluent from cylinder heel processing is unreacted ammonia from the ADU precipitation. This ammonia is mixed with 1600 cubic feet per minute of dilution air and is not monitored because of the low concentration.

Other chemical fumes arising in Building 240 are small quantities of various solvents and laboratory chemicals from the Quality Control Laboratory chemical fume hoods. The quantities used and amount of dilution air indicate very low concentrations for these materials.

4.6.4 Waste Fume Effluent From Building 250

Waste fume effluent from Building 250 consists only of water vapor and carbon dioxide from the combustion of natural gas to generate steam in the boiler room.

4.7 <u>Types of Nonradiological Solid Wastes and Methods of Disposal</u>

The bulk of the nonradioactive solid wastes are collected and disposed of by a commercial waste disposal firm. Other solid wastes originating in the manufacturing areas are disposed of as contaminated wastes (see Section 4.4.3). Old items of equipment may be disposed of to commercial scrap dealers after they are surveyed and found to be under acceptable contamination levels for unrestricted release.

TABLE 4-1

PLANT OPERATIONS AND EFFLUENTS

PROCESS STEPS	EQUIPMENT USED	LIQUID EFFLUENTS TYPE EFFLUENT	LIQUID EFFLUENTS TREATMENT	GASEOUS EFFLUENTS TYPE EFFLUENT	GASEOUS EFFLUENTS TREATMENT	SOLID EFFLUENTS TYPE EFFLUENT	SOLID EFFLUENTS TREATMENT
UF_6 to UO_2 Conversion	Fluidized bed reactors, piping. Vessels, hoods, fluid energy mill, blenders and misc. equip.	Equip. Cooling water and steam condensate. See Note 1	See 4.5.2	Air borne UO_2 fines HF Vapor Nitrogen Hydrogen H_2O Vapor CO_2	See 4.4.2 See 4.6.1	Calcium Fluoride See Note 2	See 4.4.3
UO_2 Powder Preparation	Scale Blender Dryer Granulator Hood Pneumatic Transfer	Steam condensate See Note 1	See 4.5.2	Air borne UO_2 fines TCE Vapor	See 4.4.2 See 4.6.2	See Note 2	See 4.4.3
UO_2 Pellet Pressing	Pellet Press Pneumatic Transfer Dust Planums	- See Note 1	-	Air borne UO_2 fines	See 4.4.2	See Note 2	See 4.4.3
UO_2 Pellet Dewaxing	Dewaxing Furnaces	- See Note 1	-	Air borne UO_2 fines Nitrogen Hydrocarbons CO_2 Vapor H_2O Vapor	See 4.4.2 See 4.6.2	See Note 2	See 4.4.3
UO_2 Pellet Sintering	Sintering Furnaces	- See Note 1	-	Air borne UO_2 Fines H_2O Vapor CO_2	See 4.4.2 See 4.6.2	See Note 2	See 4.4.3
UO_2 Pellet Grinding	Centerless Grinder Centrifuge Pump Hood	UO_2 Contaminated Cooling Water See Note 1	See 4.4.1	Air borne UO_2 Fines	See 4.4.2	See Note 2	See 4.4.3
UO_2 Pellet and Powder Recycle	Furnaces Scrubber Heat Exchanger Pump Hood	KOH Solution Cooling Water See Note 1	See 4.5.3.8 See 4.5.2	Air borne UO_2 Fines H_2O Vapor HF NH Nitrogen Hydrocarbons	See 4.4.2 See 4.6.3	See Note 2	See 4.4.3
UF_6 Cylinder Heel Recovery	Vessel Pump Filter Press	Contaminated Filtrate See Note 1	See 4.4.1	Air borne ADU NH	See 4.4.2	Lime See Note 2	See 4.4.3
Regeneration of Demineralized Water System	Demineralization Equipment	NaOH Caustic NaCl Solution H_2SO Acid	See 4.5.3.5 See 4.5.3.6 See 4.5.3.7	-	-	-	-
Quality Control Laboratory Operations	Balance Hood Glassware Analytical Equipment	Equipment Wash Water Laboratory Residues See Note 1	See 4.4.1 See 4.4.1	Various Chemical Fumes	See 4.6.3	See Note 2	See 4.4.3
Site Laundry Operation	Washers and Dryers	Detergent Solution	See 4,5.3.14	-	-	See Note 2	See 4.7
Steam Boiler Treatment	Steam Boiler	Treatment Chemical	See 4.5.3.13	H_2O CO_2	See 4.6.4	See Note 2	See 4.7

Note 1: UO_2 Contaminated Mop and Cleaning Water

Note 2: Effluent consists essentially of rags, paper, metal, plastic and rubber.

Table 4-2

Exhaust Stack Monitoring Results - Uranium Concentrations - September 1974 - April 1975

Month	Stack Number	Highest Daily Sample (X10^{-12} μCi/cc)	Monthly Average (X10^{-12} μCi/cc)
September	017	0.5	0.12
October		1.7	0.57
November		0.8	0.10
December		0.3	0.09
January		0.4	0.15
February		0.5	0.12
March		0.2	0.07
April		0.4	0.10
September	101	0.9	0.07
October		0.1	<0.03
November		0.4	<0.03
December		0.2	<0.03
January		0.2	<0.03
February		<0.03	<0.03
March		0.1	<0.03
April		0.1	<0.03
September	102	0.3	<0.03
October		0.4	0.08
November		<0.03	<0.03
December		0.3	0.04
January		0.2	<0.03
February		0.3	<0.03
March		0.3	0.08
April		0.2	<0.03
September	103	14.0	0.81
October		0.5	0.21
November		0.9	0.09
December		0.9	0.11
January		3.5	0.20
February		0.8	0.05
March		0.1	<0.03
April		0.3	0.02
September	106	0.4	0.06
October		40.5	4.15
November		63.4	14.67
December		4.3	0.90
January		54.9	8.84
February		16.1	2.40
March		0.9	0.23
April		0.5	0.12

Table 4-2 (Continued)

Month	Stack Number	Highest Daily Sample (X10-12 μCi/cc)	Monthly Average (X10-12 μCi/cc)
September	112	0.2	0.05
October		1.1	0.23
November		0.1	<0.03
December		0.3	0.07
January		0.4	0.04
February		11.7	0.65
March		0.3	0.07
April		0.1	<0.03
September	113	1.0	0.16
October		0.4	0.08
November		0.7	0.08
December		4.9	0.28
January		0.6	0.05
February		1.0	0.09
March		0.2	<0.03
April		0.3	0.06
September	114	0.7	0.09
October		0.2	0.05
November		0.3	<0.03
December		0.2	<0.03
January		6.4	0.47
February		0.1	<0.03
March		*	*
April		*	*
September	117	0.4	0.10
October		1.5	0.46
November		5.0	0.40
December		2.1	0.32
January		8.2	1.30
February		6.2	0.73
March		0.4	0.13
April		0.7	0.19
November**	226	0.3	0.05
December		0.2	<0.03
January		1.3	0.17
February		2.1	0.19
March		0.4	0.06
April		0.2	0.04
November**	228	2.0	0.47
December		0.8	0.14
January		0.3	0.07
February		0.5	0.11
March		0.5	0.04
April		0.2	<0.03

* No data available for this period

** Recycle/Recovery activities did not start until November, 1974

Table 4-2 (Continued)

Month	Stack Number	Highest Daily Sample ($X10^{-12}$ $\mu Ci/cc$)	Monthly Average ($X10^{-12}$ $\mu Ci/cc$)
November**	230	1.2	0.42
December		0.8	0.18
January		1.2	0.16
February		1.4	0.32
March		1.1	0.18
April		1.2	0.21
March	231	0.1	0.10
April	(Installed March, 1975)	0.4	0.07

** Recycle/Recovery activities did not start until November, 1974.

Note: Exhaust Stacks 050 and 051 (Consolidated Pellet Plant Ventilation System) were started on May 27, 1975. Highest sample for the first five days of operation was $1.0X10^{-13}$ $\mu Ci/cc$.

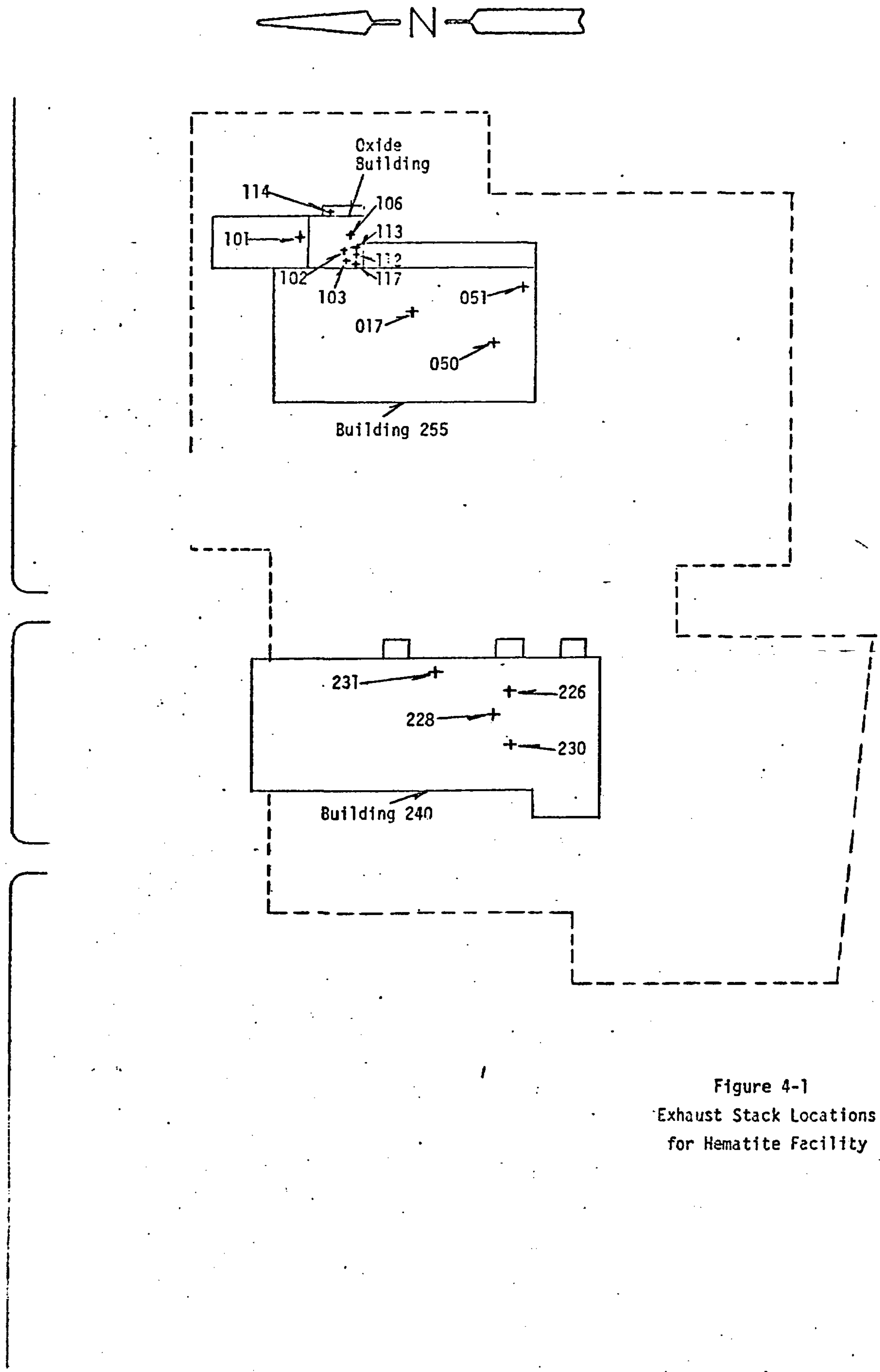


Figure 4-1
Exhaust Stack Locations
for Hematite Facility

Section 5

5. EFFLUENT AND ENVIRONMENTAL MEASUREMENT AND MONITORING PROGRAM

5.1 Radiological Effluent Monitoring System

5.1.1 Liquid Radiological Effluent

As previously described, most radiological liquid wastes are collected and evaporated to recover the uranium content. Liquids containing small quantities of uranium and uranium daughter products are collected, sampled and discharged to the evaporation ponds located within the fenced manufacturing area. Only liquid wastes containing trace quantities of uranium are discharged through the industrial waste lines to the site pond. These low level wastes are further diluted by equipment cooling water which drains through the same system. The site pond is spring-fed, providing additional dilution water averaging 500,000 gallons per day before discharge to the site creek.

The site pond, which discharges over a concrete dam through parallel weirs to form the site creek, is continually and proportionately sampled. The overflow weirs to sample weir flow ratio is approximately 36 to 1. The sample weir discharges to a 50 gallon metered sampling chamber, from which a 75 ml sample is drained to two 30 gallon collection tanks each time the chamber fills.

A 250 ml sample is withdrawn weekly from each collection tank, mixed, and submitted to an outside contractor laboratory to be analyzed for gross alpha and gross beta activity. This analysis is discussed in Section 5.1.3.2.

The only significant liquid radiological effluent from Building 255 and the Oxide Plant is waste water from the laundry, which contains small quantities of uranium compounds from washing of controlled area clothing. A 100 ml grab sample is taken weekly from the laundry effluent. A 10 ml aliquot is taken from this sample, placed in a planchet and evaporated to dryness. The planchet is then counted for alpha activity in a gas proportional counter for 10 minutes. This counter has a minimum efficiency of 31 percent, and a nominal background of less than 0.5 cpm, providing a gross alpha minimum sensitivity of 7.3×10^{-8} μCi/ml.

Liquid radiological effluent from Building 240 consists mainly of filtrate from the cylinder heel wash recovery and the discrepant material recycle furnace scrubber liquor. Cylinder wash filtrate is collected in 55 gallon drums from which a 100 ml sample is taken. This sample is filtered to remove suspended lime and a 10 ml aliquot is evaporated to dryness in a planchet. The planchet is then counted for alpha and beta activity in the gas proportional counter described above. This counter has a minimum beta efficiency of 27 percent, providing a gross beta minimum sensitivity of 8.3×10^{-6} μCi/ml.

Spent scrubber liquor, still containing up to 20 percent potassium hydroxide, is collected in a 1000 gallon tank in Building 240. This solution is agitated with a mixer and a 100 ml sample is withdrawn. A 25 ml aliquot is then analyzed by making a colorimetric determination of grams per liter of total uranium content. The minimum sensitivity of this method is 0.001 gram per liter, or about 1×10^{-6} µCi/ml using an average U-235 enrichment of 2.0 percent.

Scrubber liquor and cylinder wash filtrate are drained to the retention and evaporation ponds. They are not discharged to the site pond. Even though these effluents are not released off site, the noted analysis sensitivities are sufficient to ensure that the release levels do not exceed discharge limits of 2×10^{-5} µCi/ml for alpha and 3×10^{-5} for beta activity, as specified by 10CFR Part 20.

5.1.2 Gaseous Radiological Effluent

Radiological gaseous effluents are in the form of dust particles and vapor aerosols being discharged from ventilated hoods, processing equipment and furnaces as described in Section 4.4.2. Each of the effluent release points shown in Figure 4-1 is continuously monitored using a sampling system designed according to specifications given in ANSI-N13.1.

The samples from each exhaust stack are collected daily, and counted after allowing sufficient time to permit the decay of Radon activity. Using typical sampling rates of 15 liters per minute, a minimum sensitivity of 3×10^{-14} µCi/cc is obtained. Counting is performed using the gas proportional counter described in Section 5.1.1.

The noted sensitivity is sufficient to determine that airborne release levels do not exceed release limits of 4.0 X 10^{-12} μCi/cc, as specified by 10CFR Part 20.

5.1.3 Environmental Monitoring Program for Radiological Effluents

A comprehensive program for measuring release of effluents to the environs has been in effect since startup with low enriched uranium in September, 1974. Data obtained from monitoring programs by previous owners of the Hematite plant, although incomplete, provides a baseline for present C-E operations. Changes to the plant and discontinuance of operations with high enriched uranium have substantially lowered the release of effluents. A continuing program is conducted to reduce effluent releases to as far below the specified limits as practicable.

Collection of environmental samples has recently been expanded to also provide a comprehensive program for measurement of the environmental burden of radioactive materials on the C-E Hematite site and its immediate environs. This program complements the program for measurement of effluent releases. Operations conducted by previous owners will continue to influence the data obtained by the new environmental program to a greater extent than will the low level releases resulting from present operations.

The required evidence that present operations are not significantly contributing to the level of radioactivity on the site and its immediate environs is derived from the sources discussed below.

5.1.3.1 Fenceline Air Samples

There are 4 fenceline air samplers located on the site for collecting airborne particulate materials. The location of these sampling stations with respect to the exhaust stack discharge points are shown in Figure 5-1. These samplers are similar to the stack samplers and continuously draw a sample of air through a low-porosity filter paper. The filter paper is removed daily and counted for gross alpha activity.

Table 5-1 summarizes the fenceline station monitoring program and Table 5-2 summarizes the analytical results from this program.

5.1.3.2 Water Samples

Water samples are taken from the site pond sample collection tanks, as described in Section 5.1.1, and analyzed weekly for gross alpha and gross beta activity. Grab samples are also taken quarterly of Joachim Creek at a point immediately downstream from the site creek discharge; and taken monthly upstream at the site boundary, and downstream from the site boundary. Samples are collected quarterly from the site well and from an offsite well in Hematite. The locations of the sampling points are shown in Figure 5-2.

The environmental water samples are submitted to an outside contractor laboratory for gross alpha and gross beta activity analyses. Minimum sensitivities are reported as 2×10^{-9} μCi/ml for alpha activity and 1×10^{-9} μCi/ml for beta activity.

Table 5-1 summarizes the water sampling program and Tables 5-3, 5-4 and 5-5 summarize the analytical results from this program.

5.1.3.3 Vegetation and Soil Samples

Vegetation and soil samples are collected quarterly at the site boundaries nearest the source of emissions, downwind in the most prevalent wind direction, and nearest the town of Hematite. A sample is also collected on site West of the plant. The location of these sampling points are shown in Figure 5-3.

Soil and vegetation samples are also analyzed by the outside contractor laboratory. Table 5-1 summarizes the soil and vegetation sampling program and Table 5-6 summarizes the analytical results from this program.

5.2 Nonradiological Effluent Monitoring

5.2.1 Liquid Nonradiological Effluents

As previously described, all industrial liquid wastes are discharged to the site pond through the storm sewer line, except for wastes discharged to the retention and evaporation ponds.

A 1 gallon grab sample is collected quarterly from the site pond overflow and submitted to an outside contractor laboratory for complete chemical analysis. Chemicals tested for are listed and the test results summarized in Table 5-7.

Stream flow studies conducted by the U.S. Geological Survey indicate that a dilution factor of at least 100 is achieved when the site creek mixes with Joachim Creek.

5.2.2 Gaseous Nonradiological Effluents

Gaseous nonradiological effluents are generally of such a small magnitude that their impact on the environment is imperceptible. Use rates and stack dilution factors show gaseous chemical effluent concentrations to be considerably less than established guidelines and requirements.

The principal chemical emission of concern is fluorides from the Oxide Plant dry scrubbers. Sampling has been conducted to determine scrubber efficiency as discussed in Section 4.6.1. This sampling has shown total fluoride emissions to be well within acceptable values.

For the above reasons, there is no routine sampling for gaseous nonradiological effluents.

5.3 Maximum Individual Inhalation Doses at the C-E Site Boundary and at the Nearest Low Population Zone to the Hematite Site

In considering potential radiation exposure to the public from releases of uranium to the atmosphere, inhalation is the most probable and therefore the most important route of exposure. The effects of external exposure from enriched uranium isotopes released from the plant are insignificant. The probability of exposure from ingestion of drinking water is also insignificant since wells are the only source of drinking water within a 5-mile radius of the site. Therefore, only the radiation dose to individuals as a result of exposure by inhalation of stack effluents is discussed below.

5.3.1 Maximum Site Boundary Dose Commitment

The maximum inhalation dose was calculated by assuming an individual stood full time for a year at the nearest site boundary, approximately 100 meters north of the Oxide Building. Average meteorological conditions and a ground level release was assumed, and no credit was taken for dilution from the building wake effect or removal from the atmosphere by deposition. The isotopic content of 4.0 percent enriched uranium, shown below, is a higher enrichment than is normally released.

ISOTOPIC CONTENT OF ENRICHED URANIUM

Isotope	Abundance	Half-Life	Ci/g	Ci/gU
U-234	0.00032	2.48×10^5y	6.19×10^3	1.961
U-235	0.04000	7.13×10^8y	2.14	0.086
U-236	0.00025	2.39×10^7y	63.4	0.016
U-238	0.95943	4.51×10^9y	0.333	0.320

Dose conversion factors used in the calculations, given as dose commitment in Rems per gram of material inhaled are shown below.

DOSE CONVERSION FACTORS FOR INHALATION

Organ	50 Year Dose Commitment- Rem per Gram of Uranium Inhaled Soluble	Insoluble
Lung	1.2	690.0
Bone	231.0	7.6
Kidney	38.6	0.4
Stomach	1.7×10^{-3}	5.4×10^{-3}
Small Intestine	2.0×10^{-9}	6.9×10^{-9}
Upper large intestine	4.4×10^{-8}	2.7×10^{-6}
Lower large intestine	3.0×10^{-7}	2.0×10^{-5}

The uranium was conservatively assumed to be soluble in calculating dose commitments to the bone and kidney and insoluble for the lung and gastrointestinal tract. Using a dispersion parameter (X/Q) of 1.0×10^{-2}, the maximum individual dose commitment resulting from routine annual release at the nearest site boundary is as follows:

Organ	Dose Commitment (Rem)
Lung	1.6×10^{-3}
Bone	5.3×10^{-4}
Kidney	8.9×10^{-5}
Stomach	1.2×10^{-8}
Small Intestine	1.6×10^{-14}
Upper Large Intestine	6.2×10^{-12}
Lower Large Intestine	4.6×10^{-11}

The routine annual release was projected from stack sampling data for the period of October 1974 through April 1975. Some emission points have since been discontinued or combined with the new consolidated ventilation systems, which will result in a lower annual release than used in the above calculations.

5.3.2 Maximum Low Population Zone Dose Commitment

The unincorporated town of Hematite, being about 0.5 miles away and having an approximate population of 225 people, is the nearest populated settlement to the C-E site.

The maximum dose commitment to an individual residing full time in the town of Hematite was calculated using the same extremely conservative assumptions as used for the nearest site boundary calculations. Using a X/Q of 1.2×10^{-4}, the maximum individual dose commitment in the town of Hematite resulting from routine annual release is as follows:

Organ	Dose Commitment (Rem)
Lung	1.9×10^{-5}
Bone	6.4×10^{-6}
Kidney	1.1×10^{-6}
Stomach	1.4×10^{-10}
Small Intestine	1.9×10^{-16}
Upper Large Intestine	7.4×10^{-14}
Lower Large Intestine	5.5×10^{-13}

Table 5-1

C-E-Hematite Environmental Monitoring Program

Table No.	Sample Type	Frequency	Location	Analyses	Sample Volume
5-2	Air	Daily: when plant is running	4 Locations; See Fig. 5-1	Gross Alpha	~40,000 liters at each location
5-3	Liquid	Weekly	Site Dam; see Fig. 5-2	Gross Alpha Gross Beta	500 ml
5-4	Liquid	Monthly	2 Locations; see Fig. 5-2	Gross Alpha Gross Beta	500 ml at each location
5-5	Liquid	Quarterly	3 Locations; see Fig. 5-2	Gross Alpha Gross Beta	500 ml at each location
5-7	Liquid	Quarterly	Site Dam; See Fig. 5-2	Complete Chemical (Water Quality)	1 gallon
5-6	Soil and Vegetation	Quarterly	4 Locations; see Fig. 5-3	Gross Alpha Gross Beta	One pint of packed grass and one pint of soil (upper inch) at each location.

Table 5-2

C-E - Hematite Radioactivity Analyses, Air (Daily) - September 1974 - April 1975

Month	Station Number	Location	Average Gross Alpha ($x10^{-12}$ µCi/cc)	Highest Daily Sample Gross Alpha ($x10^{-12}$ µCi/cc)
September	1	Northwest Corner	0.21	0.9
October		Northwest Corner	>0.03	0.4
November		Northwest Corner	0.12	1.2
December		Northwest Corner	>0.03	0.1
January		Northwest Corner	>0.03	0.1
February		Northwest Corner	>0.03	0.3
March		Northwest Corner	0.04	0.5
April		Northwest Corner	>0.03	0.2
September	2	Southwest Corner	0.08	0.8
October		Southwest Corner	>0.03	0.5
November		Southwest Corner	0.04	0.3
December		Southwest Corner	>0.03	0.1
January		Southwest Corner	>0.03	0.1
February		Southwest Corner	>0.03	0.4
March		Southwest Corner	0.04	0.5
April		Southwest Corner	0.04	0.3
September	3	Southeast Corner	0.06	0.2
October		Southeast Corner	>0.03	0.5
November		Southeast Corner	0.10	0.7
December		Southeast Corner	>0.03	0.2
January		Southeast Corner	>0.03	0.1
February		Southeast Corner	0.70	0.9
March		Southeast Corner	0.04	0.5
April		Southeast Corner	>0.03	0.2
September	4	Northeast Corner	*	*
October		Northeast Corner	*	*
November		Northeast Corner	*	*
December		Northeast Corner	>0.03	0.1
January		Northeast Corner	>0.03	0.1
February		Northeast Corner	>0.03	0.2
March		Northeast Corner	>0.03	0.3
April		Northeast Corner	>0.03	0.2

*No data available for this period

Table 5-3

C-E -Hematite, Radioactivity Analyses, Liquid (Weekly) - September 1974 - April 1975

Month	Station Number	Location	Average Gross Alpha (pCi/ℓ)	Range (pCi/ℓ)	Average Gross Beta (pCi/ℓ)	Range (pCi/ℓ)
September	5	Site Dam	139.9	94.1 to 227.0	13.2	9.5 to 17.6
October	5	Site Dam	140.3	112.2 to 165.3	15.3	10.8 to 18.0
November	5	Site Dam	194.9	81.1 to 260.4	21.1	10.4 to 29.6
December	5	Site Dam	75.3	32.0 to 118.5	37.4	17.1 to 57.7
January	5	Site Dam	84.7	*	52.7	*
February	5	Site Dam	18.3	13.1 to 25.7	10.2	7.2 to 14.9
March	5	Site Dam	33.5	17.6 to 49.5	21.4	11.3 to 31.5
April	5	Site Dam	11.5	10.4 to 12.6	14.9	11.3 to 18.5

*Only one sample collected this period

Table 5-4

C-E -Hematite, Radioactivity Analyses, Liquid (Monthly) - September 1974 - April 1975

Month	Station Number	Location	Gross Alpha (pCi/ℓ)	Gross Beta (pCi/ℓ)
September	8	Joachim Creek Upstream	19.4	8.1
October		Joachim Creek Upstream	<2.0	8.1
November		Joachim Creek Upstream	155.3	27.0
December		Joachim Creek Upstream	<2.0	16.2
January		Joachim Creek Upstream	<2.0	8.1
February		Joachim Creek Upstream	*	*
March		Joachim Creek Upstream	*	*
April		Joachim Creek Upstream	<2.0	<1.0
September	9	Joachim Creek Downstream	149.6	2.3
October		Joachim Creek Downstream	<2.0	4.9
November		Joachim Creek Downstream	12.3	6.5
December		Joachim Creek Downstream	<2.0	<1.0
January		Joachim Creek Downstream	<2.0	<1.0
February		Joachim Creek Downstream	*	*
March		Joachim Creek Downstream	*	*
April		Joachim Creek Downstream	28.8	<1.0

*No sample collected this period

Table 5-5

C-E -Hematite, Radioactivity Analyses, Liquid (Quarterly) - April 1975**

Month	Station Number	Location	Gross Alpha (pCi/ℓ)	Gross Beta (pCi/ℓ)
April	6	Plant Well	<2.0	<1.0
April	7	Stream Confluence (Site Creek/Joachim Creek)	28.8	<1.0
April	10	Hematite Well	<2.0	<1.0

** Sampling program started in April 1975

Table 5-6

C-E -Hematite, Radioactivity Analyses, Soil and Vegetation (Quarterly) - April 1975*

Month	Station Number	Location	Gross Alpha (pCi/gm)	Gross Beta (pCi/gm)
		Soil		
April	12	Site Boundary Down Wind	6.5	2.2
April	13	Site Boundary Nearest Source	3.4	2.5
April	14	Site Boundary Nearest Hematite	1.3	1.0
April	15	On Site West of Plant	6.8	9.9
		Vegetation		
April	12	Site Boundary Down Wind	<0.3	3.6
April	13	Site Boundary Nearest Source	<0.3	3.6
April	14	Site Boundary Nearest Population Center	<0.3	3.1
April	15	On Site West of Plant	<0.3	4.3

* Sampling Program started in April 1975

Table 5-7

C-E -Hematite, Complete Chemical Analyses (Quarterly) - December 1974 and April 1975

Station #5 - Site Dam

Analysis	December 1974		April 1975	
Alkalinity	238	mg/ℓ	98.4	mg/ℓ
Calcium	.71	mg ℓ	28.8	mg/ℓ
Chemical Oxygen Demand	6.7	mg/ℓ	8.2	mg/ℓ
Chloride	15.0	mg/ℓ	1.4	mg/ℓ
Dissolved Solids	368.	mg/ℓ	218	mg/ℓ
Fluoride	1.4	mg/ℓ	0.11	mg/ℓ
Iron	0.021	mg/ℓ	0.181	mg/ℓ
Nitrogen,Ammonia (as N)	0.9	mg/ℓ	0.05	mg/ℓ
Nitrogen,Nitrate (as N)	0.6	mg/ℓ	0.2	mg/ℓ
Nitrogen,Organic (as N)	1.5	mg/ℓ	1.66	mg/ℓ
Nitrogen,Total Kjeldahl (as N)	2.4	mg/ℓ	1.71	mg/ℓ
Oil and Grease	13.5	mg/ℓ	122	mg/ℓ
Potassium	1.4	mg/ℓ	1.55	mg/ℓ
Sodium	26.0	mg/ℓ	3.0	mg/ℓ
Sulfate	66	mg/ℓ	36	mg/ℓ
Sulfite	1.0	mg/ℓ	<0.03	mg/ℓ
Surfactants	<0.05	mg/ℓ	<0.05	mg/ℓ
Suspended Solids	10	mg/ℓ	15	mg/ℓ
Total Hardness (as $CaCO_3$)	275	mg/ℓ	139	mg/ℓ
Total Organic Carbon	41	mg/ℓ	29	mg/ℓ
Total Phosphate (as PO_4)	1.56	mg/ℓ	0.2	mg/ℓ
Total Solids	404	mg/ℓ	233	mg/ℓ
Volatile Solids	56	mg/ℓ	58	mg/ℓ
Turbidity (as SiO_2)	1.90	mg/ℓ	4.65	Jackson Units

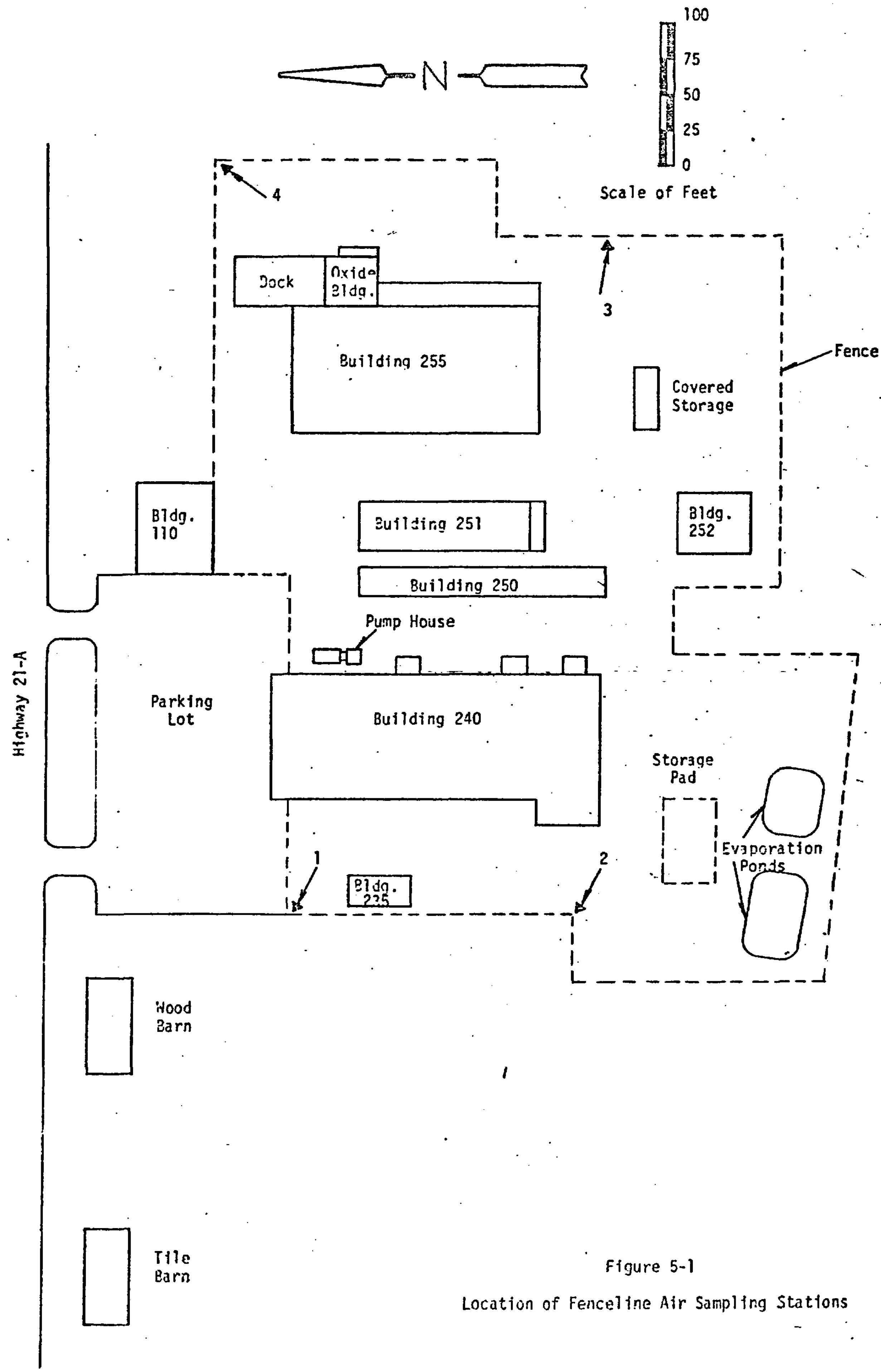


Figure 5-1

Location of Fenceline Air Sampling Stations

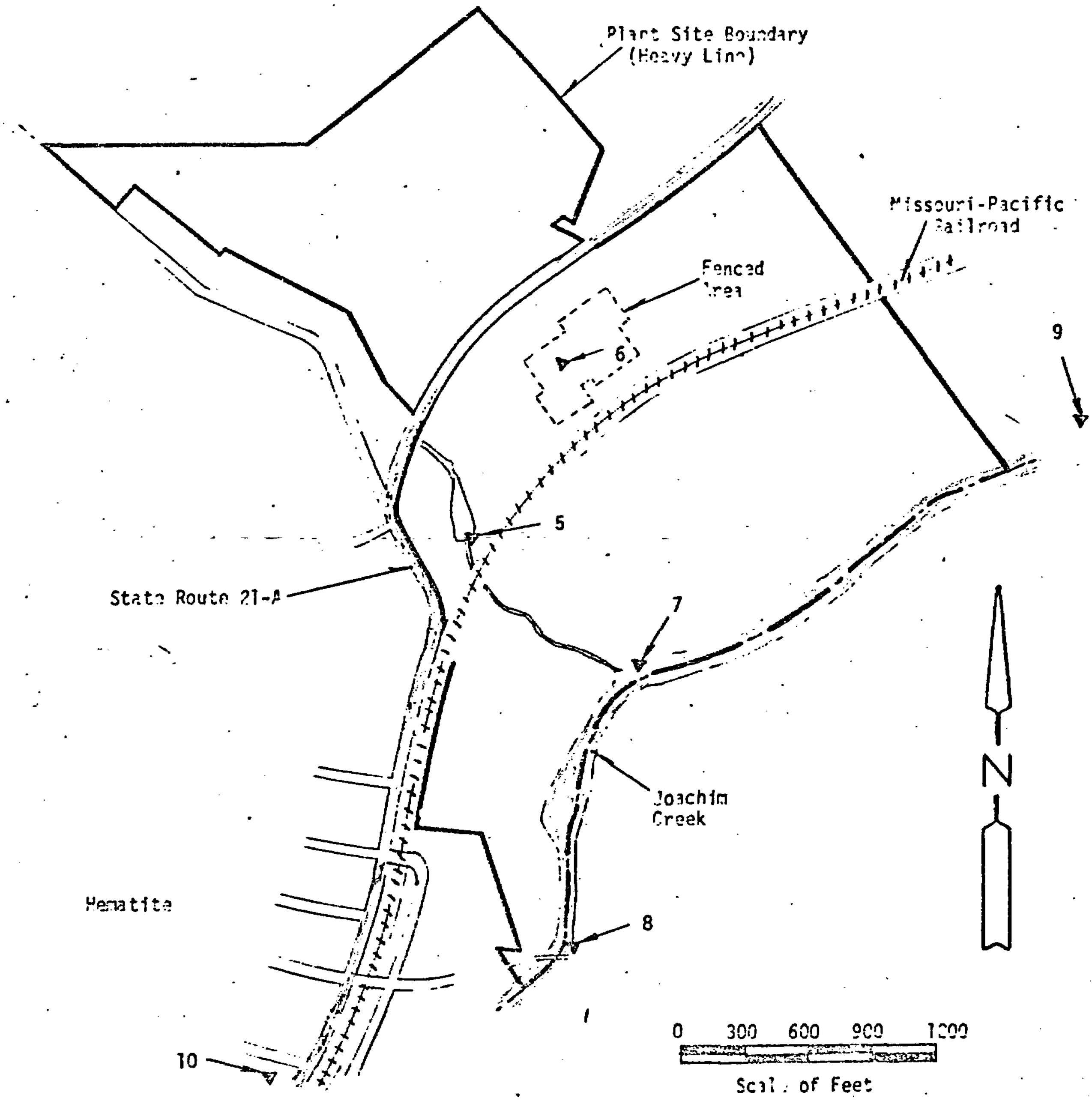


Figure 5-2
Location of Water Sampling Stations

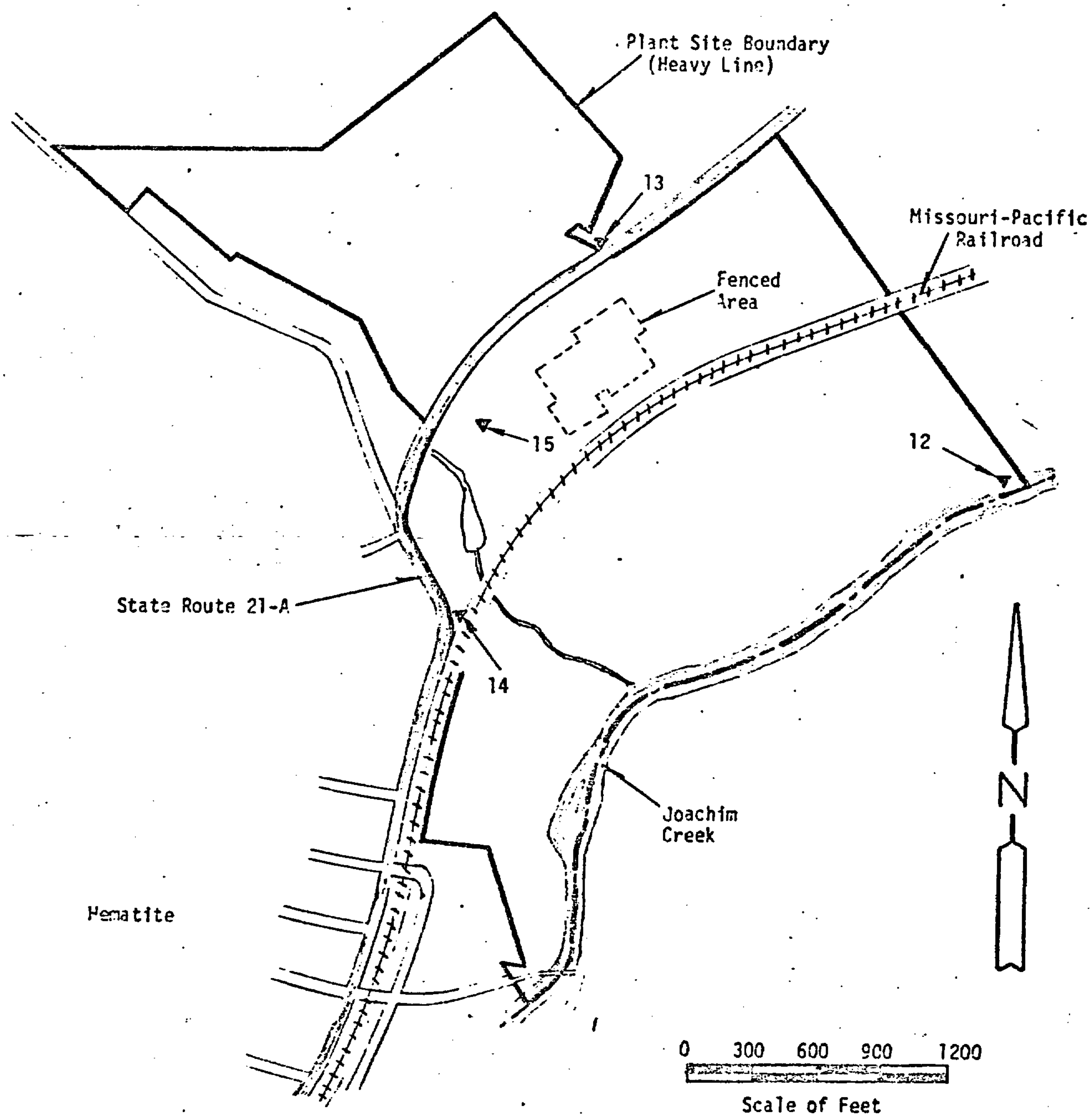


Figure 5-3

Location of Soil and Vegation
Sampling Stations

Section 6

6. ENVIRONMENTAL EFFECTS OF ACCIDENTS

6.1 Classification of Accidents

In processing low-enriched uranium, as used in the fabrication of fuel for nuclear reactors of the pressurized, light water type, the only significant amount of radioactive material present in the fuel fabrication facility is the uranium itself. Because of the low specific activity of low-enriched uranium, the radiological impact of most types of postulated accidents,with the exception of a criticality accident, would be insignificant as compared with the chemical impact. Therefore, the environmental impact which could result from postulated accidents has also been analyzed from the point of view of chemical effects. It should be noted that, in this respect, the Hematite facility does not differ significantly from any other manufacturing plant in which nonradioactive chemicals are processed and stored.

A spectrum of accidents which is possible in connection with the operation of the Hematite facility has been postulated and classified in to six categories, according to the potential for release of materials to the environment.

Class 1 - Minor accidents with no release within the facility.

Class 2 - Accidents which could release some materials inside the plant, but with no release to the environs.

Class 3 - Accidents which could release small amounts of materials outside the plant, but with no significant release offsite.

Class 4 - Accidents which could release materials offsite.

Class 5 - Radioactive materials shipping accident.

Class 6 - Natural phenomena.

6.1.1 Class 1 Accidents

Class 1 accidents may be expected to occur several times during the plant lifetime, but the consequences are small. Accidents in this class include outage of plant utilities and equipment failure.

6.1.1.1 Facility Power Outage

C-E receives electric power from the Union Electric Company (UE), and backup power is provided for critical services automatically by means of two onsite emergency generators. Complete power outages are infrequent and voltage fluctuations which would affect motors and circuit breakers rarely occur.

Services on the emergency generator systems include the nuclear criticality sensors and alarms, telephones, one air compressor, Oxide Building emergency lights, room air ventilation and control panel and instrument power. Most ventilation air systems are not on emergency power and would stop operating during a power outage. However, any backflow through the exhaust system would be so low that airborne material would not escape from process containment and hoods. This situation would be essentially the same as turning the power off for routine maintenance and absolute filter changes, where no problems are experienced.

In the unlikely event that UE power suffered an outage, and the emergency generators failed to pick up their loads, all ventilation systems and instrumentation would stop operating. Process valves used in the oxide conversion system are air-operated and spring-loaded to fail in the safe position. All processes would shut down with no loss of material containment. Thus, there would be no impact due to power outage.

6.1.1.2 Loss of Water Supply

Water is supplied to the Hematite facility by an onsite well. Loss of power would also result in loss of water supply, except for 5,000 gallons in the storage tank. Chemical extinguishers are used for fire fighting purposes, and a water tanker is available at the Hematite Fire Department if required.

In the event of total water supply failure from some unforeseen occurrence, damage to some water-cooled process equipment could occur. Such damage would not result in loss of material containment of the equipment involved.

6.1.2 Class 2 Accidents

Class 2 accidents could result in the release of small amounts of chemicals or radioactive materials within the plant with no release to the environment. Accidents in this class include a process line leak, a spill of uranium-bearing material, and a minor fire.

6.1.2.1 Process Line Leak

A process line leak inside the manufacturing buildings would be quickly detected by the operators and necessary corrective action would be taken to isolate the leaking section. Spilled material would then be cleaned up and retained for reprocessing. Some operational downtime might be required to make repairs or to replace damaged equipment or components. No release in detectable quantities outside the buildings would occur. Respiratory protection, including supplied breathing air, and protective clothing is available in the event of a leak involving hazardous chemicals.

6.1.2.2 Spills of Uranium-Bearing Materials

Spills of uranium-bearing materials are considered to be readily handled incidents. Procedures call for containment and immediate cleanup while employing standard health physics practices of air monitoring and respiratory protection. Such a spill would release a small quantity of uranium compounds to the working environment, only a small fraction of which would become airborne. No significant release to the environment would occur because of the filtered ventilation systems, the physical properties of the material, and the dilution factors involved.

Routine health physics monitoring is conducted of both controlled and clear areas to detect spread of contamination from incidents involving spills. Any contamination detected that is above control limits is promptly cleaned up. Personnel practices require clothing change, personal cleaning and use of contamination monitoring devices before leaving controlled areas. The possibility of significant spread of contamination to the environs is therefore considered unlikely.

6.1.2.3 Minor Fire Involving Uranium-Bearing Materials

Minor fires involving uranium-bearing materials could release small quantities of uranium inside the buildings, but the release of uranium compounds to the environs is improbable because of ventilation filtration systems, availability of portable fire extinguishing equipment, and the training of personnel in fire protection. Airborne uranium released within buildings as a result of a fire would be handled in the manner indicated in Section 6.1.2.2.

6.1.3 Class 3 Accidents

Class 3 accidents have a low probability of occurring, but could result in the release of small amounts of materials to the environs in the immediate vicinity of the plant. Accidents of this type include chemical accidents, a fire or explosion, and material spills on plant grounds.

6.1.3.1 Chemical Accidents

Potential accidents involving chemicals include a pipeline leak, a spill within the fenced manufacturing area, and partial or complete emptying of a storage tank.

A leak or spill outside the manufacturing buildings would again be quickly located by operators and corrective action taken. A small quantity of material could enter the storm drains and be carried to the site pond through the storm sewers. Dilution by equipment cooling water and pond water before discharge into Joachim Creek would make the environmental effects of such an occurrence negligible.

Accidents concerning bulk storage tanks are discussed below.

Anhydrous Ammonia - anhydrous ammonia is stored in a 10,000 gallon tank equipped with dual pressure relief valves. The exposure of this tank to an intense fire would result in bleeding of over-pressure through the relief valves. The release would cease as the fire was extinguished. Ammonia vapors could reach high concentrations in the vicinity of the tank, but would be rapidly dispersed. It is expected that concentrations at the nearest site boundary would be less than 500 ppm and have no permanent effect on personnel or the environs.

Liquid Nitrogen - Liquid nitrogen is stored in a 1,000 gallon tank equipped with pressure relief valves. Liquid nitrogen is nontoxic and nonflammable and rapidly evaporates and dissipates upon exposure to the atmosphere.

Hydrogen - Hydrogen is stored in a cylinder bank containing 26,300 cubic feet at standard temperature and pressure (STP). A tanker trailer, containing a maximum of 110,000 cubic feet of hydrogen at STP, is normally connected to the storage bank. Maximum storage pressure is 2200 psi. Hydrogen is nontoxic, but is highly flammable and forms an explosive mixture with air. As storage is in the open, a hydrogen leak would rise and disperse very rapidly. A jet of flame could occur if an ignition source were present, but lack of confinement of the hydrogen-air mixture would prevent an explosion. No significant environmental effect would be caused by a hydrogen leak. Explosion hazards are discussed further in Section 6.1.3.3.

Liquid Propane - Liquid propane is stored in a standard residential-type 300 gallon tank outside of the tile barn. It is used to provide heat to the Emergency Operations Center when required. The chance of a significant leak occurring is extremely low. Liquid propane is readily volatilized to a gas upon exposure to the atmosphere. Propane is highly flammable and would present a fire hazard should a large leak occur. The fire, however, would be restricted to the immediate vicinity of the tank and no significant environmental effect would be caused.

Fuel Oil - Fuel oil is stored in a 2,000 gallon underground tank for emergency use in heating the steam boiler in case of an interruption in the natural gas supply. No problems would be expected to be encountered with this type storage.

Acids - Nitric, hydrochloric, and sulfuric acids are stored in standard, approved shipping containers outside of Building 255. A spill of this material could enter the storm drains, but would be rapidly diluted and neutralized. No significant environmental effect would result.

6.1.3.2 Minor UF_6 Leak

Uranium hexafluoride cylinders arrive by truck in their protective shipping containers. The shipping container is opened and the cylinder is transferred by a stationary crane to the weighing area on the Oxide Building dock. It is then moved into a vaporization chamber or into the outside storage area. All customary handling precautions are observed, but a drop of no more than 12 feet is possible.

During testing, a 30-foot drop was required to cause even a hairline crack in a cylinder. UF_6 is a solid at ambient temperature (sublimes at 132°F) and therefore would evaporate out of a crack very slowly. Also, UF_6 reacts with atmospheric moisture to form UO_2F_2, a non-volatile solid. Thus, a slow leak in a UF_6 cylinder is self-sealing.

A leak within a steam-heated UF_6 vaporization chamber would be exhausted through the wet-scrubber prior to release to the atmosphere. No significant environmental effect would be caused by a minor UF_6 leak in the open or in a vaporization chamber.

6.1.3.3 Fire or Explosion

The primary explosion hazard within the plant is hydrogen, which is used as a reducing atmosphere in several processes. For example, a hydrogen explosion could occur in a furnace due to the presence of oxygen during furnace startup as a result of incomplete air purge. Preventive measures include flow monitoring, detailed procedures and personnel training, emergency cutoffs, and availability of portable fire fighting equipment.

The probability of a fire or explosion has been minimized through carefully engineered safeguards, strict control of combustible materials, and protective measures to control a fire if it does occur. A trained fire brigade and fire fighting equipment is maintained. Support agreements have been obtained with the Hematite, Festus and DeSoto Fire Departments and liason is maintained with these departments. Training of the onsite fire brigade is provided by St. Louis Fire Academy instructors.

A fire within a building, or a furnace explosion accompanied by fire, could result in a release of uranium-bearing materials being processed. Most of the larger particles would settle out within the building. A lesser quantity of smaller particles would be released to the atmosphere, where they would settle out on the plant site or rapidly be dispersed. No significant environmental effect offsite would be expected.

6.1.3.4 Outside Material Spills

Most material spills that could occur outside the buildings would be of the type easily cleaned up, with little release of radioactive material or chemicals to the environs. The majority of radioactive materials handled are of insoluble form in small containers.

The worst postulated situation would be a spill of a radioactive liquid which could enter the storm drains. Such an incident would be the release of the entire contents of a 55-gallon drum of cylinder wash filtrate, with all this solution entering the storm drains. The maximum concentration of beta activity observed in a drum of filtrate has been approximately 1000 times MPC. This would be diluted with the 64,000 gallons of industrial waste water flowing daily in the same line to the site pond. Additional dilution by mixing with several million gallons of water in the site pond would occur prior to release to the site creek. The concentration at this point would be several orders of magnitude below MPC. The same dilution would be achieved in the case of a chemical spill that entered the storm drain.

6.1.4 Class 4 Accidents

Class 4 accidents have a very low probability of occurring, but could result in the release of materials offsite. Accidents of this type include a massive UF_6 release, a major fire or explosion which destroys an entire building, or a criticality accident.

6.1.4.1 Massive UF_6 Release

Uranium hexafluoride (UF_6) is received at the Hematite site in standard 30-inch diameter cylinders, having a capacity of 5,000 pounds. In the case of a massive cylinder failure, the UF_6 would vaporize over a period of time, forming UO_2F_2 and HF upon contact with moisture in the atmosphere.

The maximum dose commitment to an individual located at the nearest site boundary, was calculated assuming the instantaneous release of one-half the contents of a full cylinder. A dilution factor of 1×10^{-2} was used in the calculations. Using these conservative assumptions, the calculated maximum inhalation dose commitment is:

Organ	Dose Commitment (Rem)
Lung	2.7×10^{-2}
Bone	5.5
Kidney	0.9
Stomach	1.3×10^{-4}
Small Intestine	1.6×10^{-10}
Upper Large Intestine	6.0×10^{-7}
Lower Large Intestine	4.6×10^{-7}

Although the uranium would be entirely in soluble form, the dose commitments to the stomach and gastrointestinal tract were calculated based upon the conservative assumption that the uranium inhaled was in an insoluble form. The dose commitment to the lungs was based on the soluble form.

It should also be noted there is another element of conservatism in that the postulated release would be visible as a white cloud. Hydrogen fluoride is very irritating to the lungs and mucous membranes. Thus, the natural reaction is to hold one's breath and run from the cloud. The actual maximum dose commitments are likely to be at least a factor of 100 lower than those calculated, as it is extremely unlikely that any individual would be exposed to the cloud for any length of time.

6.1.4.2 Major Fire or Explosion

A major fire or explosion that would destroy an entire building, or a major portion thereof, could release uranium compounds to the atmosphere. However, a fire or explosion of this magnitude has an exceedingly small probability of occurrence due to engineered safeguards and fire control practices.

As discussed in Section 6.1.3.3, engineered safeguards include equipment features and control systems, use of noncombustible and fire resistant materials, and strict control of flammable liquids and combustible materials. Procedures are followed for design review of plant and equipment changes for fire and explosion hazards, and routine inspections and audits are conducted to check for fire hazards. The combined safeguards for both prevention and control make the probability of an explosion or a major fire remote.

6.1.4.3 Criticality

Since the quantity of U-235 onsite is greater than a minimum critical mass, it is necessary to consider the possibility of a criticality incident. While such an accident is theoretically possible, programs of engineered safeguards, design review, operational controls, and audits are in place to prevent criticality accidents. Consequently the probability of an accident of this type is extremely low. In the history of the fuel fabrication industry, there has never been a criticality accident associated with fuel preparation or fabrication. The few criticality accidents that have occurred involved wet chemical processing in highly enriched scrap recovery operations. It should be noted that much larger quantities of the low enriched uranium handled at the Hematite plant would be required for a criticality accident than have been involved in these accidents with highly enriched uranium.

Criticality incidents that have occurred have had no significant environmental impact. Radiation injuries were limited to the individuals directly involved and fission products were mostly confined to the processing building in which the event happened. Based on this accident experience, it can be stated that significant environmental impact from a criticality accident is highly improbable.

Postulated Criticality Accident - The maximum number of fissions likely to occur, based on past accident experience, is 10^{18} fissions. The following assumptions were used in calculating the amount of radioactivity that would be released to the atmosphere.

1) The release results from 10^{18} fissions in a liquid supercritical system.
2) The accident lasts for 1 second and decay of radioactivity begins at this time. Only volatile fission products are assumed to be released; 50 percent of the halogens and 100 percent of the noble gases.
3) The volatile fission product cloud is drawn into the building ventilation system and exits the stack in 8.5 minutes. It then travels towards the nearest site boundary at 1 meter per second. Therefore, the fission products are 10 minutes old when the site boundary is reached.

An individual at the nearest site boundary would receive exposure from both internal and external sources of radiation. The radiation doses were calculated from submersion in an semi-infinite cloud of beta and gamma emitters, from inhalation of fission products, and from direct radiation connected with the incident. The direct radiation was conservatively assumed to be unshielded by walls and other materials. The inhalation dose calculated would result from the inhalation of radioiodines during cloud passage. An atmospheric diffusion factor of 5×10^{-2} was used in these calculations, taking minimal credit for turbulent wake of the buildings and assuming a ground level release.

Maximum dose to an individual at the nearest site boundary resulting from the postulated accident:

Submersion Dose	14.0 Rem
Inhalation Dose (Thyroid)	4.0 Rem
Direct Dose (promp neutrons and gamma rays)	7.8 Rem

Thus the maximum radiation dose to an individual at the nearest site boundary, calculated using very conservative assumptions, would not result in discernible radiation injury.

The maximum dose to the nearest low population zone, the town of Hematite, was calculated to be 1.7 Rem from submersion (whole body) and 0.5 Rem from inhalation (thyroid). These doses are smaller than the maximum permissible occupational radiation exposure for individuals working with radioactive materials.

6.1.5 Class 5 Accidents

In this category are accidents that could occur offsite and subsequently release radioactivity offsite. An accident falling into this classification is a radioactive materials shipping accident.

Transportation of radioactive materials takes place both to and from the Hematite plant site.

The uranium shipped to the Hematite site is principally UF_6 in Model 30B shipping containers. Shipments from the Hematite site are principally UO_2 powder and pellets. Fuel shipments from the Hematite site are made using exclusive use trucks.

All such radioactive material shipments are regulated by the U.S. Department of Transportation and the Nuclear Regulatory Commission, and are in full accordance with state and federal regulations governing the safe shipment of hazardous materials.

6.1.5.1 Shipments to the Hematite Site

The majority of radioactive material shipped to the Hematite site will consist of uranium hexafluoride (UF_6). Some discrepant uranium oxide (UO_2) powder and pellets are also received for recycle.

The low enriched UF_6 is received in Model 30B cylinders 30-inches in diameter, containing up to 5000 pounds of UF_6. These cylinders are contained in Model OR-30 protective shipping packages. Approximately 30 shipments are received annually.

Discrepant UO_2 powder and pellets are received in Type "B" steel drums meeting all DOT specifications and NRC regulations.

Shipments, on receipt, are completely surveyed for damage and radioactive contamination and the truck is surveyed before it is allowed to leave the plant site.

6.1.5.2 Shipments From the Hematite Site

Radioactive material shipped from the Hematite plant site largely consists of finished UO_2 fuel pellets and UO_2 powder, and is shipped in specially designed and tested shipping containers. Most shipments are made in Model CE-250-2 and UNC 2901 shipping containers, but other approved models may be used. These containers are shipped in exclusive-use trucks, and approximately 50 shipments are made annually.

In addition to product shipments, small quantities of radioactive materials are also shipped in the form of contaminated paper, rags and other solid wastes. Approximately 4 such truckloads of waste materials are removed from the Hematite site and shipped to a licensed burial site each year. These shipments are made using steel drums or plastic lined wooden boxes on exclusive-use trucks.

All containers and the transport vehicles are surveyed for proper loading, absence of defects that could effect container integrity, and for levels of radioactive contamination before off-plant shipment.

6.1.5.3 Environmental Impact of Shipments

All shipments of radioactive material to and from the C-E Hematite plant site are made in accordance with the stringent regulations of the DOT and NRC. These regulations specify container integrity under severe conditions. The containers are designed, manufactured, and maintained to provide containment of their contents and remain subcritical when subjected to the following hypothetical accident conditions:

1) A 30' drop onto an unyielding surface in the most damaging orientation, followed by

2) A 40" drop onto a 6" diameter steel rod, striking in the most vulnerable spot on the container, followed by

3) A 30-minute fire at 1475°F, followed by

4) Submersion in water to a depth of 3' for 8 hours.

In addition to the stringent performance standards for shipping containers, C-E imposes administrative control over the exclusive-use truck transport vehicles. The number, type, and contents of the containers loaded on each truck will be controlled to ensure that all vehicles will remain nuclear-safe under normal transport and severe accident conditions.

No transportation accident resulting in a criticality has ever occurred. In addition, container performance standards and vehicle loading controls are provided to ensure that a vehicle will remain nuclear-safe even during hypothetical accident conditions. For this reason it is extremely unlikely that a nuclear criticality could result from shipments to or from the Hematite site. Should a shipping package be breached, the impact on the environment would be low as the nuclear materials are in solid, insoluble form and not readily dispersible. Due to the low specific activity and low radiation levels of the uranium involved, the radiological impact on the environment from a transportation accident would not be significant.

6.1.6 Class 6 Accidents

Accidents of this type are naturally occurring events such as flooding, wind damage, and earthquakes.

Flooding - Flooding is not considered credible as the high water level for the area's worst recorded flood (1844) was approximately 409 feet above mean sea level. The high water level in more recent times was 395 feet in 1951. Since the Hematite site is located approximately 454 feet above mean sea level, the probability of damage resulting from a flood is very low.

Wind Damage - The average wind speed for the area, as recorded by the St. Louis U.S. Weather Bureau, was 9.5 miles per hour for 1970. Elevated wind speeds often occur as storm fronts move through the area, particularly in the Spring and Summer. However, no wind damage has been experienced in the 19-year history of the Hematite plant. The probability of a tornado is extremely low, but could cause considerable dispersement of contaminated items and require a major cleanup effort. Extensive dispersement of nuclear material would not be expected offsite, due to the physical form of the material and storage in sealed containers. The radiological impact on the environment of a tornado striking the plant would be minor.

Earthquakes - The east central Missouri general area is relatively active seismically. The southeastern area is quite active seismically and also contains a portion of the New Madrid Fault that caused the "great earthquakes" of 1811 and 1812. Three quakes of Epicentral Intensity XII (M.M.) took place near New Madrid in December, 1811, and in January and February, 1812. During recent years, there have been two quakes recorded in the New Madrid area.

In 1962 a quake measuring V (M.M.) was recorded and one with a magnitude of 4-1/2 was recorded in 1963. There is a very low probability, however, of nuclear material release from the facility caused by an earthquake.

6.2 Emergency Plans

Combustion Engineering has established plans to effectively cope with emergencies from an accident involving radiation, fire, and other emergency situations. The purpose of the plans is to protect the health of the employees and the public and effectively deal with the emergency.

6.2.1 Nuclear Alarm Procedures

C-E is required to have a nuclear alarm system to immediately detect a criticality excursion and to have an emergency evacuation procedure. A summary of the required action should a criticality incident occur includes: accounting for all personnel, administrative first aid and evacuation of injured, collecting personnel dosimeters, notifying appropriate authorities, establishing the magnitude of the incident and existing hazards, and initiating postaccident recovery and reentry operations. A copy of the "Nuclear Alarm Procedures", which gives more detail on the above action plan, is contained in Appendix A.

6.2.2 Non-Nuclear Emergency Procedures

The C-E emergency plan for the Hematite site was prepared to provide a coordinated effort to cope with: civil disturbances, fires, radiological accidents, major accidents and other conditions which seriously affect the Hematite site or adjacent property. The plan lists: the site emergency organization and the emergency call list with the attendant duties of the personnel on the call list.

Specific personnel are given specific duties to carry out in case of accidents or emergency situations that may occur. The plan lists types and location of equipment required, phone numbers of cognizant personnel to be contacted, and explicit procedures to be followed after an emergency has occurred. A copy of the emergency plan for the C-E Hematite site is contained in Appendix A.

Appendix A

COMBUSTION ENGINEERING, INC.
Hematite, Missouri

Emergency Procedures Manual

Revision 2

June, 1975

Approved: ______________________
James A. Rode, Plant Manager

____
Harold E. Eskridge, NIS/NMM Supervisor

EMERGENCY PROCEDURES MANUAL

Table of Contents

(Continued)

Table of Contents (continued)

SECTION I. SITE EMERGENCY PLAN

A. Purpose

The purpose of the Emergency Procedures Manual is to provide a plan and procedures for a coordinated effort to cope with: nuclear criticality, fire, radiological accidents, explosions, potential major hazards, civil disorders, major accidents and severe weather conditions which seriously affect the Hematite site, adjacent property or which require total plant capability.

B. Introduction

Saving human lives, and preventing or lessening personal injury are the major considerations during any emergency situation. It is also important, subsequently, to minimize property damage and to determine the cause and effect of an emergency.

The procedures contained herein are of necessity general, and apply to all C-E Hematite personnel for any emergency situation. Included are procedures for evacuating the affected area, reporting the emergency, and obtaining medical and other help. Instructions for the immediate response to an emergency are provided. All other aspects of coping with an emergency which are not covered herein will be executed under the direction of the Emergency Director or the Plant Manager.

The Site Emergency Plan can be implemented in several ways:

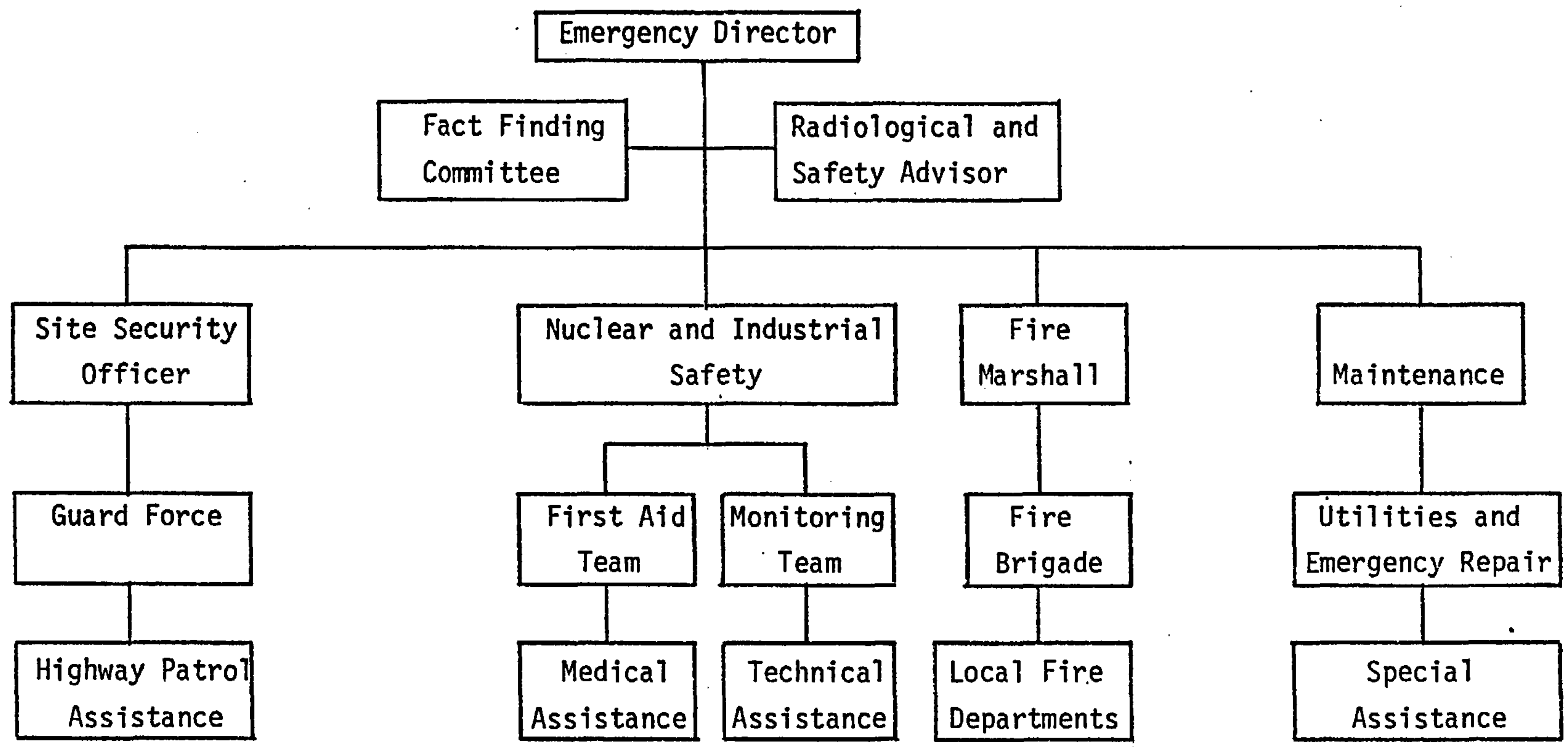
1. Sounding of the nuclear alarm (intermittent horn).

2. Sounding of the non-nuclear alarm (loud, continuously ringing bell).

3. By any personnel cognizant of an actual or impending emergency situation.

At such time as the Site Emergency Plan is put into effect, all aspects of the emergency situation will be coordinated within the scope of the site emergency organization (see chart, next page).

Telephone numbers of personnel that may be required in emergency situations shall be maintained. A copy of the current list will be found in Section II.



EMERGENCY ORGANIZATION CHART

C. Responsibilities

1. Emergency Director

   a. Activate Emergency Control Center in the tile barn emergency room, or establish an alternate control point from which activities can be directed.

   b. Direct, coordinate, and evaluate actions to be taken by functioning emergency teams.

2. Fact Finding Committee

   Members to serve on this committee will be selected by the Director depending on the nature of the emergency. The Chairman of the committee shall be an individual who is not a member of the immediate response teams.

   a. Communicate with the Emergency Director and others to obtain facts for determining the cause and effect of the emergency.

   b. Interview personnel who witnessed the incident or those who can contribute information leading to cause and effect.

   c. Review and examine all evidences (photographs, recoverable materials, etc.) that may be considered pertinent and informative for evaluation purposes.

   d. Prepare a written report for the Plant Manager.

3. Radiological and Safety Advisor

   a. Accumulate and evaluate known data to determine the extent of the emergency.

   b. Establish a liaison between the Director and a direct source of available information.

   c. Establish policies regarding the emergency plan of action for controlling the incident.

   d. Shall be responsible for collecting and disseminating information pertaining to the emergency.

   e. Normally be the sole contact with news media.

   f. Maintain a close liason with the Plant Manager regarding emergency activity progress.

g. Inform and consult with the Fact Finding Committee.

h. Review and obtain approvals for public releases and notices.

4. Supervisors

   a. Each supervisor is responsible for proper implementation of the Site Emergency Plan.

   b. Shall assure himself that personnel under his supervision are familiar with the location and use of emergency equipment.

   c. Shall assure personnel familiarization with the Emergency Plan and Procedures.

5. Nuclear and Industrial Safety

   a. Shall assess and delineate an emergency radiation or toxic fume, vapor or mist condition.

   b. Provide personnel monitoring, decontamination, recovery accident dosimetry for analysis and collect health physics or industrial hygiene samples for analysis.

   c. Conduct environmental monitoring.

   d. Assist with first aid and emergency rescue.

   e. Procure, store and issue protective clothing and equipment for recovery operations.

   f. Prepare necessary records and reports.

6. Site Security Officer

   a. Direct and coordinate Security Guard activities.

   b. Restrict assess to the site to authorized personnel and outside supporting services.

   c. Coordinate activities with state and local police.

7. Fire Marshal

   a. Coordinate the fire-fighting activities of site fire brigades with local fire departments.

   b. Organize site fire brigades.

   c. Assure that personnel have been trained in fire-fighting techniques.

8. Security Guards

   a. Provide traffic control and communication with outside supporting services.

   b. Be familiar with Special Guard Orders for all emergency occurrences.

9. Maintenance

   a. Maintain or discontinue as necessary utility services during the emergency.

   b. Provide, fabricate or modify equipment needed for recovery operations.

   c. Provide equipment and personnel for recovery and salvage operations.

   d. Obtain special assistance as necessary.

SECTION II. EMERGENCY CALL-IN LIST

Names under each position are to be called in order until one is contacted.

Ex. 6

Emergency Directors

1. Arlan Swaringin
2. Bob Miller

Radiological and Safety Advisors

1. Harold Eskridge
2. Lou Swallow

Nuclear and Industrial Safety

1. Bob Bilbrey*
2. Charles Lovell*
3. Steve McClenahan
4. Nancy Wilper

* Alternate Radiological and Safety Advisors

Fire Marshals (Also act as Alternate Emergency Directors)

1. Don Dixon
2. Glen Thomas
3. Arlon Noack

Plant Manager

J. A. Rode

The following are to be called as required.

Maintenance Assistance

1. A. Day
2. H. Gilmore
3. E. Szramkowski
4. W. Curtis
5. R. Moore

Ex. 6

Guard Force Assistance

1. C. Kloth
2. R. Bess
3. R. Rode
4. R. Tyner

Ex. 6 [ ]

Technical Assistance

1. Tom Gutman — Office: 203/688-1911 Ext. 684

Ex. 6 [ ]

Medical Assistance

1.	Ambulance - Dietrich	586-3337	(DeSoto)
	Mahn	586-2288	(DeSoto)
	Politte	937-3631 or 937-4444	(Crystal City)
	Mercy	296-8650	(Arnold)
2.	Jefferson Memorial Hospital	937-8651	(Crystal City)
3.	Barnes Hospital	367-6400	(St. Louis)

		Office	Home
4.	Dr. Mayfield	937-6800 (Crystal City)	Ex. 6 [ ]
	Dr. Knowlton	361-7600 (St. Louis)	
	Dr. Haffner	367-0446 (St. Louis)	
	Dr. Schapleigh	862-3711 (St. Louis)	

Fire Fighting Assistance

Hematite, Festus and other local Fire Departments	937-9619 or 937-4622	(Central Dispatcher)

Police Assistance

1.	Sheriff's Office	789-3346	(Hillsboro)
		296-0411	(St. Louis)
2.	Highway Patrol	434-5500	(Creve Coeur)
3.	FBI	241-5357	(St. Louis)

Utilities Assistance

1.	Missouri Natural Gas Company	937-7662	(Festus)
2.	Union Electric Company	937-4654	(Festus)
3.	Southwestern Bell Telephone Company	937-4102	(Festus)

Ex. 6

Management Notifications (by Title)

1.	J. A. Rode	Plant Manager
2.	L. J. Swallow	Q.A. Manager
3.	R. H. Niemeier	Engineering Supervisor
4.	R. C. Miller	Prod. & Mat'l Control Supv.
5.	H. E. Eskridge	NIS/NMM Supervisor
6.	A. G. Swaringin	Production Superintendent
7.	F. J. Pianki	General Manager

NRC Notification

Region III	8:00 a.m.-4:30 p.m.	312/856-2660
	Nights, weekends, holidays	312/739-7711

SECTION III. NUCLEAR ALARM PROCEDURE

A. General Instructions - All Personnel

1. Applicable whenever nuclear alarm sounds (except during regular weekly test of the alarm).

2. Alarm: Intermittent horn.

3. Action: All personnel immediately evacuate to the tile barn emergency assembly area. Do not attempt recovery operations.

   a. Leave building by nearest exit.

   b. RUN - do not walk - to the nearest exit from the building.

   c. Get outside by the shortest path. Then proceed to front gates. Stay well away from buildings. Guard and Foremen will unlock gates.

   d. Once outside gate - walk rapidly to the tile barn.

   e. If visitors or outside contractors are in the area, see that they are evacuated to the barn with other personnel.

   f. It is of greatest importance that ALL personnel be evacuated from the plant. DO NOT LEAVE ANYONE BEHIND!

   g. The Emergency Director will take full charge. All others will follow his direction.

   h. If indications of a nuclear incident were observed (blue flash, tank foaming over, or other unusual activity), report the incident to the Emergency Director immediately. Fill out Form No. 1, Personnel Statement Concerning Incident.

   i. The assembly in the barn must be quiet and orderly. Smoking is not permitted. Do not use the telephone.

   j. Do not re-enter the plant until directed to do so by the Emergency Director.

B. Emergency Director Instructions

1. Assume responsibility for emergency action.

2. Evacuate plant. All personnel must be removed.

3. See that guard opens main gates for personnel leaving area. Send all personnel to barn. Post guard at main driveway at highway to prevent anyone from entering or leaving plant area until the "All Clear" is given.

4. Upon assembly at the barn, determine that all personnel have been evacuated.

On day shift, have senior member of all departments check their personnel roll, including their visitors and any outside contractors.

If anyone is missing, instruct re-entry team to prepare for emergency rescue.

5. Question those assembled to determine if any unusual occurrences were observed.

6. Post Assistant Director at telephone.

7. Silence alarm (silencing switch in barn).

8. Instruct survey team to prepare for re-entry.

9. Determine if any emergency or hazardous situation exists as a result of unattended operations. Provide this information to survey team.

10. Dispatch re-entry team to the plant. Be sure that their instructions are clear, and understood.

11. Instruct health physics technician to check all badges for indium foil activation.

12. Provide first-aid for persons injured during evacuation.

13. Receive report of re-entry team. Decide if alarm is false or if actual criticality has occurred.

    Note: A false alarm occurred if:

    No gamma radiation above normal background is found. Normal background is less than 5 mr/hr.

    There has been no physical evidence such as a blue flash, tank eruption, or mechanical damage to equipment.

    No radiation detected on indium foil personnel badge.

14. When it is determined that a false alarm has occurred:

    a. Release all personnel to return to normal work area.

    b. Have foreman check all operations to insure safe resumption of plant activities.

    c. Determine which detector is faulty and arrange for its replacement with the spare unit.

d. Issue instructions to prohibit movement of uranium in area covered by the faulty detector.

   Rescind these instructions when detector has been returned to service.

e. Prepare report.

15. When it is determined that an actual criticality has occurred:

    a. Arrange for treatment of injured or exposed personnel.

    b. Arrange for decontamination of personnel.

    c. Determine radiation level in assembly area. Decide need to relocate.

    d. Collect film badges and record indium foil readings.

    e. Instruct health physics to initiate sampling of airborne contamination:

    f. Start action to obtain assistance:

       (1) Ambulance

       (2) Hillsboro sheriff

       (3) Dr. Knowlton, Jr. (radiation exposure)

       (4) Barnes Hospital (radiation exposure)

       (5) CE Management list. Request first individual contacted to inform the NRC and other persons on management notification list.

    g. Direct survey team to establish 100 mr/hr boundary line.

    h. Based on information from survey team, initiate action to shut down the plant.

    i. Obtain other assistance as required.

    j. Do not permit anyone to leave unless:

       (1) Their report has been completed.

       (2) Their indium foil reading was zero (0).

       (3) They have been monitored for contamination, and decontaminated, as necessary.

C. Guard Force Instructions

1. Applicable whenever nuclear alarm sounds (except during regular weekly test of the alarm).

2. Alarm: · Intermittent horn.

3. Action: Unlock the east main gate to permit personnel to leave the plant from the yard areas.

   Take station at the intersection of the highway and the plant driveway. Do not permit anyone to enter or leave plant area unless directed to do so by the Emergency Director.

   Note: It may be necessary in an unusual situation to proceed to the tile barn to admit the personnel to the assembly area.

   WEEKEND OR HOLIDAY: When plant is vacant, proceed to barn and call the Emergency Director, then take station at plant driveway and do not permit anyone to enter the plant area until directed by Emergency Director.

D. Plant Survey Team

1. Re-entry to the plant shall be made by a radiation survey team of at least two persons designated by the Emergency Director.

2. Equipment required

   a. New film badge from emergency supply.

   b. Pocket dosimeter from emergency supply.

   c. Low level survey meter (marked low).

   d. High level survey meter (marked high).

3. Initial Survey

   a. Be sure survey meters are working (use check source).

   b. Approach plant cautiously.

   c. One member of the team shall closely watch readings on the low level meter.

d. Proceed in to main entrance and to the nuclear alarm control panel. Determine which area alarmed.

   NOTE: Report back to Emergency Director immediately if radiation levels of 100 mr/hr or higher are detected.

e. Approach the alarmed area carefully - note closely the readings on the survey meters.

f. Continue survey of entire plant as long as radiation readings do not exceed normal background of 5 mr/hr.

g. Report back to Emergency Director.

E. Emergency Rescue or Equipment Shut-down

1. General

Re-entry to areas where the radiation levels exceed 100 mr/hr may be authorized by the Emergency Director only to save life or prevent loss of valuable property, and only within the below listed limits.

Re-entry for any other purpose is not authorized without specific approval of the Radiological and Safety Advisor.

2. Team Personnel

The re-entry team will be composed of two or more persons designated by the Emergency Director.

3. Requirements

a. Protective Equipment

Coveralls or smocks
Plant shoes or rubber shoe covers
Self contained breathing apparatus
Radiation survey instruments - (Range to 500 R/hr or greater)
Dosimeters
Film badges.

b. Rescue Equipment

50 feet rope
Disposable splints
Disposable stretcher
First-aid kit

4. Restrictions

   a. Two survey meters shall be used. Frequent cross-checks are required to assure similar readings are obtained on both meters.

   b. Do not enter a radiation field in excess of 200 R/hr. (Roentgens/hour).

   c. Maintain at least 10 feet distance from the system that was critical.

   d. Prompt evacuation is required if the radiation level seems to fluctuate or suddenly rises without apparent reason. Avoid unnecessary exposure.

5. Permissible Exposure

   a. Allowed exposure for any person shall not exceed 12.5 Roentgens. Under unusual circumstances, exposures may be permitted to a maximum of 25 Roentgens.

   b. Time-of-stay during re-entry shall be limited according to Table I. Such time-of-stay will commence upon penetrating beyond the 100 mr/hr boundary and terminate upon re-crossing it while exiting.

   c. Time-of-stay limits established by Table I will be based upon the highest dose rate to which the re-entry team will be exposed and will limit their exposure to the recommended 12.5 Roentgens.

Table I

Emergency Rescue Time-of-Stay

Max. Radiation Level	Permitted Minutes in Area
200 R/hr	4
150 R/hr	5
100 R/hr	7.5
75 R/hr	10
50 R/hr	15
30 R/hr	25
15 R/hr	50

A copy of this table is affixed to the re-entry survey instruments for guidance of the re-entry team.

F. First-Aid Crew

1. Formal training in first-aid is required of persons designated as the first-aid crew.

2. Administer immediate first-aid to injured.

3. Prepare injured for evacuation for further medical attention.

4. Set up first-aid station for sorting and caring for injured if situation warrants.

5. Keep Emergency Director informed of requirements for ambulances, additional supplies and personnel.

6. Accompany injured to hospital with indium foil readings, if appropriate.

7. After delivering injured to hospital, report to Emergency Director for contamination survey and possible bio-assay samples. Shower or decontaminate as specified by Nuclear and Industrial Safety.

G. Nuclear and Industrial Safety

1. Prepare survey meters for use. Check their operation with test source.

2. Check radiation level in barn. Report it to Emergency Director if greater than 100 mr/hr.

3. Monitor indium foil on film badges for radiation. Record person's name and reading in duplicate.

4. Check survey or emergency rescue team equipment.

    a. New film badges
    b. Pocket dosimeters
    c. Survey meters

5. Prepare air sampling equipment for use.
Prepare for contamination monitoring of personnel.

6. Other, as instructed by Emergency Director.

7. Record dosimeter readings from pocket dosimeters used by re-entry team.

AFTER FALSE ALARM

1. Re-set nuclear alarm system.

2. Assist in replacing defective unit.

3. Other as instructed by Emergency Director.

SECTION IV. NON-NUCLEAR EMERGENCY PROCEDURE

A. General Instructions

1. Applicable

Applicable to production and health physics personnel and others in the affected area(s).

2. Type of Emergency

This procedure applies for:

a. Fire
b. UF_6 release
c. Powder (UO_2) spill
d. Uncontrolled hydrogen, ammonia, or natural gas leak
e. Any potential major hazard requiring assistance, including severe weather
f. Any emergency determined by Emergency Director, except for a nuclear criticality.

3. Alarm

Loud continuously ringing bell. Alarm is to be sounded by any person requiring assistance to control the emergency.

4. Assembly Point

Driveway by water tank.

5. Action

a. Evacuation to emergency assembly point shall be required for:

(1) All personnel in immediate area of emergency.
(2) Fire brigade, Emergency Director, Foreman, NIS Technician, and Nuclear and Industrial Safety Supervisor.

b. Production Area Monitors

(1) Two experienced operators designated in advance by the Area Superintendent or Foreman shall remain in each plant production area that is not immediately affected by the emergency.

c. All others shall return to their regular assigned work area and remain there until given specific instructions to evacuate.

(1) These persons shall evacuate to the parking lot when instructions to evacuate are received.

B. Special Instructions

1. Fire Brigade

   a. Bring fire extinguishers to assembly point.
   b. Bring standard dust respirator.
   c. Bring Scott Air Pak from hallway in Building 240.

2. Pellet Plant/Oxide Operator

   a. Bring Scott Air Pak from emergency board near restroom in Pellet Plant.
   b. Bring Scott Air Pak from Oxide Building control room.

3. Production Area Monitors

   a. Be sure that all personnel (including "outside" personnel) have evacuated your area.
   b. Monitor process equipment to maintain control. Shut down if control cannot be maintained.
   c. Shut down equipment as directed by Emergency Director.
   d. Inform Emergency Director of hazards developing in your area.

C. Emergency Director Instructions

1. Assume command of emergency brigade.

2. Determine what the emergency is, and its location.

3. Determine if personnel are trapped in the affected area.

4. Issue instructions for:

   a. Recovery of injured or trapped personnel.
   b. Combating specific problem.
   c. Prevent unauthorized access to emergency area.

5. Determine need to evacuate other plant areas.

6. Evaluate potential hazards to other parts of plant and issue appropriate instructions.

7. Determine need for additional assistance - initiate necessary action to call in assistance.

8. When emergency has been controlled:

   a. Request NIS survey of affected area and approval to return to normal operation.
   b. Initiate restoration of emergency equipment to "ready" condition.
   c. Prepare written report.

D. Guard Force Instructions

1. When Plant is in operation:

   a. Return to station.
   b. Determine visitors present, off-shift CE personnel present, and all other CE personnel and their locations.
   c. Do not permit unauthorized use of the telephone.
   d. Stand by to unlock gates and barn.
   e. Stand by to admit ambulance, fire department, and/or other service units.

      ALLOW AMBULANCE IMMEDIATE ACCESS TO EMERGENCY AREA

      Hold Fire Department and "other" at gate, until released by Emergency Director.
   f. Prepare to establish road blocks.

2. When Plant is shut-down:

   CALL: Emergency Director and other personnel required in accordance with call-in list (Section II).

E. Plant Re-Entry

1. Personnel Protective Equipment

   a. Minimum: Comfo Respirator

   b. Special Requirements
      (1) Fire or UO_2 Spill

      Emergency Director shall determine need to wear the Scott Air Pak. If there is any doubt of its need, then it shall be worn.

      (2) UF_6 Release

         (a) Scott Air Pak required.
         (b) Rubber or plastic rain coat required.

      (3) Ammonia or Natural Gas Leak

         (a) Scott Air Pak required.

      (4) If any acids are potentially involved, wear face shields, rubber gloves, and other standard equipment normally worn for acid or chemical solutions.

2. Emergency Squad Membership

   a. At least two persons shall work together as a team.

3. Action

   a. Take action as directed by Emergency Director - insofar as possible, determine alternate actions prior to re-entry.

   b. Report to the Emergency Director if specified action and alternate action can not be completed.

4. After the Emergency

   a. When released by the Emergency Director:

      (1) Report to Health Physics for contamination survey and possible bio-assay samples.
      (2) Take shower or other decontamination, as directed by Health Physics.

   b. Complete reports requested by Emergency Director.

   c. Report any injury to the Emergency Director.

F. First-Aid Crew

1. Formal training in first-aid is required of persons designated as the first-aid crew.

2. Administer immediate first-aid to injured.

3. Advise Emergency Director on methods of evacuating injured from emergency area.

4. Set up first-aid station for sorting and caring for injured, if situation warrants.

5. Keep Emergency Director informed of requirements for ambulances, additional supplies, and personnel.

6. Accompany injured to hospital.

7. After delivering injured to hospital, report to Emergency Director for contamination survey and possible bio-assay samples.

   Take shower or other decontamination specified by NIS.

G. NIS Personnel

1. Proceed to assembly point and then to emergency area as directed.

2. Investigate and evaluate airborne contamination danger. Advise Emergency Director of recommended protective equipment for emergency crew, evacuation measures, or other courses of action.

3. Investigate and evaluate explosion hazard and/or toxic atmosphere problems. Advise Emergency Director of situation.

4. Evaluate criticality hazard and brief the Emergency Director.

5. Set up monitoring equipment as required.

6. Investigate and evaluate contamination levels of personnel, equipment and the plant environs. Brief the Emergency Director on safe working limits and decontamination requirements.

7. Set up decontamination center, if required.

8. Set up check point for monitoring outside personnel, equipment, and vehicles.

9. Advise the Emergency Director on changes in exposure levels and safe re-entry evaluation.

10. After emergency, check personnel contamination. Specify need for decontamination of personnel and bio-assay samples. Specify need and monitor any cleanup operations required for plant or environs.

H. <u>Movement and Storage of Special Nuclear Materials</u>

1. Material should be moved only to prevent a fire or other emergency situation from becoming more hazardous by causing the spread of the radioactive material or a criticality accident.

2. When the Emergency Director decides relocation is required:

   a. Request advice from H. E. Eskridge, R. E. Bilbrey or L. J. Swallow, if they are present, or can be contacted promptly.

   b. If Eskridge, Bilbrey or Swallow are not available, proceed to relocate the material by:

   NOTE: If practical, obtain assistance of NMC personnel to record identity and location of moved material.

      (1) Decide where to move it. Possible locations in order of preference area:

         (a) Unused spaces in warehouse.
         (b) Product shipping containers.
         (c) West half of the pellet plant floor.
         (d) Any yard area <u>inside</u> the fence.
         (e) Office areas.

      <u>DO NOT</u> permit use of any driveway or walkway.

(2) Specify that the distance between containers be at least as much as it was originally.

(3) Permit each person to carry only one container at a time.

(4) If storage is not possible on existing safe shelving or in shipping containers, instruct that separating devices be placed between containers to insure their continued separation. This is required for all containers weighing less than 50 pounds.

Separating devices that can be used are concrete block, pipe or conduit, or empty drums.

(5) Assign someone to make a record of each container, its contents, identity, and location; and to maintain watch over the material to prevent undesired movement or unauthorized removal.

c. Arrange for prompt and orderly return to standard storage as soon as possible when the emergency has been controlled, or threatened hazard has passed.

d. Remember, the important requirement is to maintain as much space as possible between containers.

SECTION V. BOMB THREAT PROCEDURE

A. Scope

This section describes action to be taken in the event of a bomb threat or discovery of a bomb in or on the premises of Combustion Engineering, Inc.

All bomb threats (telephoned, written) or actual discovery of a bomb or suspicious object on the premises, will be reported to the Emergency Director, Security Officer, Plant Manager, and Nuclear and Industrial Safety Supervisor.

Between the hours of 4:30 p.m. and 8:00 a.m., the guard on duty will call the on-site Emergency Director. During non-working shifts (i.e., Saturdays, Sundays and holidays), the guard will call an Emergency Director from the list provided in Section II. He will continue calling until an Emergency Director has been contacted. (See Attachment A for guidance for telephone threats. See Attachment B for guidance for written notification of bomb threats. See Attachment C for guidance for an employee discovering a bomb or suspicious object in or on Combustion Engineering premises. See Attachment D for guidance for official responsibilities). The Emergency Director will decide, based on information transmitted to him, whether evacuation will be necessary. If time permits, a search will be initiated. Evacuation is recommended unless the threat is clearly capricious. The Emergency Director will notify Management (see call-in list, Section II).

B. Search Procedure

1. If the decision is made to not evacuate, a search will be immediately conducted in the areas indicated by the initial notification. If no location is indicated, the entire plant and premises will be searched, including the parking lots.

2. A search party will be comprised of volunteer members of management, security guards, fire brigade, NIS personnel, as designated by the Emergency Director. The search party must be notified of:

a. Expected time of explosion
b. Exact words given as to location
c. Exact description of object, if known.
d. Times to halt or continue search (usually one hour ahead of or one hour after explosion time).
e. Likely places to look are:

Storerooms	Corridors
Lockers	Waste baskets and disposal cans
Behind clocks or signs	Closets
Toilet tanks	Heating Vents
Behind and under sinks and plumbing	Furnace rooms
	Electrical control areas
Stairwells	Shipping and Receiving docks

A bomb may be as small as a fountain pen or as large as a trailer truck, solid or liquid, disguised and concealed. An object or package may be suspect if it fits any one or combination of the following:

a. The object fits the circumstances described in the threat or warning.

b. The object is foreign to the premises.

c. The origin of the object is questionable or cannot be readily determined.

d. The object is labeled "bomb" or "danger", etc.

e. The physical appearance of the object is unusual in regard to size, shape, weight, or audibility.

Searches should start from the outside of the building and work toward the center. Areas open to the public should be given priority. Begin at the bottom of an area and work up.

Searches must be well organized, regardless of their extent. The Emergency Director should assure that a check list is made of the areas to be searched. As the results of the search are concluded, reports should be made to the person keeping the check list to assure that all areas are checked. The times that searches were completed and the names of the reporting parties should be recorded. This systematic approach is necessary if the responsible official is to be assured that the designated searches have been completed.

BOMBS OR SUSPECT OBJECTS OR PACKAGES SHOULD NOT BE MOVED OR OPENED EXCEPT BY EXPLOSIVE EXPERTS.

C. Evacuation

If evacuation is decided upon, the following steps will be taken prior to the search:

1. The Emergency Director will authorize announcing of the evacuation. The evacuation will be communicated to the employees in the following manner:

   Manual activation of the fire alarm bell - it will be sounded intermittently.

2. All personnel will evacuate to an assembly area north of the parking lot, on the grass section between the parking lot and Route 21-A.

Once evacuation has been executed, it is recognized that a dangerous situation probably exists. Consequently, the Emergency Director(s) must use volunteers, obtained either by pre-arrangement or obtained at the time of the incident, to go into the plant and perform the activities listed below:

a. Secure in-process material of a critical nature, if possible.

b. Shut off gas, power, and fuel lines in all areas, if possible.

c. Venting open all windows and doors to minimize blast damage.

d. Have flammable or toxic materials removed.

e. Obtain mattresses, pillows, sandbags, or other baffle devices, if possible.

f. Secure Special Nuclear Material in storage racks.

3. Assure that the fire brigage has been notified and is standing by with assembled fire extinguishing devices.

4. The Emergency Director will make assignments to:

a. Obtain and record statements from personnel about incident.

b. Maintain a log for preparation of the formal investigation report.

c. Assure that the Jefferson County Sheriff's Department has been notified and assistance requested, if required.

d. Assign a Supervisor to meet the Hematite Fire Department and Jefferson County Sheriff's Department, and assure that he is aware of the special precautions.

e. Notify Fire Department and Police Department of the name of the supervisor who will meet them.

5. Plant Security Officer will notify:

a. Local office of the FBI

b. Jefferson Memorial Hospital

c. And maintain liaison with Jefferson County Sheriff's Department.

6. The Emergency Director will assure that the guards will obtain the names of all non-employee personnel that have entered the plant; stop

all other non-employees from entering the plant; and remove non-employees from plant during evacuation.

D. Location of Questionable Object

If a bomb is found, the Emergency Director and/or Security Officer will obtain the services of an Explosive Ordnance Disposal expert through the Jefferson County Sheriff's Department, who is to contact the Military Explosive Ordnance Disposal Control Center, 543rd Ordnance Detachment, Fort Leonard Wood, Missouri, area code and telephone 314/368-3814 or 314/368-4313. Also, certain protective work, utilizing a minimum number of volunteer personnel to effect the measures for reasons of safety, should be undertaken:

1. Baffling procedures: mattresses, sandbags or other materials placed around bomb, NOT ON TOP. This is to direct and minimize blast and fragment damage.

2. Post guards or supervisory personnel on Route 21-A, at the electrical sub-station, and at the tile barn, to assure that no one may gain entry while these operations are in progress.

E. Return to Work

When the problem is resolved, the Emergency Director and the Nuclear and Industrial Safety Representative will determine the extent to which personnel may return to their work station.

1. With the assistance of the Security Officer/Maintenance, identify and barricade any prohibited areas.

2. Announce, to all present, the cleared and prohibited areas.

3. The Fact Finding Committee should collect all information and prepare a formal report, addressed to the General Manager, with copies to the Plant Manager, the Emergency Director, Security Officer, and Nuclear and Industrial Safety Supervisor.

SECTION V - ATTACHMENT A

GUIDE FOR RECEIVERS OF TELEPHONED THREATS

1. If possible, mechanically record the conversation. If not, write down the exact words of the caller. If a second person is available, have him listen in on the call and make notes. Pay closest attention to the time and location of the alleged bomb. Nothing should be deleted from the message.

2. Try to engage the caller in further conversation for the purpose of making him reveal vital details of the threat or possibly some clue to his identity. A special effort of this nature should be made when the time and place are not specified. This can be accomplished by pretending not to hear or understand, and asking the caller to repeat his message. He might even be asked to spell some of the words. If the caller does not indicate the location of the bomb or time of detonation, ask him. The receiver may also express doubt of the seriousness of the call so that the caller will add information to "prove" the validity of the message.

3. Observe vocal characteristics. Note whether the voice is that of a male or female, adolescent or adult, and marking any unusual characteristics such as: peculiar pronunciations of certain words or syllables, or an accent - either foreign or of a particular American locality. Anxiety, laughter, or detectable emotional state, including evidence of intoxication, should be noted in the voice. Accompanying background noises will sometimes indicate whether the call is being made in a tavern, at a party, or from some public place. (A juke box, tinkling of glasses, loud and noisy conversation.) Note the sounds of motors running, type of music, etc.

4. Notify the Emergency Director, Plant Manager, Security Officer, and Nuclear and Industrial Safety Supervisor.

SECTION V - ATTACHMENT B

GUIDE FOR RECEIVERS OF WRITTEN THREATS

1. Handle the message as little as possible. To preserve possible fingerprints and avoid smudging, the message should be handled carefully. Clip boards and plastic envelopes may be useful.

2. Record all details of the receipt: where found, how delivered, by whom, time, etc.

3. Notify the Emergency Director, Plant Manager, Security Officer, and Nuclear and Industrial Safety Supervisor.

SECTION V - ATTACHMENT C

GUIDE FOR PERSONS DISCOVERING BOMBS OR SUSPICIOUS OBJECTS

1. If conditions warrant, warn personnel to evacuate the surrounding area. (Generally, this would be done if the object was known to be an explosive - stick of dynamite (?) - or marked as an explosive, or otherwise appearing to be very likely an explosive).

2. See that the object is not moved, opened, or disturbed. Remain there, and obtain assistance to limit access to the object.

3. Notify the Emergency Director, Plant Manager, Security Officer, and the Nuclear and Industrial Safety Representative.

SECTION V - ATTACHMENT D

GUIDE FOR OFFICIALS RESPONSIBLE FOR ACTION

1. Evaluation of the Threat

   All of the information available to make a timely decision should be considered. In general, such information includes:

   - Existing tensions in the locality.

   - Previous experience with bomb threats and bombings.

   - Reliability of the source. Anonymity is not a basis for discounting, since anonymous tips are most likely, and have often been the most valuable.

   - Credibility of the message - the extent to which the original source (not necessarily the caller) appears to be familiar with the facility in which the explosion is threatened.

2. Investigate the Information

   If practical, listen to any recording of any telephone call by having the recording or other record brought to the official's office, or by his going to the office where the data is located. If no record exists, personal interview with the receiver of the message should take place. If not practical, a member on the responsible official's staff should perform these duties for him. Written messages should be read carefully. Suspicious objects may be x-rayed, if feasible.

3. Notify the Top Management of the Organization

4. Factors Influencing Selection of Proper Action Option

   - The results of the evaluation of the message and of the threat.

   - The length of time specified.

   - The specificity of the location.

   - The relative ease/difficulty of evacuation.

   - The effect of evacuation on production and costs.

   - Hazards involved in evacuation itself.

   - Effect of evacuation on capability of making search.

5. Additional Decision Guidance

- Where a specific building is named but a time not specified, the decision will probably be to evacuate and search. This decision may be modified to a search only, if time (say 24 hours) permits a good search before the alleged time of explosion, or if the message was evaluated as of extreme doubt.

- Where a specific building is named and a time is specified, the decision will probably be to evacuate and search . While it is possible that the message might indicate less, it is extremely doubtful that it would be such as to lessen the prudence of evacuation and search.

SECTION VI. CIVIL DISOBEDIENCE AND DISORDER

During periods of threatened or actual civil disobedience and disorder, the Emergency Director shall cause the following activities to take place. (See Attachment A for concise activity summary).

A. Facility Preparation

1. Customer Notification

The Production Control Supervisor shall inform customers with active contracts, and such visitors as are expected, of the impending disturbance. Such notification will be by telephone and a record kept of all contacts made. Upon completing notification, this record or a copy thereof will be forwarded to the Security Officer.

2. Log of Events

A consolidated log of events shall be kept by the Security Officer. All staff and supervisory personnel shall also inform him of completion of their appointed duties and any unusual activities observed or reported to them. The Security Officer shall maintain close liaison with the Emergency Director to expedite the flow of information to him.

3. Communications

Contact with news media will ~~be~~ handled by the Plant Manager, in concert with corporate headquarters when appropriate.

4. Vendor Notification

The Purchasing Department shall inform all vendors of the disturbance and safely reroute or suspend deliveries for the duration. A record of all such contacts will be made. Upon completing notification, this record or a copy thereof will be forwarded to the Security Officer.

5. Live-In of Key Personnel

Key personnel will be informed by the Emergency Director and should be prepared to remain in-plant if the situation requires this. In their absence, the Emergency Director or his designated assistant shall contact such key personnel and request their return to the plant as rapidly as possible.

B. Plant Security

1. Guard Force

At the discretion of the Emergency Director, some or all of the Combustion Engineering Guard Force shall be summoned to the plant. Such summons shall be made by the Guard Force Supervisor or his designated representative. This call-in shall be made to provide security personnel at points of ingress/egress, for special patrols, and for coverage of vulnerable facilities or equipment. Guard personnel may be required to live-in.

2. Assistance for Guard Personnel

After completion of other duties, certain select personnel may be assigned to accompany or assist the Guard Force in their duties. This Supplementary Security Force will report to the Guard Force Supervisor until and unless relieved for other duties.

3. Protection of Property

The plant perimeter shall be guarded to the degree necessary to maintain its integrity. Breach of the perimeter must be promptly reported to the Guard Force Supervisor. Vehicles on the parking lot will not be protected unless this may be accomplished without jeopardizing security of the plant itself.

4. NRC Notification

The NIS/NMM Supervisor shall, after being instructed by the Emergency Director, contact Region III and inform them of the disturbance, the cause of the disturbance, and the actions being taken to counter or control the disturbance.

5. Telephone Contact with Local Authorities

Telephone liaison shall be maintained on a periodic basis between the Security Officer and the Sheriff's Office/Fire Department responsible for the Hematite Facility. Such contact shall be made by the Security Officer, the Guard Force Supervisor or their designated representative.

C. Employee Conduct and Plant Operations

1. Employee Conduct

Employees should report for work at their normal time using telephone check-in or local radio as a means of determining the safest route to the plant. If, when arriving at the plant, it is not possible to enter because of outside activity, employees should attempt to enter the plant through another point of entry or return home and call in giving detailed information of the attempted entry. Under no circumstances should any employee engage in disorderly acts or attempt to quell any activity being engaged in by members of local community. Where possible, reports of unlawful activity should be made to Security Guards or the security office.

2. Plant Operations During Disturbance

Personnel on-site and those called-in shall report to the Emergency Director for instructions. Such instructions will normally include:

1) Safe shut-down of sensitive equipment.
2) Safe shut-down of equipment idled by personnel unable to enter the plant.
3) Securing SNM.
4) Surveillance of operating and shut-down equipment for adequate health and safety precautions.

3. Live-In Personnel

If access to the plant is denied, operators and/or technicians may be required to live-in to maintain equipment and production in a viable position. Such individuals will be designated by the Emergency Director.

4. Training Sessions

Personnel will attend training sessions on location of emergency equipment, fire fighting equipment, and proper usage of each. All such equipment will be examined to determine that it is in proper operating condition and accessible. This training and inspection is the responsibility of the NIS/NMM Supervisor.

5. Bussing of Employees

Should access to the plant be denied, the Emergency Director shall consider bussing of employees from a common meeting place onto plant premises for the added measure of safety afforded a group entry. Police assistance may be desirable.

6. Live-In Provisions

Production and Materials Control will be responsible for obtaining provisions and bedding to support live-in personnel should the occasion demand.

7. Attendance Reports

Attendance records shall be kept by all groups and turned in to the Emergency Director one hour after the beginning of each shift. The most senior member present from each group shall be responsible for compiling such lists.

D. Resumption of Normal Activity

1. Restoring Operations

The Emergency Director shall assign such personnel as necessary to restore or have restored all equipment and/or services to operating condition upon termination of the disturbance. He shall continue to serve as Emergency Director until normal conditions have been restored or he is relieved by competent authority.

2. Customer and Vendor Notification

Customer and vendor notification of termination of the disturbance shall be made that the period of disorder is over and normal conditions have been restored. For customers, any disruption of delivery schedules will be identified at the time of this contact or at the earliest opportunity thereafter.

3. Post Emergency Evaluation

The Emergency Director and the Fact Finding Committee will hold a meeting with the Plant Manager to assess the events which occurred during the period of unrest and an evaluation will be made of protective measures that were employed. Where necessary, revisions to plans will be made and new plans promulgated for future incidents.

SECTION VI - ATTACHMENT A

Concise Summary of Activities

ACTIVITY	RESPONSIBILITY
1. Facility Preparation	
a. Customer Notification	Production and Materials Control
b. Log of Events	Security Officer
c. Communications	Plant Manager
d. Vendor Notification	Purchasing
e. Live-In Key Personnel	Emergency Director
2. Plant Security	
a. Guard Force	Guard Force Supervisor
b. Assistance for Guard Personnel	Guard Force Supervisor
c. Protection of Property	Guard Force
d. NRC Notification	NIS/NMM Supervisor
e. Telephone Contact w/Local Authorities	Security Officer
3. Employee Conduct and Plant Operations	
a. Employee Conduct	All Employees
b. Plant Operations During Disturbance	Emergency Director
c. Live-In Personnel	Emergency Director
d. Training Sessions	NIS/NMM Supervisor
e. Bussing of Employees	Emergency Director
f. Live-In Provisions	Production and Materials Control
g. Attendance Reports	Senior Department Personnel
4. Resumption of Normal Activity	
a. Restoring Operations	Emergency Director
b. Customer and Vendor Notification	Purchasing
c. Post Emergency Evaluation	Emergency Director/Fact Finding Committee

SECTION VII. EMERGENCY PREPAREDNESS

A. Emergency Equipment Locations

Following is a listing of emergency equipment in the various areas and a facility lay-out map designating the locations of the equipment stations.

Station #1 (Pellet Plant

1 ea. Scott Air Pack
2 ea. Fire Extinguishers
1 ea. Stretcher
1 ea. M.S.A. All Service Gas Mask
2 ea. Emergency Medical O_2 Bottles
1 ea. First Aid Kit

Station #2 (Building 240 Hallway)

1 ea. Scott Air Pack
2 ea. Fire Extinguishers
1 pkg. Inflatable Splints
1 ea. M.S.A. All Service Gas Mask
2 ea. Emergency Medical O_2 Bottles
1 ea. First Aid Kit

Station #3 (Pellet Plant Break Area)

1 ea. M.S.A. Pneolater/Resuscitator

Station #4 (Well House)

1 ea. Scott Air Pack

Station #5 (Oxide Control Room)

1 ea. Scott Air Pack
1 ea. Emergency Repair Kit for 30-B (UF_6/Chlorine) Cylinders

Station #6 (Warehouse)

1 ea. Fire Extinguisher - 125 lb. Wheeled Unit

Station #7 (Outside Old Boiler Room)

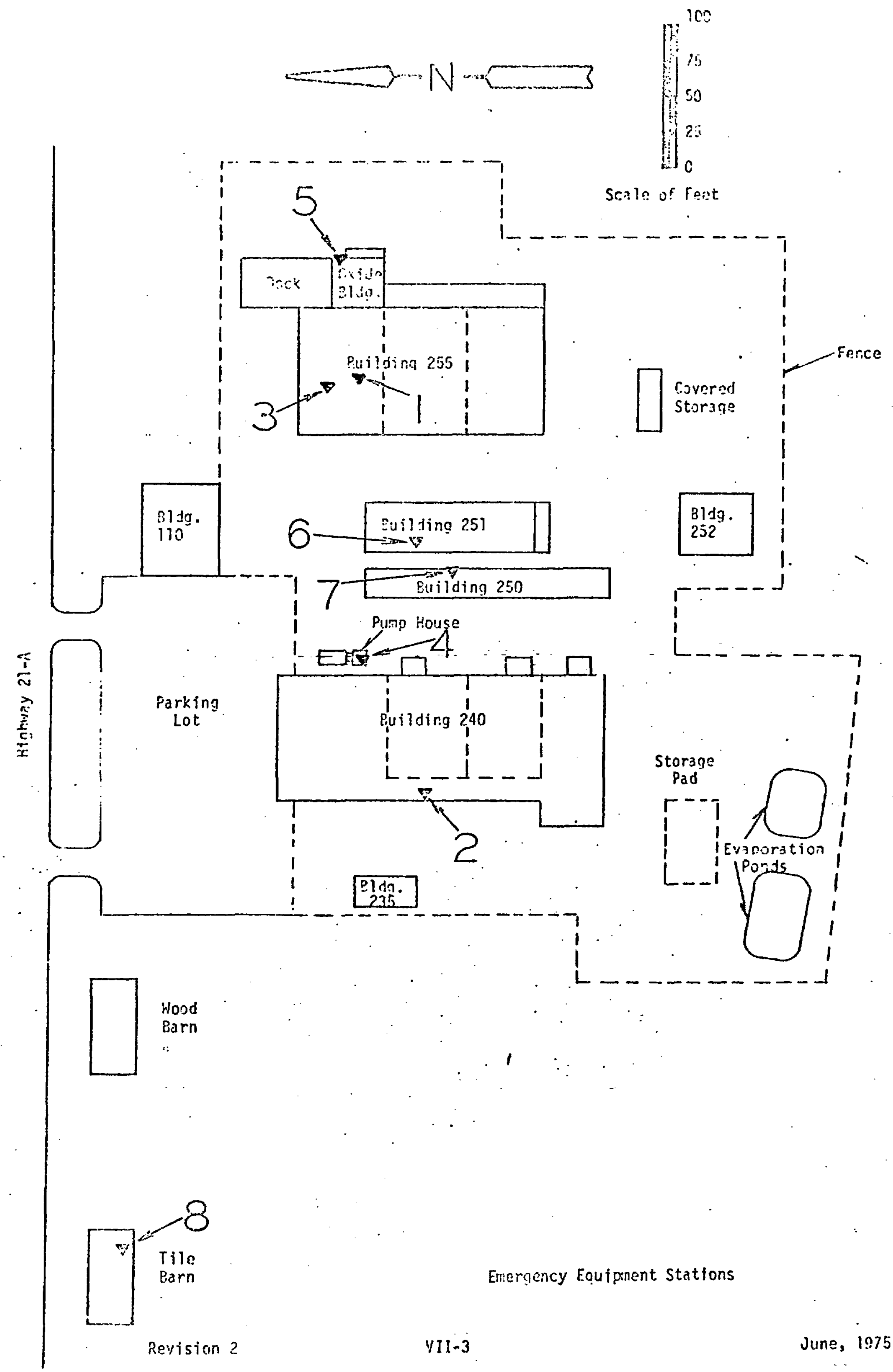
3 ea. M.S.A. Comfo Respirators
3 ea. Acid Suits w/hoods
1 ea. Rubber Suit w/hood
1 ea. Harness w/Life-Line
1 ea. Face Shield
1 ea. Vinyl Rain Coat
1 ea. Emergency Procedures

Station #8 (Assembly Area, Tile Barn)

5 ea. Radiation Survey Instruments
10 ea. Dosimeters
6 ea. Film Badges w/Film
6 ea. Lab Coats - White
1 ctn. Urine Sample bottles
6 ea. M.S.A. Comfo Respirators
2 ea. M.S.A. Chemox Breathing Apparatus
2 pkg. Flares, Red - 15 minute
1 ea. First Aid Kit
8 ea. Disposable Litter
2 ea. Disposable Splint
8 ea. Blankets
8 ea. Sheets
1 doz. Surgical Caps
1 ctn. Surgical gloves
1 ea. Telephone Instructions
1 ea. Emergency Procedures
1 ea. Check Source (B-γ)
2 ea. Portable Radio Transceivers
1 ctn. Misc. Environmental Sample Containers
- Miscellaneous Forms

B. Equipment Maintenance Responsibility

Nuclear and Industrial Safety shall be responsible for routine inspection of all equipment and supplies at the above stations and other reserve equipment, and for maintenance and servicing, or obtaining servicing, for all emergency equipment. NIS shall also procure, or initiate procurement, of all supplies listed above and other miscellaneous supplies necessary to cope with foreseeable emergency situations.



Emergency Equipment Stations