TABLE OF CONTENTS

Page

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TABLE OF CONTENTS
(Continued)

Page

LIST OF FIGURES

Page

LIST OF TABLES

U.S. NUCLEAR REGULATORY COMMISSION

OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS

ENVIRONMENTAL ASSESSMENT RELATED TO THE CONSTRUCTION AND OPERATION OF THE FORT ST. VRAIN INDEPENDENT SPENT FUEL STORAGE INSTALLATION

DOCKET NO 72-009

PUBLIC SERVICE COMPANY OF COLORADO

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ENVIRONMENTAL ASSESSMENT
RELATED TO THE CONSTRUCTION AND OPERATION
OF THE FORT ST. VRAIN
INDEPENDENT SPENT FUEL STORAGE INSTALLATION

1.0 INTRODUCTION

1.1 DESCRIPTION OF THE PROPOSED ACTION

By letter dated June 22, 1990, Public Service Company of Colorado (PSC or the Applicant) submitted an application for an NRC license to construct and operate a dry Independent Spent Fuel Storage Installation (ISFSI) to be located on the Fort St. Vrain Nuclear Generating Station site in Weld County, Colorado[1]. The ISFSI or some other spent fuel storage system is needed in order to provide interim storage of spent fuel, and proceed with the first stage of decommissioning of the High Temperature Gas-Cooled Reactor (HTGR) at Fort St. Vrain which was permanently shut down in August 1989. This Environmental Assessment (EA) addresses the expected environmental impacts associated with the proposed construction and operation of the ISFSI on the Fort St. Vrain site.

The proposed ISFSI will be located on PSC-controlled land in Weld County, Colorado, just outside the Fort St. Vrain Nuclear Generating Station protected area, but within the current Fort St. Vrain exclusion area boundary, approximately 1500 feet northeast of the Reactor Building. Figure 1.1 shows the location of the proposed ISFSI relative to the other features on the site including the reactor buildings and security fence. Figure 1.2 provides additional detail on the ISFSI layout.

The Applicant has selected a Modular Vault Dry Store (MVDS) system designed by GEC Alsthom Engineering Systems, LTD., and licensed by Foster Wheeler Energy Corporation, Energy Applications Division (formally Foster Wheeler Energy Applications, Inc.). The MVDS

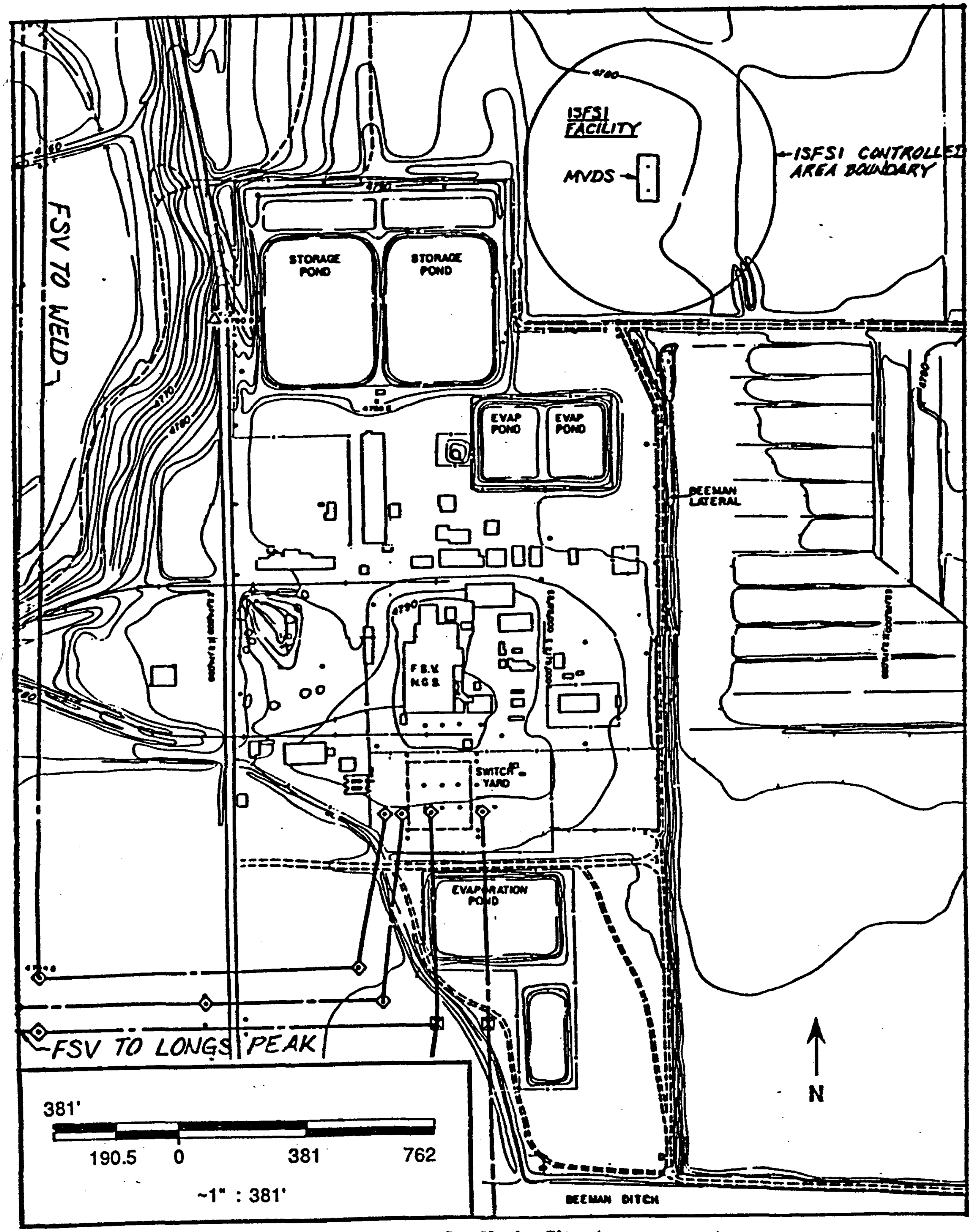

Figure 1.1. Fort St. Vrain Site Arrangement

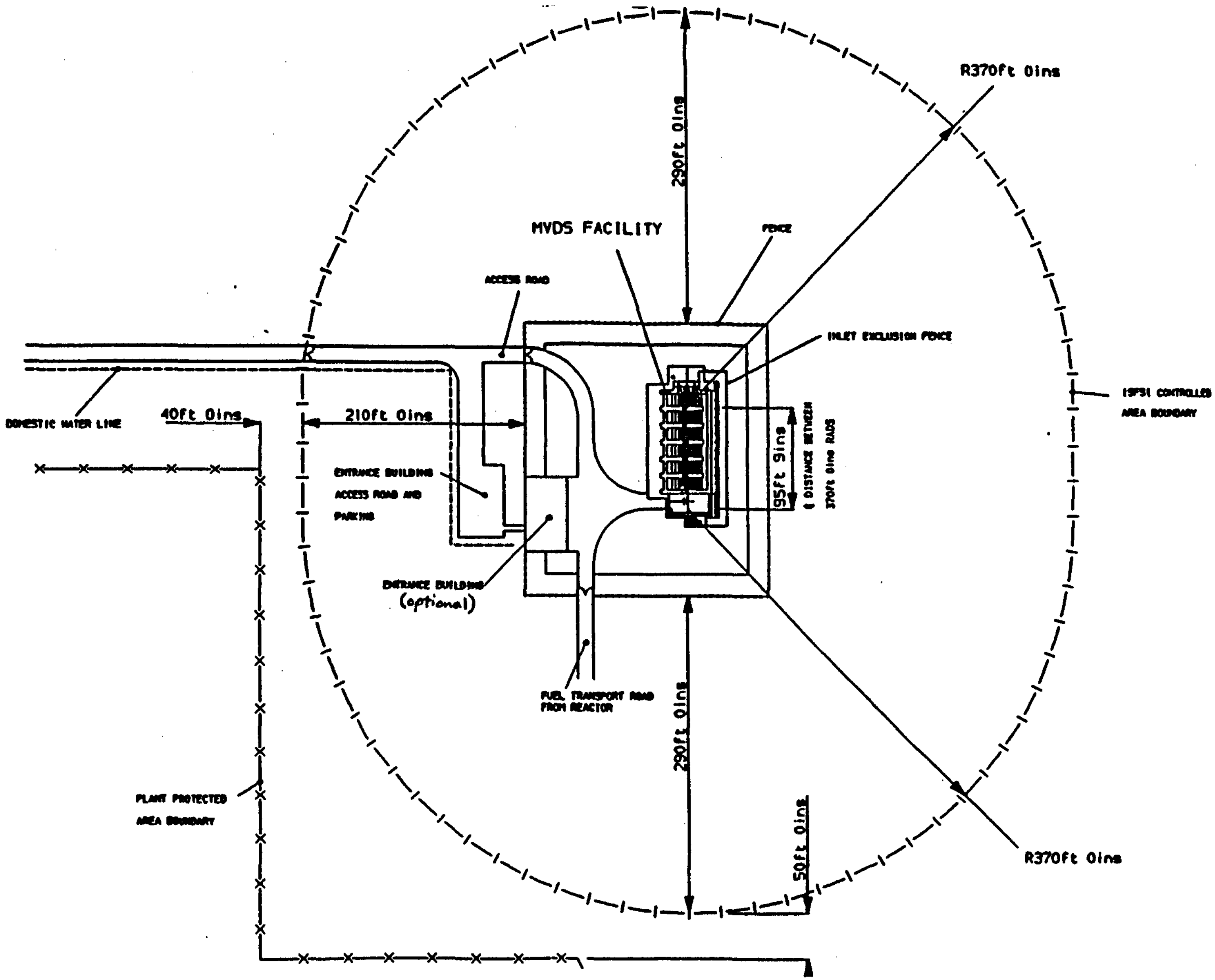

Figure 1.2. ISFSI Plot Plan

system has been approved by the Nuclear Regulatory Commission (NRC) in its Safety Evaluation Report (acceptance as a reference of "Topical Report for the Foster Wheeler Modular Vault Dry Store (MVDS) for Irradiated Nuclear Fuel," Revision 1, dated March 23, 1988)[2]. The ISFSI will provide passive, dry storage for Fort St. Vrain's spent fuel, neutron sources, and reflector elements through an array of vertical fuel storage containers (FSCs). The fuel is stored dry, and decay heat is removed from the FSC by a once-through, buoyancy-driven ambient air system flowing across the exterior of the FSCs. The MVDS will be designed, constructed and operated to conform to the requirements of Subpart F of Title 10 Part 72 of the Code of Federal Regulations (10 CFR 72)[3].

The MVDS is designed for 40-year interim storage of Fort St. Vrain HTGR fuel in a contained, shielded system. Licenses for ISFSIs issued under 10 CFR 72 are for 20 years, but the licensee may seek to renew the license, if necessary, prior to its expiration.

1.2 BACKGROUND INFORMATION

The Fort St. Vrain Nuclear Generating Station was granted its construction permit in September of 1968. The unit went critical in January of 1974 and began commercial operation in July 1979. Operational problems led to an early permanent shutdown of the reactor in August 1989, and PSC proceeded with plans to decommission the reactor.

A contract between the Department of Energy (DOE) and PSC had initially arranged for fuel from Fort St. Vrain to be placed in dry storage at the Idaho National Engineering Laboratory (INEL). Under this agreement, over 120 shipments have been made since 1981, and currently remain in dry storage at INEL. However, in September 1989, the Governor of Idaho prohibited DOE from receiving any subsequent shipments of Fort St. Vrain spent fuel. Final defueling began at Fort St. Vrain in December 1989, and one-third of the core was off-loaded into spent fuel storage wells and two shipping casks. No more spent fuel storage capacity exits onsite, and subsequently, defueling was suspended in February 1990.

Because shipment of fuel to INEL is not an available option, PSC has proposed to construct and operate an ISFSI at its Fort St. Vrain Station. Under the proposed schedule, construction of the ISFSI is to be completed by November of 1991, with defueling to the ISFSI to commence in October 1991 and loading to be completed by mid-1992.

The proposal to use an ISFSI for interim storage of Fort St. Vrain fuel is consistent with NRC long-range policy as detailed in "Final Generic Environmental Impact Statement (FGEIS) on Handling and Storage of Spent Light Water Power Reactor Fuel", NUREG-0575[4], issued by NRC in August 1979[1]. The preparation of this generic environmental impact statement (EIS) on spent fuel storage was directed by the Commission in 1975 because commercial reprocessing did not develop as anticipated. Specifically, the Commission directed the staff to analyze alternatives for the handling and storage of spent fuel from light water power reactors with particular emphasis on developing long range policy. The staff also considered the consequences of restriction or termination of spent fuel generation through nuclear power plant shutdown.

While the FGEIS is directed toward the storage of spent fuel from light water power reactors, a number of its conclusions may be extended to HTGR fuel. In the FGEIS, the storage of spent fuel is considered interim storage until the issue of permanent disposal is resolved and a plan implemented. Interim storage options evaluated in detail and included in the FGEIS which are applicable to HTGR fuel include the use of ISFSIs. The FGEIS concluded that an ISFSI represents the major means of interim storage at a reactor site. While the environmental impacts of the dry storage ISFSI option were not specifically addressed in the FGEIS (storage of light water cooled power reactor spent fuel in water pool was specifically addressed), the use of alternative dry passive storage techniques for aged fuel appeared to be equally feasible and environmentally acceptable, although environmental impacts need to be considered on a site-specific basis. Since that time several ISFSIs of varying designs have been licensed by NRC

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[1] It should be noted that Fort St. Vrain is a High Temperature Gas-Cooled Reactor (HTGR), and that HTGR fuel differs from light water power reactor fuel.

according to the requirements of 10 CFR 72, and environmental impacts assessed according to the requirements of 10 CFR 51[5].

As required by 10 CFR 72 and 10 CFR Part 51, this assessment addresses the site-specific environmental impacts of construction and operation of the dry store ISFSI at the Fort St. Vrain Nuclear Generating Station site.

1.3 PREVIOUS ENVIRONMENTAL ASSESSMENTS AND SUPPORTING DOCUMENTS

This EA is built upon previous environmental analysis and monitoring including several environmental documents prepared specific to the Fort St. Vrain Nuclear Generating Station site. A Final Environmental Statement (FES) related to the operation of the Fort St. Vrain Nuclear Generating Station was prepared by the U.S. Atomic Energy Commission in 1972[6]. This document relied somewhat on information supplied by PSC in the Applicant's Environmental Report Operating License Stage prepared in 1970[7]. An environmental monitoring program in the vicinity surrounding the Fort St. Vrain site was established in 1970 and completed in 1979. The results of this study indicated that little, if any, changes to the ecosystem were attributable to the reactor plant. Additional environmental radiation surveillance and monitoring was initiated by PSC in response to licensing requirements. The program has been implemented by personnel of Colorado State University (CSU), Department of Radiology and Radiation Biology. Results of this effort are compiled and submitted to NRC in the form of Radioactive Effluent Monitoring Program Reports. Radioactive Effluent Release Reports are also compiled by PSC and submitted to NRC.

Additional environmental documents have been prepared specific to this proposed action. In the selection of an appropriate site for the Fort St. Vrain ISFSI, PSC performed an evaluation of three independent sites within the Fort St. Vrain exclusion area boundary. Based on regulatory requirements, hazards analyses, security, engineering, safety, environmental, and other storage system-related concerns, the proposed ISFSI site was selected and documented[8]. An

Environmental Report (ER) related to the proposed ISFSI for the Fort St. Vrain Nuclear Generating Station was then prepared and submitted to NRC in June 1990[9]. Supplementary information was submitted in response to NRC questions[10]. In conjunction with the license application, PSC contracted with CSU to conduct an ISFSI site background radiation study. The study determined the radionuclide concentrations in surface soil samples, and soil core samples, by integrated exposure rate measurements using thermoluminescent dosimeter (TLD) devices and by continuous air sampling. The findings of this study were submitted to NRC in December 1990[11].

This EA is tiered on the 1972 FES, the 1990 ER with supplementary information, and the FGEIS (NUREG-0575) with independent assessment of data, analyses and results. Additional information used in this assessment is provided in the Applicant's Final Safety Analysis Report (SAR) for the operation of the Fort St. Vrain Nuclear Generating Station and updates[12], the SAR for the proposed ISFSI[13], and the Foster Wheeler Energy Corporation "Topical Report for the Foster Wheeler Modular Dry Vault Store (MVDS) for Irradiated Nuclear Fuel", Revision 1[2].

2.0 NEED FOR PROPOSED ACTION

PSC of Colorado has initiated a program of defueling the reactor at Fort St. Vrain as part of the reactor decommissioning program. As part of long-term contracts with DOE, Fort St. Vrain spent fuel had been shipped to INEL prior to September 1989. However, in September 1989, the Governor of Idaho prohibited DOE from receiving any subsequent shipments of Fort St. Vrain spent fuel. One-third of the core was off-loaded into spent fuel storage wells and two shipping casks. No more spent fuel storage capacity exits onsite, and subsequently, defueling was suspended in February 1990.

Because storage is not available at INEL (as discussed in Section 1.2) PSC must find interim storage for 1482 fuel elements (which includes standard fuel elements, control fuel elements, and bottom control fuel elements), 37 keyed top reflector control rod elements, and 6 neutron source elements. The Applicant proposes to solve the problem of storage of spent fuel and reactor elements at its Fort St. Vrain Station through the construction of an onsite ISFSI.

3.0 ALTERNATIVES

The Applicant evaluated a number of alternatives for the storage of spent nuclear fuel prior to the selection of the preferred alternative, i.e., the onsite storage of fuel in an ISFSI. Each of the alternatives evaluated either did not sufficiently meet the requirements for storage of irradiated nuclear fuels generated at the Fort St. Vrain Nuclear Generating Station, were deemed to be less protective of the environment, or were deemed to be economically infeasible. A brief discussion of the evaluated alternatives (and, in addition, a few alternatives not considered by PSC) is presented below.

Permanent Federal Repository or Monitored Retrievable Storage Facility

If a permanent Federal repository or monitored retrievable storage (MRS) facility were available, an attractive alternative would consist of prompt shipment to either facility for disposal or storage (providing that the applicable acceptance criteria could be met). The DOE is currently working to develop a high-level waste repository and an MRS as required under the Nuclear Waste Policy Act (NWPA), but it is not likely that either facility will be licensed and ready to receive fuel before 1998. This alternative does not meet short-term storage requirements of PSC.

Storage of Fort St. Vrain Spent Fuel in the Fuel Storage Wells at Fort St. Vrain

PSC evaluated the option of using existing fuel storage wells in the Reactor Building for Fort St. Vrain spent fuel storage. These fuel storage wells, situated below the Reactor Building refueling floor, consist of nine wells supported in three concrete shielded vaults. Desirable features of this alternative are that the facility is currently licensed and operational. Undesirable features of this alternative are that: (1) it provides no expansion capability to handle all of the fuel elements to be stored; (2) it requires the operation and maintenance of support facilities including fire suppression, fuel handling machines and active cooling; and (3) it precludes decommissioning the Reactor Building at an early date. This alternative does not meet the needs of fuel storage requirements of PSC.

Storage of Remaining Segments of Fort St. Vrain Spent Fuel at INEL

These facilities are currently not available to PSC (as discussed in Section 1.2). Therefore, this alternative is infeasible.

Storage of Fort St. Vrain Fuel at Other Commercial Reactor Sites

Except for INEL, no other facilities are authorized to receive fuel. Even if a license were to be obtained, the implementation of this action would necessitate the incurrance of unnecessary transportation-related accident risks. It is desirable to store the HTGR fuel in a dry condition, but dry storage facilities at other sites are not currently available. This alternative, therefore, is not feasible, nor more protective than the proposed action.

Alternative Locations for ISFSI MVDS Construction

Alternative sites were considered but rejected due to unnecessary risks associated with possible transportation-related accidents, and the expectation that other sites would not be any more protective of the environment. For example, other sites may require the disturbance of additional land, additional electric power, and security program-related facilities, while the Fort St. Vrain site is already a disturbed site, which possesses adequate security and electric capacity. Thus, an alternative location is expected to be associated with increased environmental impacts than the proposed alternative, and therefore, not as attractive as the proposed action.

Spent Fuel Reprocessing

Notwithstanding the Executive Order prohibiting commercial fuel reprocessing, the engineering and processing costs alone for this alternative would preclude it from being feasible. In addition, high-level radioactive waste would still need to be stored or disposed, and this alternative is not more protective of the environment.

4.0 EXISTING ENVIRONMENT

The general environment around the Fort St. Vrain Nuclear Generating Station is well characterized as a result of studies conducted in support of the license application for the ISFSI, as well as the characterizations of geology, hydrology, and soils conducted in support of the reactor licensing application[2]. This section provides a discussion of the existing environment, including land use and terrestrial resources; water use and water resources; socioeconomics and historical, archaeological and cultural resources; demography; meteorology; geology, seismicity, and soils. An assessment of impacts to the environment due to construction and operational activities is presented in Chapter 6.

4.1 SITE LOCATION, LAND USE AND TERRESTRIAL RESOURCES

Site Location

The Fort St. Vrain ISFSI is proposed to be constructed on a site located about 1,500 feet northeast of the Reactor Building, adjacent to the existing Fort St. Vrain Nuclear Generating Station facilities. The immediate ISFSI site is protected by an 8-foot-high chain link fence and is afforded 24-hour security in conjunction with Fort St. Vrain Generating Station security. This fence is located just over 100 meters (330 feet) from the MVDS, at its minimum distance as required by 10 CFR 72.106. The Applicant has committed to long-term restrictions on land use within a 2600-foot radius of the ISFSI[10]. The Applicant currently owns all of this land. Figure 1.1 shows the location of the ISFSI in relation to other features at the Fort St. Vrain Nuclear Generating Station. Figure 1.2 provides additional detail of the ISFSI Site Plan.

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[2] Data collected in support of characterization of site geological, hydrological, and soils condition descriptions for the reactor licensing are applicable to the ISFSI because these conditions have not changed since the data were collected (these conditions change slowly with time) and were collected in an area contiguous to and including the proposed ISFSI site.

The site is located in Weld County in northeastern Colorado (40 degrees 14 minutes north latitude and 104 degrees 52 minutes west longitude), approximately 3 1/2 miles northwest of the town of Platteville, 1/2 mile west of the South Platte River, and 35 miles north of Denver. About one mile north of the site is the confluence of the South Platte River and St. Vrain Creek. The St. Vrain Creek flows in a northerly direction and passes within approximately 3/4 of a mile west of the site at its nearest approach.

The topography at the ISFSI site is flat. It is situated on the high plains, overlooked by the foothills of the Front Range, which rise about 20 miles to the west, and by the Front Range crest, which rises to 14,255 feet (Longs Peak) about 45 miles to the west. The Front Range crest due west of the ISFSI site is the most easterly section of the continental divide in the Rocky Mountains. The divide runs along ridges at an altitude of approximately 12,000 feet to a high point of 13,327 feet (McHenry's Peak).

Land Use

Most of the land in the immediate vicinity of the ISFSI is disturbed, agricultural land. Its agricultural value is enhanced by a number of irrigation ditches fed by surface water diversions from the South Platte River and St. Vrain Creek. The predominant use of land, surface water and groundwater is agricultural. The only planned water project expected to affect any portion of the St. Vrain Creek watershed is a diversion to the Little Thompson Reservoir, 20 miles northwest of Fort St. Vrain, from St. Vrain Creek below Button Rock Dam (approximately 30 miles west of Fort St. Vrain). This modification to the watershed is not expected to impact land use in the vicinity of the ISFSI, have any impact on ISFSI operations, or is being proposed to support any aspect of ISFSI operations.

Geologically, the site is located in the Denver basin, which is associated with a commercially valuable oil deposit that is being recovered by many actively pumping oil wells. Some of these wells are situated on PSC property.

There are no airports within the immediate vicinity of the proposed ISFSI site. Stapleton International is about 30 miles south of the site. County roads with their associated rights-of-way are adjacent the exclusion area boundary or provide access to the generating station (County Roads 21 and 19 1/2, respectively). A railroad spur connects the site to the Union Pacific Railroad main line located about 2 miles to the west.

Licensed landfills are located within a reasonable distance of the site, including an EPA-approved landfill at a distance of about 8 miles.

Terrestrial Resources

Wildlife indigenous to the area include several species of ducks and geese, the mourning dove, cottontail rabbit, fox squirrel, and to a lesser extent bobwhite quail, ring-necked pheasant, deer, and antelope. The most abundant fish species include the white sucker, carp, notropis, creek chub, and to a lesser extent, several types of perch[7].

With most of the land dominated by agriculture, natural vegetation is minimal. Most of the trees found along roads, in hedge rows, and around farm houses are cottonwood. Trees found in the river area are primarily cottonwoods, willows and Russian olives. Typical grasses and weeds found in river bottom areas include goat heads, golden weed, snake weed, Smith grass, indian grass, foxtail and big bluestem[7]. The proposed site does not have readily visible evidence of recent farming, but is now overrun with plants which are typically indigenous to disturbed land; plant species include Russian Thistle, Cocklebur, Canada Thistle, Dandelion, and Poor-mans's Pepper Grass.

The only threatened or endangered animal species known to occur within the area of the project are the Bald Eagle and Peregrine Falcon. However, this land has not been identified as a critical habitat for these or any other species. Use of project land by individuals of these species would at most be transitory. The black-footed ferret, also endangered, may be found as a transient within the region, but requires a permanent habitat which is occupied by prairie dogs. Prairie dogs are not present at the site.

4.2 WATER USE AND AQUATIC RESOURCES

The topography in the immediate vicinity of the site is relatively flat and water use is primarily agricultural (as noted previously). Its distribution is through the use of irrigation ditches. The nearest major surface water features are the South Platte River, about 1/2 mile east of the site, and the St. Vrain Creek, about 1/2 mile west of the site. Local surface water diversions from these rivers, which feed irrigation ditches to support agriculture, are somewhat closer, about 1/3 of a mile east and west of the site, and about 4/10 of a mile to the north of the site. The net local topography, which controls the direction of surface runoff, slopes slightly to the northeast toward the South Platte River. This trend is interrupted by the irrigation ditches. Fish, aquatic macroinvertebrates, and algae in diversion ditches and area streams (including the South Platte River) are indicative of polluted waters with a high salinity (primarily from agricultural loading) which make them less than optimal sources of drinking water. Consequently, communities in the area and downstream municipalities along the South Platte River rely on other sources of drinking water. As discussed above, there are no proposed changes in local water use.

4.3 SOCIOECONOMICS AND HISTORICAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

The immediate area surrounding the Fort St. Vrain Generating Station site is rural with many communities within commuting distance. The nearest community is Platteville. Larger cities in the vicinity include Boulder, Denver, Estes Park, Fort Collins, Greeley, Longmont, Loveland and Lyons.

There are no known archaeological, cultural, or historical resources within, adjacent to, or in the immediate vicinity of the ISFSI site. The nearest landmarks fitting any of these designations are more than two miles from the site. They include the following:

- o The Dent site, an archaeological excavation with mammoth remains left by prehistoric Indians, situated about 4.5 miles northeast of Fort St. Vrain;

- o The original Fort St. Vrain, located 2.5 miles northeast of the ISFSI site;

- o Fort Vasquez, located 4 miles southeast of the ISFSI, and listed on the National Register of Historic Places;

- o Fort Jackson, situated 8 miles southeast of the ISFSI site.

4.4 DEMOGRAPHY

The population density in the vicinity of the Fort St. Vrain Generating Station is low. The nearest residence is in excess of 2,600 feet north-northwest of the site. The number of residents living within 1 mile of the proposed ISFSI site (based on projections from 1980 census data[3]) is 39; the projected figure for the year 2012 is 40[14]. The number of residents projected to be living within 5 miles of the site in the year 2012 is estimated to be 4,526, with 3,040 of these living in Platteville, the nearest town. Platteville was reported to have a population of 1,662 in the 1980 census; preliminary 1990 census data indicate that the population of Platteville has declined by 8.8% to 1515[15]. The county population has increased by 6.5% from 123,438 (1980) to 131,480 (1990), according to preliminary census figures[15].

Projections for vicinity population in the year 2012 presume an annual growth rate of 1.43%, as used by the Colorado Department of Local Affairs[14]. The Weld County Planning Commission used a growth rate of 1.965% for their planning activities[14]. However it is apparent that this

[3] While some of the population figures used to assess site demography are not recent, more current data, most notably the preliminary 1990 Census figures, indicte populations which are changing at a similarly low rate, less than 1% per year.

growth rate has not been realized when 1980 census figures are compared to the preliminary 1990 results (0.65% per year).

The transient agricultural population is estimated to be about 20% of the permanent rural population. During the summer months, within a 5-mile radius of the site, this transient population is estimated to reach about 300 by the year 2012.

4.5 METEOROLOGY

The general climate around the Fort St. Vrain site is typical of the Colorado eastern-slope plains region. The weather is generally mild. Most seasons are characterized by low humidity and sunny days, with occasional, short-lived storms bringing precipitation to the area. Thermal radiation losses resulting from lack of cloud cover provide considerable variation in temperature from night to day. In this semi-arid region, the precipitation averages 10 to 15 inches a year, mostly from thunderstorms in late spring and summer. Snowfall is significant; however, the snow cover is usually melted in a few days. Relative humidity averages about 40 percent during the day and 65 percent at night.

Meteorological conditions in the local area include a preponderance of unstable meteorological conditions and rather low wind speeds. Based on measurements at the Fort St. Vrain meteorological station 10-meter tower, the annual frequency of atmospheric stability categories is as follows: unstable, 26%; neutral, 18%; and stable, 56%. Wind speeds generally range from 1 to 7 mph (80% of the time). Wind directions are rather evenly distributed, although there is a preponderance of winds from the southwest and northeast quadrants[10]. Seasonally, winds tend to be strongest in the late winter and spring, the season with high chinook frequency, and again in the summer, when thunderstorms occur frequently. Strong winds, especially under chinook conditions, have been observed on various occasions in eastern Colorado. The chinook winds are strongest immediately to the east of the mountain ridge and diminish rapidly over the plains with increasing distance from the mountains.

The region typically experiences 5 tornadoes per year per 10,000 square miles, with peak tornado activity occurring during the month of June[16]. According to the National Weather Service, Weld County has had 117 tornadoes during the period 1950-1987. A study of tornadoes in the area concluded that 100 mph winds should constitute maximum forces to be expected at Fort St. Vrain[17].

Northeastern Colorado has moderate thunderstorm activity. The region near Fort St. Vrain averages 50 days/year in which thunder and lightning occur[18]. The majority of these thunderstorms are present from late spring through the summer.

Measurements from the 10-meter meteorological monitoring station operated at Fort St. Vrain by the National Oceanic and Atmospheric Administration (NOAA) yielded the following weather extremes for the period January 1985 through October 1990[10]:

Maximum Temperature	104.2 °F
Minimum Temperature	-26.4 °F
Maximum Hourly Cumulative Precipitation	2.5 inches
Maximum Daily Cumulative Precipitation	3.8 inches
Maximum Monthly Cumulative Precipitation	4.5 inches
Minimum Monthly Cumulative Precipitation	0.0 inches
Maximum Annual Cumulative Precipitation	21.7 inches
Minimum Annual Cumulative Precipitation	8.4 inches
Maximum Wind Velocity	42.4 mph

This information was extracted from archived data collected from the Fort St. Vrain meteorological tower.

4.6 GEOLOGY, SEISMICITY AND SOILS

Geology

The Fort St. Vrain site is located on the east flank of the Colorado Front Range, a complexly faulted anticlinal arch. Numerous faults and smaller folds are superimposed on the arch and are related to the uplift of the Front Range which began in Late Cretaceous and continued into the Tertiary. Granitic rocks ranging in age from Precambrian to Tertiary have intruded the Precambrian gneisses, schists, and quartzites that comprise the core of the anticlinal arch. Paleozoic and Mesozoic sedimentary rocks make up the east flank of the arch. In addition to the axes of the superimposed folds, two groups of high angle faults have been recognized: a series of faults along the mountain front that extend in a generally northwest-southeast direction from the Precambrian into the Paleozoic-Mesozoic sediments; and northeast-southwest oriented faults observed primarily in coal mines located east of Boulder.

The FSV site lies within the Denver Basin and is near the basin's axis. Available information indicates that the structural geology of the area near the site is not complex and can be characterized as Cretaceous sediments gently dipping to the east. Beneath the site, the bedrock is a competent shale (the Pierre Shale) capable of supporting heavy loads[12]. Overlying the bedrock is 40 to 50 feet of Quaternary alluvium.

Seismicity

The FSV site has not experienced any observed earthquake activity. A field examination and photo interpretation of the area provided no evidence of recent movement along any of the known faults. The closest area of recent activity is about 25 miles south of the site in northeast Denver. Between April 1962 and May 1967, there were approximately 1,130 earthquake events in this area with magnitudes ranging from 1.0 to 5.0 on the Richter Scale. The 5.0 earthquake produced ground accelerations in the Vrain Valley of 0.002 ± 0.001 g. This period of earthquake activity was correlated to waste disposal activities in a deep injection well at the Rocky Mountain Arsenal. A sharp reduction in earthquake activity in the area was observed when the use of the well was discontinued in 1966[7,12]. An earthquake with a Modified Mercalli[4] intensity of VII (slight to moderate damage to structures) occurred on November 7, 1882 and was felt throughout Colorado and Southern Wyoming. Due to the sparse population in the epicentral region, the assigned intensity may in actuality be an underestimate. A reasonable guess for its Richter magnitude is 6.5, implying that most of the strain energy released by earthquakes of Colorado in the last century was released in this one earthquake[12].

Soils

Soil and foundation testing data were accumulated from 5 test holes drilled for the MVDS structure (3 holes) and the Entrance Building (2 holes). In addition, 7 holes were drilled for determining soil properties of the access road. Previous site and vicinity investigations involved 40 test holes which provide a significant body of data for comparison[12]. These investigations determined the relative density, stiffness/hardness of the soils and bedrock layers, moisture content, dry density, gradation, compaction, static and dynamic engineering soil properties, soil classification, and related soil parameters.

The subsoils[5] at the ISFSI have been determined to consist of St. Vrain-Platte River alluvial sands and gravel overlying the Pierre Shale bedrock. Up to 5 feet of loose, slightly clayey sand overlies a variable thickness (4 to 7 feet) of loose, medium dense clean to silty sand, underlain in turn by medium dense to dense silty and slightly silty sand, and then very dense, gravelly sand overlying hard sandstone and shale bedrock. The bedrock is generally found at a depth of 47 to 49 feet and is present as gravelly sand overlaying hard sandstone and shales. At a depth of 49 to 51 feet, this zone undergoes a transition to very hard sandstone. Site preparation will include a compacted

[4]The Modified Mercalli Scale is a qualitative measure of the intensity of an earthquake in the felt area and is based on the extent of damage. The scale ranges from I to XII. The Richter Scale is a quantitative measure of the amount of energy released at the earthquake source (i.e., magnitude), which is measured using seismographic instruments. The Richter Scale ranges from 1.0 to 10.0. The Modified Mercalli Scale is particularly useful in describing seismic events that occurred before the availability of seismographic instrumentation.

[5] Site preparation will include a compacted structural backfill to a depth of about 12 feet. This will greatly improve the ability of the foundation of shallow reinforced concrete to support the MVDS structure.

structural backfill to a depth of about 12 feet[13]. This will greatly improve the ability of the foundation of shallow reinforced concrete to support the MVDS structure. The minimum depth to groundwater is 16 feet. No dewatering or other special construction techniques will be required.

4.7 BACKGROUND RADIATION

The proposed ISFSI site location falls within the Fort St. Vrain exclusion area, and consequently was included as a portion of the area surveyed by the FSV Environmental Radiological Surveillance Program from 1974 to 1983, and by the Fort St. Vrain Radiological Environmental Monitoring Program (REMP) since 1984.

An ISFSI Site Background Radiation Study[11] was completed by Colorado State University in October 1990. This study documented the radiological status of the ISFSI site prior to receipt of any spent fuel. Surface soil samples were taken at each of 41 survey grid points located within a 400 foot radius from the MVDS and analyzed for radionuclide concentrations. At eight of the grid points, soil samples were collected from a depth of 150 centimeters and similarly analyzed. Calcium fluoride thermoluminescent dosimeters (TLDs) were positioned at all 41 grid points to measure integral photon exposure rates for an 81-day period. Continuous air monitoring stations were established at the north and south ends of the ISFSI site, with particulate filters for the collection of gross beta emitters, activated charcoal cartridges for iodine sampling, and silica gel collectors for tritium sampling.

Results from the study, including the TLD-measured, mean integral exposure rate of 0.34 mR/day, were consistent with data acquired for the area during previous years of sampling by the Fort St. Vrain REMP. With the exception of Cs-137, whose average surface activity concentration of 0.18 pCi/g is consistent with regional levels due to global fallout, no statistically significant concentrations of activation or fission products were detected. Sample collection at the two air monitoring stations will continue through MVDS construction activities.

5.0 DESCRIPTION OF THE FORT ST. VRAIN NUCLEAR GENERATING STATION ISFSI

5.1 GENERAL DESCRIPTION

The ISFSI system is designed to safely store spent fuel by confining the fuel material and providing bulk shielding from radiation through the incorporation of physical components and a system of procedures designed to protect onsite personnel and the general public from radioactivity in the spent fuel. The physical components of the proposed ISFSI are described in Section 5.2, while the operational procedures are described in Section 5.3. The planned monitoring program for the ISFSI is described in Section 5.4.

5.2 ISFSI DESIGN

This section provides a brief description of the spent fuel, FSC, transfer cask and transfer trailer, MVDS system, and entrance building. The MVDS equipment and utilities are also discussed. Detailed design information is presented in the ISFSI SAR[13].

5.2.1 Spent Fuel

The characteristics of the HTGR fuel elements served as a principle basis for the design of the MVDS. Parameters of the fuel adapted as design criteria were generally upper-bounding and worst-case. Table 5.1 summarizes the design-basis parameters of the fuel elements. Fuel to be stored in the ISFSI will originate only from Fort St. Vrain, will have decayed for a minimum of 600 days post-shutdown, and will have a maximum neutron source strength of 0.4 Curies per source. These acceptance criteria and the MVDS design will ensure that no potential exists for nuclear criticality, that fuel elements will not be subjected to excessive temperatures, and that radioactive dose rates are not high.

TABLE 5.1
Summary of Fuel Element Parameters
Relevant to MVDS Design

Thermal Characteristics

Maximum burnup period: 945 Effective Full Power Days, equivalent to 52000 MW days/MTHM*

Minimum post-shutdown decay period: 600 days

Fuel element decay heat output** (Watts):

Decay Period (days)	Average	Peak
600	85.0	150
900	58.8	103
1100	48.5	85.4

Radiological Characteristics

Design Source Strength of Cf-252 Neutron Sources: 0.4 Curies, based upon 440 days of decay

Total gamma emissions** for an average fuel element:

Decay Period	Photons/sec
600 days	2.97E14
900 days	2.30E14

Quantities

Six segments of fuel, including:

1482 HTGR fuel elements
6 neutron source elements
37 keyed top reflector elements

*MTHM = metric ton of heavy metal
**Instantaneous rate, after decay period given

5.2.2 Fuel Storage Container

The FSCs are tubular, constructed of carbon steel, closed at the lower end and sealed at the top. They provide the primary confinement for the fuel elements, neutron source elements, and reflector elements, and replicate the functions and features of the Fort St. Vrain 10 CFR 71[19] licensed shipping cask inner container. They are vertically positioned with their lower ends on the floor of the concrete vault module and supported at their upper ends by the charge face structure (a carbon steel fabrication filled with concrete, designed to close the top of the storage vault and provide shielding). Vertical storage in the vault module matrix is the same orientation for which the fuel was designed to operate in the reactor. A shield plug is positioned in the charge face structure above each FSC to provide additional shielding.

Empty and new FSCs are normally stored in the MVDS vault until required for fuel loading, at which time the empty transfer cask is moved to the Reactor Building, loaded/sealed, returned in the transfer cask to the MVDS and placed in a vacant vault position.

5.2.3 Transfer Cask and Trailer

A spent fuel shipping cask and its associated trailer have been modified to serve as a fuel transfer system for the ISFSI, to move FSCs and contents from the reactor building to the MVDS. This cask and trailer will continue to operate under a license issued previously for transportation purposes under the requirements of 10 CFR Part 71[20]. Fuel transfers will take place entirely within the boundaries of Fort St. Vrain owner-controlled property, and will not access any public roadways.

5.2.4 MVDS

The general arrangement of the MVDS structure is shown in Figures 5.1 and 5.2. It is made up of six vault modules, a transfer cask reception bay for receiving the transfer cask, and three standby and neutron source storage wells as discussed below. Its foundation structure is designed to

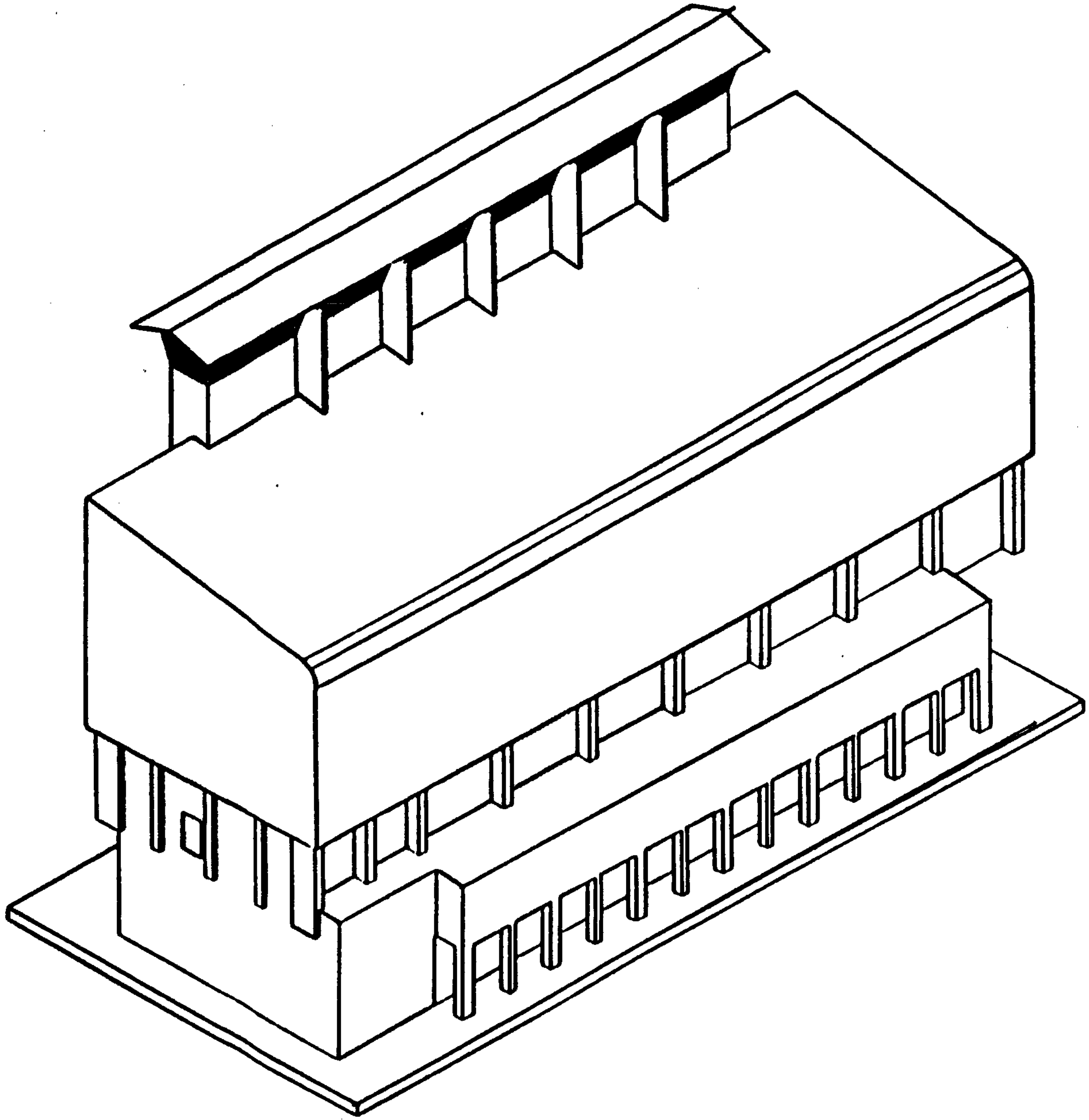

Figure 5.1. Fort St. Vrain ISFSI Modular Vault Dry Storage Facility

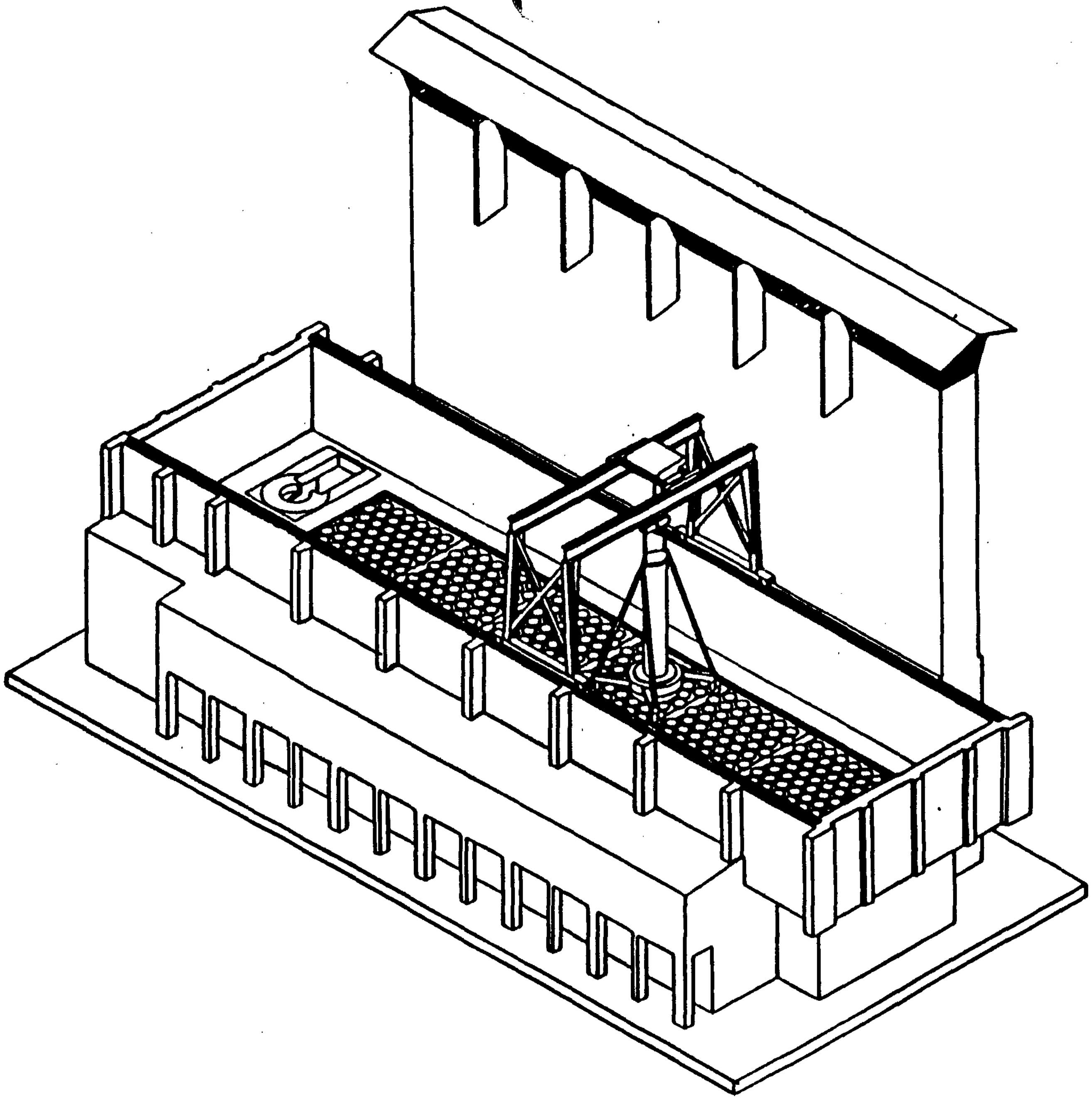

Figure 5.2. Fort St. Vrain ISFSI Modular Vault Dry Storage Facility - Section View

support the MVDS against the imposed loads created by the structure weight, operating loads, environmental loadings, and design basis earthquake. The floor of the vault module is sloped for drainage and is provided with drainage connections. To facilitate the eventual off-site disposal of fuel, the MVDS is designed with the ability to unload fuel by removing each FSC or by handling each individual fuel element.

Vault Module

The vault module unit is the basis of the modular construction of the MVDS. There is a matrix of 45 fuel storage positions within each concrete vault module; a maximum of six vault modules will accommodate the complete Fort St. Vrain core. The vault module provides shielding around the array of FSCs and provides for defined cooling air inlet/outlet flow paths. Cooling air enters the vault module (a common inlet plenum exists for all modules) through a mesh covered opening, which prevents the ingress of birds, small animals, and large debris, and serves as a security barrier. The labyrinth arrangement of the cooling air inlet structure provides radiological shielding for the stored fuel. The fuel is stored dry, and decay heat is removed by a once-through buoyancy driven ambient air system flowing across the exterior of the FSCs. There is no contact between this cooling air and the fuel. Cooling air distribution across the outside of FSCs is improved by means of precast concrete collimators that are set into grooves in the structure walls. The collimators also contribute to the radiological shielding of the stored fuel. The cooling air leaves the vault module through a second set of concrete collimators, which serve the same functions as those at the inlet, and is exhausted to the atmosphere through a concrete cooling air outlet chimney. The opening of the outlet chimney is fitted with wire mesh. A steel canopy is provided on the top of the cooling air outlet chimney to prevent the ingress of rain and snow. The ambient cooling air does not come into contact with the fuel in the FSCs so that the internal walls of the vault module will remain radiologically non-contaminated. However, in order to promptly detect any airborne release from a postulated credible accident, an effluent monitoring and alarm system will be installed as discussed in Section 5.4.

Transfer Cask Reception Bay

The transfer cask reception bay is alongside and integral with the vault module structure. The bay provides an access tunnel for the transfer cask trailer and tow vehicle. A rectangular access penetration through the roof of the bay is provided for movement of the transfer cask to the charge face.

Standby Storage Wells

Two standby storage wells are incorporated into the MVDS structure at the north end of the storage module. These are comprised of a simple closed-ended liner tube set into an enclosure created by the MVDS structure. The tube is designed to house a FSC and support its base in a manner identical to that used in the storage vault. The standby storage well can be closed using a charge face shield plug and sealed using a cover plate. Decay heat is dissipated to the surrounding air. A sampling point allows the storage well volume to be evacuated for total FSC leak testing.

The functions of the standby storage wells are as follows:

1. Allow isolation of a defective FSC from the vault cooling system after removal from the vault.

2. Allow total individual FSC leak checking throughout the storage period in a location remote from the radiation fields associated with the storage vault(s).

3. Provide basic provision to change fuel elements from one FSC to a spare unit in the unlikely event of FSC failure.

4. Provide basic provision to move fuel elements from FSCs and discharge these into a DOE shipping cask for ultimate movement to the Federal repository or MRS.

One standby storage well can be equipped with a spare FSC. The second will normally remain empty unless a full defective FSC is removed from the vault.

Neutron Source Storage Well

Neutron source elements are stored in a location remote from the storage vault because neutron shielding materials can be incorporated easily into the special storage location. The neutron source storage well is identical to the standby storage wells described above and will be located alongside the two standby storage wells.

5.2.5 Entrance Building

An entrance building may be erected on the west side of the MVDS to house facilities to support ISFSI security. If erected, the entrance building will be propane-heated and electrically-cooled to provide comfort for the occupants. There are no MVDS design or safety requirements associated with the entrance building. If the entrance building is not built, security functions, which were planned for the entrance building, will be performed at another existing building onsite.

5.2.6 MVDS Equipment

The MVDS equipment include the container handling machine, charge face structure container, shield plug and handling device, and MVDS crane. This equipment is described below.

Container Handling Machine

The container handling machine provides the means of raising/lowering the FSCs from the transfer cask, move fuel from the transfer cask to the selected FSC storage position in the vault module, and lowering/raising FSCs into the vault storage locations. The container handling machine will also be used when off-loading the MVDS prior to decommissioning using a reverse procedure. The handling machine is moved over the storage vault using the MVDS crane and is controlled via a control panel located at the base of the machine.

Charge Face Structure

The charge face structure is a carbon steel fabrication filled with concrete, designed to close the top of the storage vault, create the MVDS charge face, and provide shielding.

Shield Plug and Handling Device

The shield plugs complete the radiation shielding within the charge face structure penetrations in conjunction with the FSCs. The shield plug handling device is designed to remove the charge face shield plugs using the MVDS crane and an isolation valve, and provide necessary shielding during the operation.

MVDS Crane

The MVDS crane operates above the MVDS charge face and is used for all lifting operations. The MVDS crane is also used during MVDS construction to erect most MVDS components.

5.2.7 ISFSI Utilities

Utilities at the MVDS include electrical power and in-house communications. Also, the proposed ISFSI entrance building, which may be constructed for security purposes, would be served by domestic water, telephone, radio, electrical power, and a propane heating, ventilation and air conditioning (HVAC) unit.

Electrical power is required during transfer cask loading operations. This will be supplied by a 13 KV overhead distribution line southeast of the ISFSI facility, fed from the Vasquez Substation. Backup power, which is used for security purposes only, is supplied by a propane engine generator or batteries.

Domestic water is supplied to the entrance building via a new line supplied from the Weld County Water District. A septic system and leach field is located west of the entrance building such that any required maintenance may be performed without entering the protected access area. This system will be designed in accordance with Weld County requirements.

5.3 ISFSI OPERATIONS

The loading of fuel for transfer from the Reactor Building is addressed by existing Fort St. Vrain procedures (under the 10 CFR 50 reactor operating license) and is not duplicated by ISFSI procedures. During handling of spent fuel, operating controls are provided for spent fuel handling equipment. Minimal controls and surveillance are required during its storage mode because the MVDS is a passive spent fuel storage system. Only the cooling air inlets and outlets need to be periodically observed to guard against massive blockage. Surveillance activities associated with operational security and monitoring for radioactivity are discussed in Sections 7.0 and 5.4, respectively.

5.3.1 Operating Controls and Limits

The proposed operating controls and limits for operation of the MVDS are described in Section 10.0 of the ISFSI SAR[13]. These involve the type of fuel and reflector elements allowed to be stored at the ISFSI, the requirements for the FSC, the maximum lift height of the container handling machine, the screen area of the MVDS cooling inlet and outlet protective mesh that must be free from blockage, the operability of the container handling machine, and the number of operable seismic instruments (see Section 5.4) at the ISFSI.

5.3.2 Operations Summary

The MVDS will have a short dedicated campaign of fuel transfers; the anticipated duration for loading the ISFSI is eight months. Operations involved with transfer from the reactor and loading the ISFSI are summarized below. Health physics and other safety-related checks form an integral part of the transfer and storage procedures.

Containerizing and sealing the fuel is completed within the Reactor Building. Fuel movement from the Reactor Building to the MVDS is accomplished by use of shipping casks licensed under

10 CFR 71[20] which have been modified to perform as ISFSI transfer casks, and by use of an existing transfer cask trailer and tow vehicle. The transfer takes place entirely on PSC owner-controlled property and does not cross or traverse any public roadways. The operations using the transfer cask are consistent with the licensed cask handling procedures, and the fuel handling staff is trained in these techniques. The transfer cask is received in the transfer cask reception bay where it is removed from the transfer cask trailer by the MVDS crane and positioned in the cask load/unload port, for unloading. A shielded container handling machine, carried by the MVDS crane, is provided to remove the FSC and place it in the vault module storage matrix in conjunction with an isolation valve.

5.3.3 Equipment and Structural Maintenance and Monitoring

Equipment Maintenance

During the short fuel loading schedule of the MVDS, the fuel handling and transfer equipment will not require special maintenance. Normal maintenance associated with equipment operations will be performed as required. All lifting slings will be certified to the standards of the American National Standards Institute (ANSI)[21] before the loading campaign.

During the fuel storage period, the container handling machine will be bolted onto its storage pad. A local power supply will be available for periodic operation of the MVDS crane, container handling machine raise/lower mechanism, and control systems. The cask load/unload port and charge face isolation valves and the shield plug handling devices will remain on the charge face structure. The transfer cask reception bay entrance will be closed. In this way all equipment can be preserved, retrievable for use at any time. The volume above the charge face and the transfer cask reception bay can be routinely accessed for inspection of the stored equipment.

Structural Maintenance

Civil structure maintenance is not expected to be necessary during the storage period. Routine inspections will be performed, and should any cracks or general degradation of the concrete be observed, they will be evaluated for their effect on the structure and repair requirements. All steelwork associated with the enclosure structure is accessible to inspection and repainting if necessary during the anticipated storage duration.

Monitoring and Surveillance

An operational surveillance program will include visual inspections of all air inlets for obstructions and screen damage once each 24 hours. As necessary, removal of obstruction or screen repair will be initiated immediately. The ISFSI will also be included in routine site patrols by Fort St. Vrain security personnel.

It is not necessary to monitor the MVDS performance parameters such as cooling air flow, cooling air temperature, or criticality because of the passive heat removal system, the margins on allowable fuel element temperature, and the margin of subcriticality during all normal and off-normal events.

Instrumentation will be supplied for seismic monitoring. Seismic instrumentation will be used to determine the severity of any seismic disturbances. This instrumentation will consist of Triaxial Time History Accelerographs which will measure earthquake acceleration.

5.4 RADIATION MONITORING PROGRAM

An effluent monitoring program is not required for the ISFSI since the design of the MVDS is such that its operation will not (1) result in any water or other liquid discharges, (2) generate any chemical, sanitary, or solid wastes, or (3) release any radioactive materials in solid, gaseous or liquid form during normal operations. Consequently, effluent monitoring systems, including area radiation and airborne radioactivity monitors, are not needed at the ISFSI to support normal operations. However, in order to promptly detect airborne releases from a postulated maximum credible event (as described in Section 6.2.2 of this document, and Section 8.2.15 of the ISFSI SAR[13]) a stack alarm system will be installed. The system will consist of two Geiger-Mueller or other appropriate detectors, which will be evenly placed within the ventilation stack, and will be operated in accordance with ANSI N42.18-1974[23]. Alarm signals will output to the continuously manned ISFSI security facility.

Similarly, with the absence of liquid or gaseous effluents from the ISFSI, specific environmental monitoring for these exposure pathways is not required. However, as an additional verification of the proper operation of the ISFSI system, PSC will incorporate environmental surveillance activities for the ISFSI into the Fort St. Vrain REMP, as described in Section 8.2 of the Technical Specifications for 10 CFR Part 50[22] licensing. The REMP monitors air, water and food pathways to establish the basis for evaluation of environmental impacts of facility operation, and is used in the assessment of public and occupational dose from Fort St. Vrain operations. Trend analysis of surveillance and monitoring data will be applied to assure that any necessary corrective actions can be taken sufficiently early to prevent unnecessary exposures.

When the Fort St. Vrain reactor operating license is amended or terminated, those portions of the program that are relevant to the ISFSI will be retained or modified. As a surveillance measure to confirm that external radiation levels from the ISFSI remain within predicted levels, TLD monitoring (as described in Section 4.7) at the controlled area boundary fence will be continued throughout the operational life of the ISFSI.

Any waste water which accumulates in the vault area collection system will be routinely sampled and analyzed for radioactivity at least quarterly to verify compliance with activity concentration limits of Appendix B, Table II of 10 CFR 20[24].

6.0 ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION

The ISFSI site area will be developed and managed so as to minimize construction impacts. All construction activities will comply with Federal, State, and local regulations for environmental protection as well as occupational safety and health.

6.1 CONSTRUCTION IMPACTS

Construction impacts are expected to be of short duration, on the order of 10 months. The more significant construction-related impacts will occur during earth-moving activities at the front-end of the project; however, these are not expected to be significantly different from the impacts associated locally with preparing fields for planting.

6.1.1 Land Use and Terrestrial Resources

Site preparation will involve site grading, excavation, backfilling and compaction of soils within the immediate vicinity of the MVDS structure, and the stockpiling of some soil within the ISFSI secure area. In addition, up to 6 temporary trailers or buildings will be hauled to the site or erected to support construction activities, but these will be removed upon completion of construction. A total of about 0.8 acre of land will be removed from biological production for access roads, parking, and buildings (including excavation). The MVDS construction will temporarily remove up to about 0.25 acre of this total. The remainder of the site (an 18-acre area) will be graveled to control erosion and minimize the generation of fugitive dust, although the existing vegetation is expected to recede into the gravel cover within a few growing seasons.
Inclusive with a soil stockpile, most of the 20-acre site will be disturbed as a result of facility construction and operation. The removal of this small parcel of land from sustaining biota, principally old world weeds, small mammals, birds, and invertebrates associated with this habitat will not alter the character of the community or affect local land use. This area is not presently in agricultural production, nor does it provide critical habitat for any species.

The remaining unpaved area surrounding the fenced area of the ISFSI will be revegetated to reduce fugitive dusts and erosion. The immediate area, secured by an 8-foot chain link fence, is already under PSC control, and will not be open to public access.

Provisions to be made to accommodate onsite runoff include sloping the concrete around the building and providing concrete drainage channels to divert runoff away from the site toward the northeast (i.e., toward the South Platte River and St. Vrain Creek). These measures, together with active site maintenance, revegetation efforts, and graveling, will prevent appreciable onsite erosion.

The stockpiled soil would be subject to flooding and low-velocity flows if a probable maximum flood (PMF) with a repeat frequency of 1,000 to 10,000 years were experienced, but this would not be a significant impact, when compared to surrounding flood impacts closer to principal channels. The MVDS structure and the Entrance Building will not be affected by such a flood, as they are sited at an elevation of one foot above the PMF level.

6.1.2 Water Use and Aquatic Resources

The only domestic water use anticipated at the ISFSI will occur during construction to supply construction workers. Drinking water will be supplied by the Fort St. Vrain plant domestic water system, and transported as needed. Total drinking water consumption is not expected to exceed 10,000 gallons. Portable restroom facilities will not require onsite sources of water.

Water will also be used for ready-mixed concrete, to control fugitive dust, and for cleaning equipment as necessary. The non-domestic water will be supplied by truck from either St. Vrain Creek or the South Platte River, and is expected to not exceed 250,000 gallons (about 3/4 of an acre-foot). Some of this water may percolate into shallow aquifers recharging to areal streams, but a significant percentage will evaporate.

The excavation will not require dewatering. Erosion of topsoil or excavated material during site preparation will be contained within the immediate facility. Local ditches could, in theory, be subjected to slightly elevated silt levels attributable to site preparation, but it is unlikely due to the distance from ground disturbance to the ditches and the flat nature of local topography. The ditches have raised banks along most of their length to prevent water loss by overtopping. These raised banks also prevent the collection of significant quantities of local runoff.

The domestic water system and the water rights currently owned by PSC are adequate to meet these water requirements. The above-discussed construction activities are not anticipated to adversely affect water resources, or impact local water use, alter the water table, or affect aquatic biota.

6.1.3 Other Impacts of Construction

Historical, Archaeological and Cultural Resources

There will be no adverse impact on any historical, archaeological, or cultural resources in the area.

Air Quality

Temporary increases in levels of suspended particulate matter will result from construction activities. In addition, exhaust from construction vehicles will add to levels of hydrocarbons, carbon monoxide and oxides of nitrogen. Measures, such as watering of unpaved roads, will be used to minimize the generation of fugitive dust. An administrative speed limit of 15 miles per hour will also reduce the quantity of fugitive dusts generated by onsite traffic. In addition, cleared areas and exposed earth will be seeded, graveled, or paved to minimize dust generation, as well as to stabilize and control runoff, and minimize soil erosion. The increased atmospheric pollutant loading due to these activities should be minor and short-term.

Impact on Wildlife

The addition of the MVDS is not expected to create any additional disturbance to wildlife in the area.

Traffic

Except for cement trucks and minor increases in truck traffic associated with the hauling of building materials and removal of wastes, the traffic will be identical in character to that associated with current activities at the site.

Noise

Other impacts of construction will include the noise associated with earth-moving activities. No blasting is expected to be necessary for site preparation. The equipment needed to complete site preparation is not expected to produce more noise than agricultural equipment already used in the area. The distance between the site and the nearest resident is approximately 1/2 mile. This buffer will prevent any acute noise impacts. To protect onsite personnel, Occupational Safety and Health Administration standards for noise levels will be followed.

Chemical Control

Chemical consumption related to the ISFSI is expected to be limited to the use of cleaning materials for support facilities. Petroleum or other liquid wastes will be discharged into tanks for removal to appropriate offsite locations. A Chemical Control Program[24] in place at Fort St. Vrain will govern the potential or actual use of any hazardous chemicals.

Spoils Stockpile

Soils and weeds excavated for site preparation and prior to foundation compaction will be stockpiled in the southeast portion of the site. A minor amount of erosion and fugitive dust from the pile is likely until vegetation is reestablished.

Erosion

Erosion of soil by runoff will be limited due to (1) the low gradient in the vicinity; (2) the interruption of natural surface drainage by irrigation ditches; (3) incorporation of a concrete downslope around the ISFSI foundation and provisions for drainage channels to divert runoff toward the South Platte River and St. Vrain Creek; (4) the extensive use of gravel; (5) revegetation efforts; and (6) the distance to nearby streams.

Disposal of Construction Debris

Construction debris other than soils and vegetation will be hauled to a nearby licensed landfill. Trash generated by the temporary workforce will be included as construction debris. The traffic to complete this task will be intermittent and not out of character with existing traffic patterns. The amount to be hauled will not be significant since soils/vegetation will remain onsite, and no existing structures will need to be razed prior to construction of the MVDS.

6.1.4 Socioeconomics

The current workforce is declining at the Fort St. Vrain Generating Station as a result of its shutdown. It is expected that some of the workers that would otherwise be released will be absorbed into the construction workforce. The peak requirement during construction is expected to be 60 workers. This workforce is too small to significantly affect the character of the area. Because there are many communities within commuting distance, it will not be necessary to relocate workers for this project. The nearest town of Platteville is about 3 1/2 miles away and Denver is 3.5 miles to the south. There are many other communities closer than Denver as well.

6.1.5 Radiological Impacts from Construction

The MVDS will be a new facility, constructed in a radiologically uncontaminated area. All construction activities related to this project will have been completed prior to the commencement of fuel shipping. Ambient radiation levels at the construction site do not differ significantly from average background levels in the area; consequently, radiological impacts from construction activities are considered to be negligible.

6.2 OPERATIONAL IMPACTS

6.2.1 Radiological Impacts from Routine Operations

Direct and scattered external irradiation is the only significant exposure pathway for both offsite and occupational dose commitments during normal operation of the ISFSI. Because the design basis for ISFSI includes only dry storage of spent nuclear fuel in sealed containers, no significant liquid or gaseous effluents will result from storage operations[6].

Both occupational and offsite dose commitments are assessed according to the design basis assumptions described in the ISFSI SAR[13] and other conservative assumptions, including the following:

(1) All fuel elements are assumed to be from the hottest segment of the reactor and to have a burnup of 52000 MW-days/metric ton of heavy metal.

(2) For some dose estimates, fuel elements were assumed to have decayed for 600 days, post shutdown. Actual fuel loading will probably not commence until after 760 days post-shutdown.

(3) For some dose estimates associated with the MVDS fuel storage phase, it is assumed that the MVDS immediately reaches a fully-loaded configuration.

(4) No credit is taken in the estimates for subsequent declines in source activity over time, as the operations proceed.

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[6] Although activities associated with cask loading and decontamination may result in the generation of some liquid and gaseous effluents, these operations will be conducted within the Fort St. Vrain Reactor Building, under the conditions imposed by the 10 CFR Part 50 operating license. Any radiological impacts from those effluents fall within the scope of reactor operations which were assessed in the Fort St. Vrain Final Environmental Statement[6].

The resulting dose estimates are therefore conservative, and actual doses should be significantly less.

6.2.1.1 Offsite Dose

The highest annual dose rates resulting from fuel storage in the MVDS will be delivered during the first year. This is due both to the loading campaign and to the fact that the post-irradiation decay period increases with each subsequent year. Dose rates at the controlled area boundary were calculated for the first year of storage, assuming that the MVDS is fully loaded with fuel which has decayed for 760 days. Because of the MVDS configuration, its radiation fields are not radially symmetrical; the highest dose rates are found toward the west boundary.

Because the immediate area beyond the controlled area boundary is occasionally used by agricultural workers, an assessment was performed to estimate the dose to a maximally exposed individual at the ISFSI boundary. Assuming that a worker occupies the area for 20 hours per week, 50 weeks per year, and that he spends all of that time in the direction of maximum exposure (i.e., the west side of the controlled area boundary fence), it is estimated that he would receive a maximum dose of 13 mrem/year. If he averaged his time along all points of the boundary, he would not receive a dose in excess of 4 mrem/year. The nearest resident is located in excess of 2600 feet north-northwest of the ISFSI. The maximum expected dose to an individual at this location, assuming 100% occupancy, would be about 0.1 mrem/yr. Based on population projections for the year 2012, 4526 individuals will reside within a five-mile radius of the ISFSI.

To assess the dose to the offsite population, it was conservatively assumed that the maximum annual dose to an offsite individual (as discussed above) is delivered to each member of the population of 4526. The maximum annual population dose commitment is estimated to equal about 0.45 person-rem. Dose to the population beyond the five mile radius is insignificant.

Section 72.104 of 10 CFR 72 requires that the dose delivered to the whole body of any real member of the population located beyond the ISFSI controlled area boundary, when considered with doses resulting from normal operations of all uranium fuel cycle activities within the region, shall not exceed 25 mrem/yr. The projected doses are well within this limit.

6.2.1.2 Collective Occupational Dose

Spent fuel storage operations at the Fort St. Vrain ISFSI will result in a small increase in the total occupational dose. Engineered features of the storage modules and application of administrative controls are designed to ensure that all exposures are maintained at levels which are as low as reasonably achievable (ALARA). ISFSI operations will be conducted under either (1) existing procedures suitably modified and approved for this activity, or (2) procedures to be prepared under the existing PSC administrative requirements which meet NRC Quality Assurance (QA) and ALARA requirements.

The onsite collective dose has been assessed for each of three operational phases by estimating the number of personnel required to perform specific tasks, the time required to perform these tasks, and the estimated radiation levels in the areas in which the tasks are performed. The specific phases of ISFSI activity for which occupational dose has been assessed include: (1) fuel transport and loading into the MVDS; (2) inspection, monitoring and maintenance at the ISFSI during the implementation of Fort St. Vrain reactor decommissioning; and (3) inspection, monitoring and maintenance at the ISFSI after Fort St. Vrain reactor decommissioning has been completed.

The fuel transfer and loading phase will be completed during the first year of operation, and will contribute an estimated 27 person-rem to ISFSI workers (drivers, operators, and Entrance Building occupants). An estimated 200 Fort St. Vrain personnel are assumed to be located at the Reactor Building and another 10 persons at a temporary building (or buildings) during this phase. These personnel will receive a collective dose of about 0.2 person-rem for this phase. Inspection, monitoring and maintenance activities at ISFSI during the first year are estimated to contribute about 5.2 person-rem, conservatively assuming a fully-loaded MVDS configuration for the entire year.

Inspection, monitoring and maintenance will continue for the duration of operations at the ISFSI, and these personnel are expected to receive an additional collective dose of about 55 person-rem over the next nineteen years. Fuel storage at the MVDS will slightly increase dose rates to personnel working on the Fort St. Vrain reactor decommissioning, contributing about 0.66 person-rem to this work group. After reactor decommissioning is completed, a substantially reduced workforce at Fort St. Vrain will receive a collective dose of 1.4 person-rem, cumulative through the twentieth year of storage.

Collective doses to staff from ISFSI decommissioning activities will depend upon the length of the storage period and thus the post-irradiation decay period of the fuel. If offloading and shipment occurs after twenty years, the fuel will have decayed to a factor of 0.16 of its 600-day activity (on which this analysis was based). Since the respective tasks for each operation are comparable, the collective dose from offloading and shipping after twenty years can be estimated as a fraction equal to 0.16 of the collective dose associated with initial fuel transport and loading, or 4.3 person-rem. Collective doses received from decontamination and dismantling, which occur after fuel offloading, are expected to be negligible.

6.2.2 Radiological Impacts of Accidents

A range of credible accident scenarios which might affect the safe operation of the Fort St. Vrain ISFSI were identified and analyzed. The scenarios were grouped into four Design Event categories in accordance with ANSI/ANS-57.9[26], to establish design requirements for satisfying operational and safety criteria. The postulated Design Event IV (accident) scenarios included earthquakes, tornadoes, tornado missiles, fire and explosions, vehicular impact, blockage of air inlets and outlets, dropping an FSC, dropping a transfer cask, long-term loss of electrical power, lifting of equipment out of sequence, and leakage from an FSC. Of these scenarios, all but the following two exceptions were either determined to be too incredible to merit further analysis or were found to have no radiological consequences: (1) lifting equipment out of proper sequence, and (2) gross leakage of radionuclides from an FSC. The possible accident resulting from lifting equipment out of sequence was found to have consequences for occupational radiological exposure, delivering a dose of 400 mrem to a single operator, but no offsite dose consequences. The container leakage event was found to represent the maximum credible accident for this facility and is described below.

In the container leakage scenario, one fuel storage container loses integrity due to failure of its metal o-ring seals, or by corrosion of the container walls which allows leakage of an inventory of fission products into the vault module. Gross failure of the o-ring seals or container walls is an extremely unlikely event which cannot be postulated on the basis of realistic mechanisms. In this sense, the leakage accident does not represent a credible scenario. Nevertheless, since the accident consequences bound those of other postulated events, this accident is assessed to show the inherent safety of the storage system.

It is assumed that the released inventory is fully suspended and vented in its entirety, unfiltered, from the MVDS stack within a ten-minute time interval. The total amount of radioactivity released in this scenario is based on the following assumptions:

(1) Fission product inventory of a single FSC containing 6 maximum-powered fuel blocks;

(2) 760-day post-irradiation decay period;

(3) Fuel particle failure fraction of 0.1% (a value which is consistent with Fort St. Vrain reactor experience);

(4) Release involves 100% of the releasable inventory of noble gases, 50% of the halogens, and 1% of the solids.

The Gaussian plume atmospheric dispersion model described in Regulatory Guide 1.25[27] was used in the assessment. Plume dispersion was conservatively assessed for Pasquill stability class F, a constant windspeed of 1 m/s, and a uniform wind direction over the duration of the release. The release was assumed to be ground-level, and a building wake correction factor was applied. The atmospheric dispersion factor derived on this basis for the nearest ISFSI controlled area boundary was 3.3×10^{-3} s/m^3.

The potential dose to an individual located at this point for the duration of plume passage has been assessed for the plume immersion and inhalation pathways. The calculated maximum offsite dose to the whole body from immersion in the plume is about 0.24 mrem, while the dose to the skin from this mode of exposure is about 0.9 mrem. The "effective dose equivalent" (which is analogous to whole body dose) from inhalation is about 0.35 rem. The highest organ dose from the inhalation pathway is 2.7 rem to the lung.

Most of the dose is due to inhalation of the particulate fission products Sr-90 and Ce-144. Since the 1% release fraction for particulates is considered highly conservative for this case, and since all of the released fraction is assumed to be of respirable particle size, the calculated result can truly be considered an upper bound to the actual dose from a leakage event.

The resultant whole-body and organ doses to an individual at the controlled area boundary from this postulated accident are within the 5 rem criteria (whole body or any organ) specified in 10 CFR 72.106. These doses are also below the Protective Action Guides (PAGs) established by the Environmental Protection Agency (EPA) for individuals exposed to radiation as a result of accidents: 1 rem to the whole-body and 5 rem to the most severely affected organ[28]. Doses at the location of the nearest resident (i.e., at a distance of 2600 feet from the MVDS) would be substantially less. Thus, the release of radioactive materials from the ISFSI due to accidents, even those with a very low probability of occurrence, will not have any significant radiological consequences on individuals in the vicinity of the Fort St. Vrain Nuclear Generating Station.

6.2.3 Nonradiological Impacts

6.2.3.1 Land Use and Terrestrial Resources

The operation of the ISFSI will not affect local land use. The immediate site will be secured 24-hours per day and will not be open to public access. The MVDS building, parking lot, and access roads will reduce the land area sustaining biota by about 0.8 acre, which will not significantly alter the character of the area. This impact is limited to a previously disturbed area which is currently supporting weeds.

6.2.3.2 Water Use and Aquatic Resources

The ISFSI will not consume water to support its operation. Onsite facilities to support personnel will be supplied from existing water supplies for which water rights have already been secured. Discharge of a domestic septic tank into a leach field will not significantly alter the water table or affect local water use.

6.2.3.3 Other Impacts of Operation

Historical, Archaeological and Operational Resources

There will be no adverse impact on any historical, archaeological, or cultural resources in the area.

Air Quality/Climatology

Except for a nominal amount of warmed air, operation of the ISFSI produces no effluents. Analyses have indicated that with a fully loaded MVDS, the outlet temperature may exceed the ambient temperature by about 11° F. During rainy days, precipitation may vaporize upon contact with the surface of the MVDS as a result of the relative higher temperature of the surface or outlet air. Consequently, fog may form above the structure. However, a significant increase in the temperature amount of fog extending beyond the plant's exclusion boundary is not expected.

A back-up propane fueled generator is available for use in the event of power interruption; its operational testing schedule (and by association, air pollutant emissions) is limited by the requirements of an Colorado Department of Health Air Quality Control Division Emissions Permit which will be secured.

Impact on Wildlife

The addition of the MVDS is not expected to create any additional disturbance to wildlife in the area.

Traffic

Routine operations at the site will result in a continuing light traffic burden on area roads. The ISFSI is not expected to cause any other effects from operation.

Noise

Noise associated with operation of the ISFSI will result from transfer of the designated spent fuel to the MVDS. The noise associated with this activity is not expected to be distinguishable from other operational noise at the site or to result in adverse impact to local residents.

Chemical Control

The storage of fuel at the ISFSI is a passive operation and will not require the use of hazardous chemicals. Chemical consumption related to the ISFSI is expected to be limited to the use of cleaning materials for support facilities. Chemical purchase, storage, use and disposal is managed by a Chemical Control Program[24] in place at Fort St. Vrain.

Spoils Stockpile

Soils excavated for site preparation and prior to foundation compaction will be stockpiled in the southeast portion of the site. A minor amount of erosion and fugitive dust from the pile is likely until vegetation is reestablished.

Erosion

Erosion of soil by runoff will be limited due to (1) the low gradient in the vicinity; (2) the interruption of natural surface drainage by irrigation ditches; (3) incorporation of a concrete downslope around the ISFSI foundation and provisions for drainage channels to divert runoff toward the South Platte River and St. Vrain Creek; (4) the extensive use of gravel; (5) revegetation efforts; and (6) the distance to nearby streams.

Socioeconomics

Operation of the ISFSI will require a minimal staff of about 10 persons, and will not contribute to any socioeconomic impacts in the region.

7.0 SAFEGUARDS FOR SPENT FUEL

The Commission's requirements for the protection of an ISFSI are set forth in 10 CFR Part 72 Subpart H and include a security organization, response guards, access controls, detection aids, communications systems, and liaison with law enforcement agencies.

The applicant has submitted to the NRC a Physical Security Plan which contains commitments to these requirements. This physical security plan incorporates measures presently in effect for the protection of the Fort St. Vrain reactor, and establishes additional safeguards specifically for the stored fuel. The combined plans assure that:

- Access to the site is controlled and limited to authorized individuals,
- Unauthorized intrusions or activities are detected in a timely manner,
- Armed responders are available to counter the threat,
- The capability to call for assistance from local police units is available,
- Explosives and contraband weapons are excluded from the site,
- The fuel storage canister is additionally protected by a reinforced concrete storage module,
- Access to the concrete storage modules is limited and controlled,
- All special equipment needed to gain access to storage canisters are secured to prevent misuse, and

- Movement onsite is under the surveillance and protection of the site's armed security force.

The implementation of these physical security plans will be inspected for effectiveness and operational compliance.

Theft or diversion of spent power reactor fuel by subnational adversaries with the intent of utilizing the contained special nuclear material (SNM) for nuclear explosives is not considered credible due to (1) the unattractive form of the contained SNM, which is not readily separable from the radioactive fission products, and (2) the immediate hazard posed by the high radiation levels.

The applicant's security plan, when implemented, will protect against a threat comparable to the design basis threat set forth in 10 CFR 73.1(a)(1). Accordingly, the storage of spent fuel at this site will not constitute an unreasonable risk to the public health and safety from radiological sabotage.

8.0 DECOMMISSIONING

The only activities expected in decommissioning the Fort St. Vrain ISFSI are the removal of the spent fuel, and source and reflector elements for transfer to a Federal repository or MRS (although the final destination and the time horizons until shipping are still uncertain) and the decontamination of structures, if necessary.

The ISFSI design will allow for many optional handling and shipping configurations, to adapt to the shipping and disposal arrangements when they are finally determined. These include provisions for the handling of either multiple or individual fuel elements. If the FSCs are compatible with the criteria of the receiving site, they may be deposited into a transport cask and shipped directly to the receiving location. A transfer cask is available if reconfiguration of the fuel elements is required.

Because design features of ISFSI provide for essentially all contaminant material to be contained within the FSCs, areas requiring decontamination are expected to be minimal. The container handling machine and standby storage wells used for handling individual fuel elements will require decontamination, and failed FSC will result in localized contamination where the elements are re-transferred. Decontamination will be accomplished using acceptable industry techniques; no extraordinary processes should be required. The facility will be decontaminated to an established level for residual radioactivity which will allow release for unrestricted use, as required by 10 CFR Part 72. Once this level of decontamination is reached, the pursuit of any further dismantlement activities will be at PSC's discretion.

It is projected that decommissioning-related activities will require 2.5 years to complete, and that they will begin in the year 2033. Annual occupational doses associated with unloading spent fuel after 20 years and with decontamination activities are estimated to be small.

In accordance with the requirements of 10 CFR 72.30, a decommissioning plan has been submitted by the Applicant, included as Attachment C to the ISFSI License Application[1]. This document includes a commitment to establish an externally administered, sinking trust fund as described in 10 CFR Part 72.30(c)(3), to fund decommissioning costs. According to the requirements of 10 CFR 72 Subpart 72.54, the licensee may apply to the NRC for authority to surrender a license voluntarily and to decommission the ISFSI within two years following permanent cessation of operations, and in no case later than one year prior to expiration of the license. The Applicant must receive approval of the final decommissioning plan from the NRC prior to the commencement of any decommissioning activities. The NRC will then terminate the license after it has been determined that (1) the decommissioning has been performed in accordance with the approved final decommissioning plan and the order authorizing the decommissioning; and (2) the terminal radiation survey and associated documentation demonstrates that the ISFSI and site are suitable for release for unrestricted use.

9.0 SUMMARY AND CONCLUSIONS

9.1 SUMMARY OF ENVIRONMENTAL IMPACTS

As discussed in Section 6.1, no significant construction impacts are anticipated. The activities will affect only a very small fraction of the land area of the Fort St. Vrain Nuclear Generating Station. With good construction practices, the potentials for fugitive dust, erosion and noise impacts, typical of the planned construction activities, can be controlled to insignificant levels. The only resources committed irretrievably are the steel, concrete and other construction materials used in the ISFSI structure, operating equipment, foundation, and FSCs.

The primary exposure pathway associated with the ISFSI operation is exposure of site workers and nearby residents to direct radiation. The dose to the nearest resident from ISFSI operation is about 0.1 mrem/yr, well below the regulatory limit of 25 mrem/yr stipulated in 10 CFR 72.104. The maximum collective dose to residents within five miles of the ISFSI is about 0.45 person-rem/yr. Occupational dose to site workers during the loading campaign is about 32 person-rem. After that time, the dose will drop to less than 2 person-rem/yr. Individual doses are controlled to within the limits established by 10 CFR Part 20. As discussed in Section 6.2.1, there are no radiological liquid or gaseous effluents during normal operation of the ISFSI.

The upper-bound offsite radiological impacts due to accidents at the Fort St. Vrain ISFSI are about 0.35 rem to the whole-body and 2.7 rem to the lung of an individual located at the controlled area boundary. These doses are within the criteria specified in 10 CFR 72.104(b) and by the EPA Protective Action Guides.

As discussed in Section 6.2.3, no significant nonradiological impacts are expected during operation of the ISFSI. The only environmental interface of the ISFSI is with the air surrounding the MVDS; the only discharge of waste to the environment is warmed air from the passive heat dissipation system. Climatological effects will be insignificant.

9.2 BASIS FOR FINDING OF NO SIGNIFICANT IMPACT

We have reviewed the proposed action relative to the requirements set forth in 10 CFR Part 51, and based on this assessment have determined that issuance of a materials license under 10 CFR Part 72 authorizing storage of spent fuel at the Fort St. Vrain ISFSI will not significantly affect the quality of the human environment. Therefore, an environmental impact statement is not warranted, and pursuant to 10 CFR Part 51.31, a Finding of No Significant Impact is appropriate.

10.0 REFERENCES

1. Public Service Company of Colorado, "Fort St. Vrain Independent Spent Fuel Storage Installation License Application", June 22, 1990.

2. Foster Wheeler Energy Corporation, "Topical Report for the Foster Wheeler Modular Vault Dry Store (MVDS) for Irradiated Nuclear Fuel," Revision 1, Energy Applications Division, March 23, 1988.

3. U.S. Nuclear Regulatory Commission, "Licensing Requirements for the Independent Storage of Spent Fuel Radioactive Waste," 10 CFR 72.

4. U.S. Nuclear Regulatory Commission, "Final Generic Environmental Impact Statement on Handling and Storage of Spent Light Water Power Reactor Fuel," NUREG-0575, August 1979.

5. U.S. Nuclear Regulatory Commission, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," 10 CFR 51.

6. U.S. Atomic Energy Commission, "Final Environmental Statement Related to Operation of Fort St. Vrain Nuclear Generating Station," August 1972.

7. Stearns and Rogers, "Fort St. Vrain Nuclear Generating Station Applicant's Environmental Report Operating License Stage," December 1970.

8. Public Service Company of Colorado, "Engineering Evaluation to Determine Optimum Location for Independent Spent Fuel Storage Installation (ISFSI)," EE-DEC-0018, Revision A, March 30, 1989.

9. Public Service Company of Colorado, "Fort St. Vrain ISFSI Environmental Report," June 22, 1990.

10. Public Service Company of Colorado, "Supplements to Fort St. Vrain ISFSI Environmental Report," dated December 20, 1990 and January 14, 1991.

11. Johnson, J.E., Ph.D., "Results of ISFSI Site Background Radiation Study," Colorado State University, Ft. Collins, Colorado, November 2, 1990.

12. Public Service Company of Colorado, "Fort St. Vrain Nuclear Generating Station Final Safety Analysis Report," with updates through July 1986.

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19. U.S. Nuclear Regulatory Commission, "Packaging and Transportation of Radioactive Material," 10 CFR 71.

20. FSV-1 A and FSV-1 Shipping Cask Certificates of Compliance Number 6346.

21. American National Standards Institute, "Slings," ANSI-B30.9-1984.

22. GEC Alsthom Engineering Systems LTD., "Technical Specification: Project Data File Modular Vault Dry Storage (MVDS) Fort St. Vrain - Colorado, U.S.A.," June 10, 1989.

23. American National Standards Institute, "Specification and Performance of On-Site Instrumentation for Continuously Monitoring Radioactivity in Effluents," ANSI N42.18-1974.

24. U.S. Nuclear Regulatory Commission, "Standards for Protection Against Radiation," 10 CFR 20.

25. Public Service Company of Colorado, "Chemical Control Program," August 29, 1990.

26. American National Standards Institute/American Nuclear Society, "Design Criteria for and Independent Spent Fuel Storage Installation (Dry Storage Type)," ANSI/ANS-57.9, 1984.

27. U.S. Nuclear Regulatory Commission, "Regulatory Guide 1.25, Assumptions Used for Evaluating the Potential Radiological Consequences of a Fuel Handling Accident in the Fuel Handling and Storage Facility for Boiling and Pressurized Water Reactors," March 1972.

28. U.S. Environmental Protection Agency, "Manual of Protective Action Guides and Protective Actions for Nuclear Incidents," Office of Radiation Protection, Environmental Analysis Division, September 1975.

11.0 LIST OF AGENCIES AND PREPARERS

Those NRC staff members principally responsible for the preparation of this EA are listed below:

Name	Responsibility
F. Sturz	Project Manager - EA
S. Ruffin	Project Manager - SAR

The following outside agencies were contacted for supporting documentation. Their support is appreciated.

Colorado Department of Health, Radiation Control Division

Weld County Planning Commission
Weld County Sheriff's Office
Weld County Health Department
Weld County Office of Emergency Management

12.0 LIST OF ACRONYMS

ALARA	As Low As Reasonably Achievable
ANS	American Nuclear Society
ANSI	American National Standards Institute
CFR	Code of Federal Regulations
CSU	Colorado State University
DOE	Department of Energy
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ER	Environmental Report
FES	Final Environmental Statement
FGEIS	Final Generic Environmental Impact Statement
FSAR	Final Safety Analysis Report
FSC	fuel storage container
HTGR	High Temperature Gas-Cooled Reactor
HVAC	heating, ventilation and air conditioning
INEL	Idaho National Engineering Laboratory
ISFSI	Independent Spent Fuel Storage Installation
kV	kilovolts
mph	miles per hour
mR	milliroentgen
mrem	millirem
m/s	meters per second
MVDS	Modular Vault Dry Storage
MW	megawatt
MTHM	metric ton of heavy metal
NOAA	National Oceanic and Atmospheric Administration
NRC	Nuclear Regulatory Commission

NWPA	Nuclear Waste Policy Act
PAG	Protective Action Guide
pCi/g	picocuries per gram
PMF	Probable Maximum Flood
QA	quality assurance
REMP	Radiation Environmental Monitoring Program
SAR	Safety Analysis Report
s/m^3	seconds per cubic meter
SNM	Special Nuclear Material
TLD	thermoluminescent dosimeter

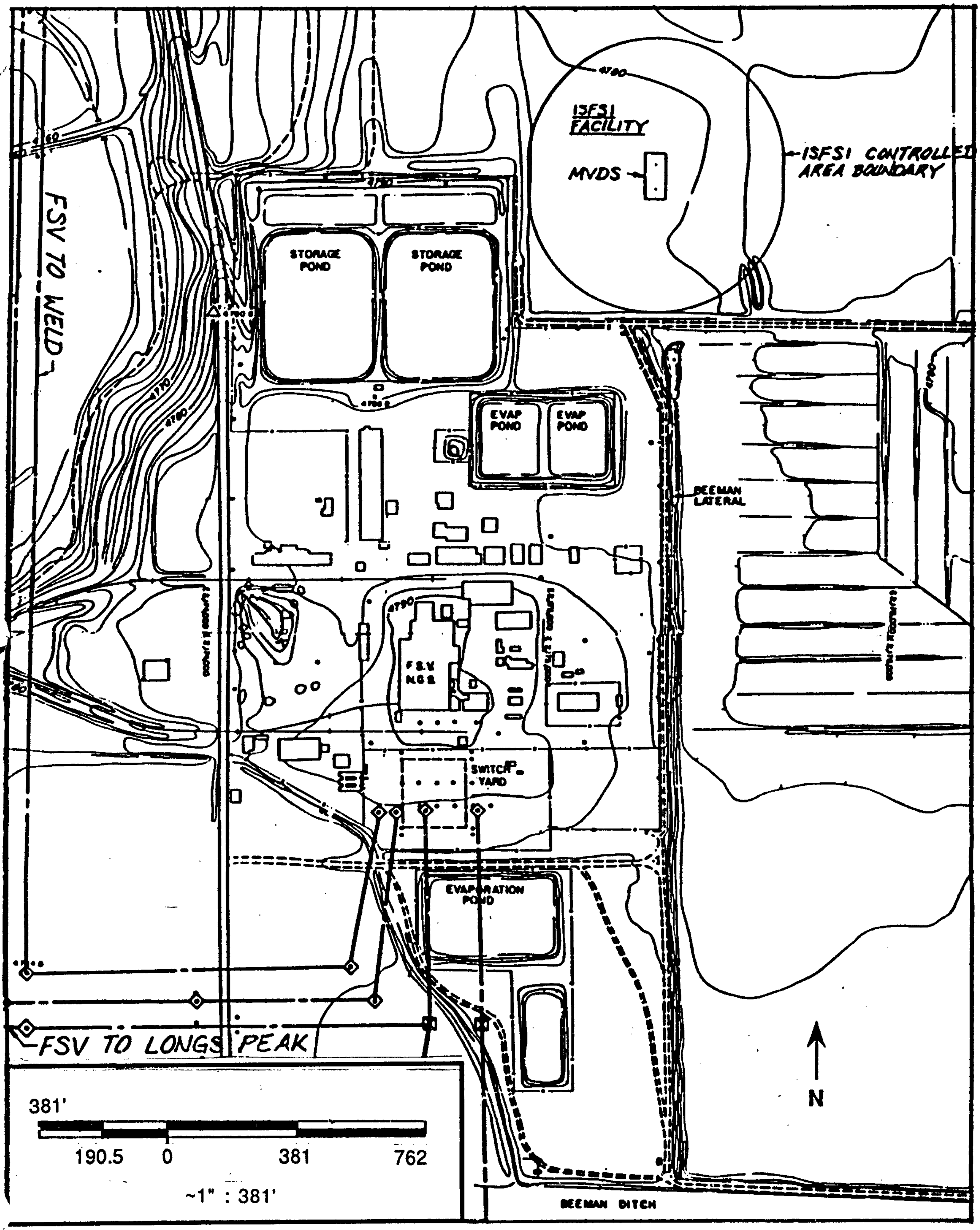


Figure 1.1. Fort St. Vrain Site Arrangement

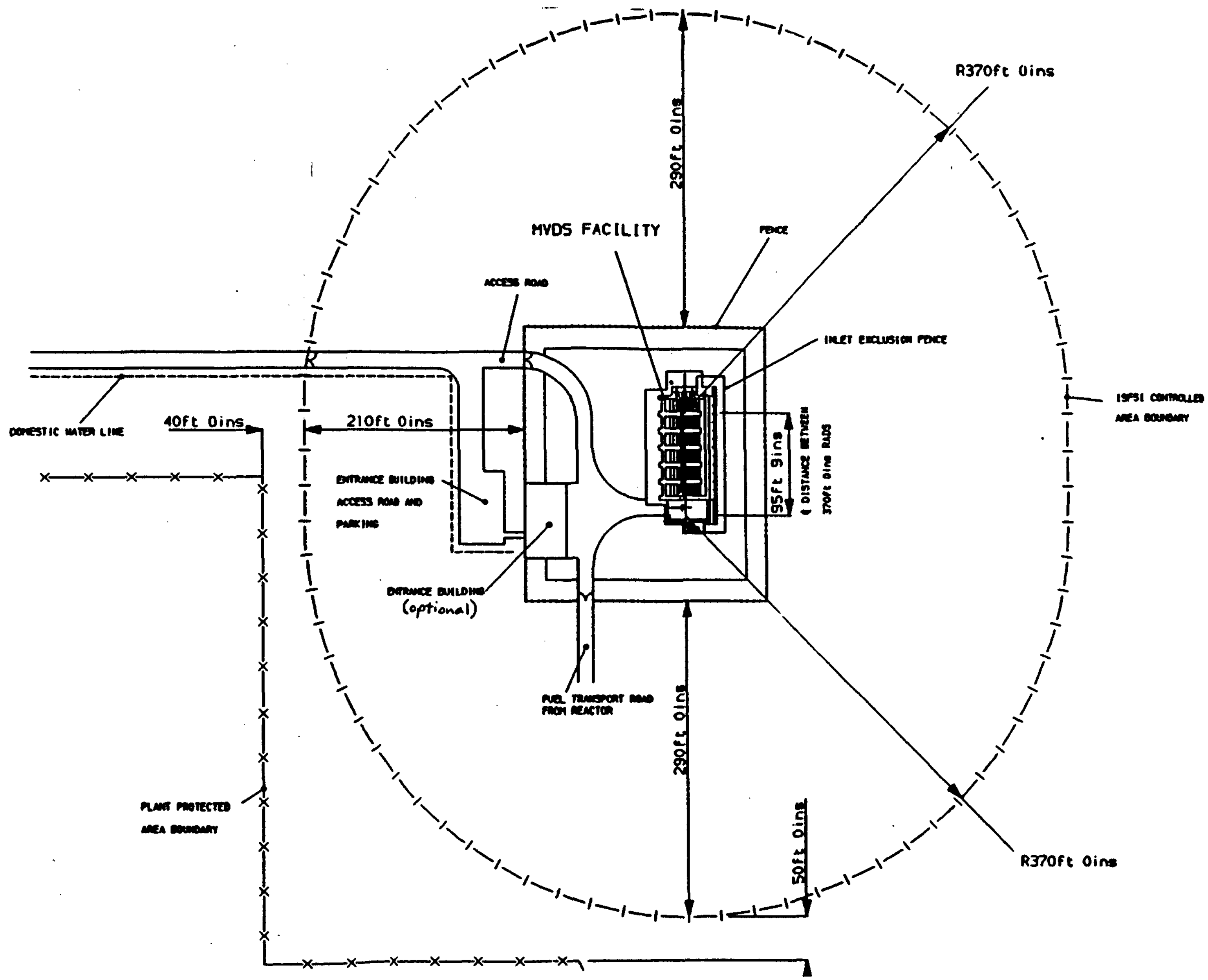


Figure 1.2. ISFSI Plot Plan

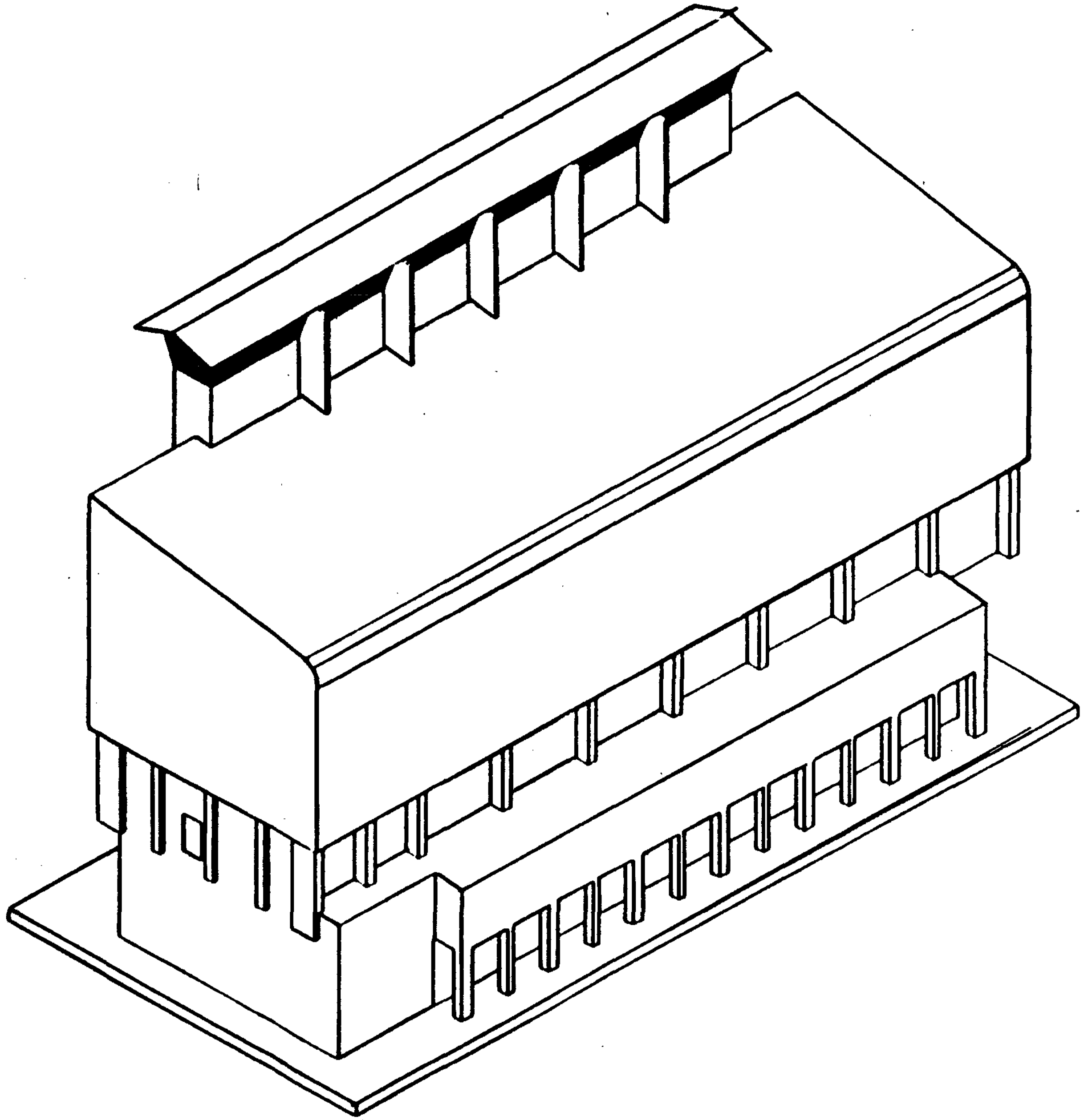


Figure 5.1. Fort St. Vrain ISFSI Modular Vault Dry Storage Facility

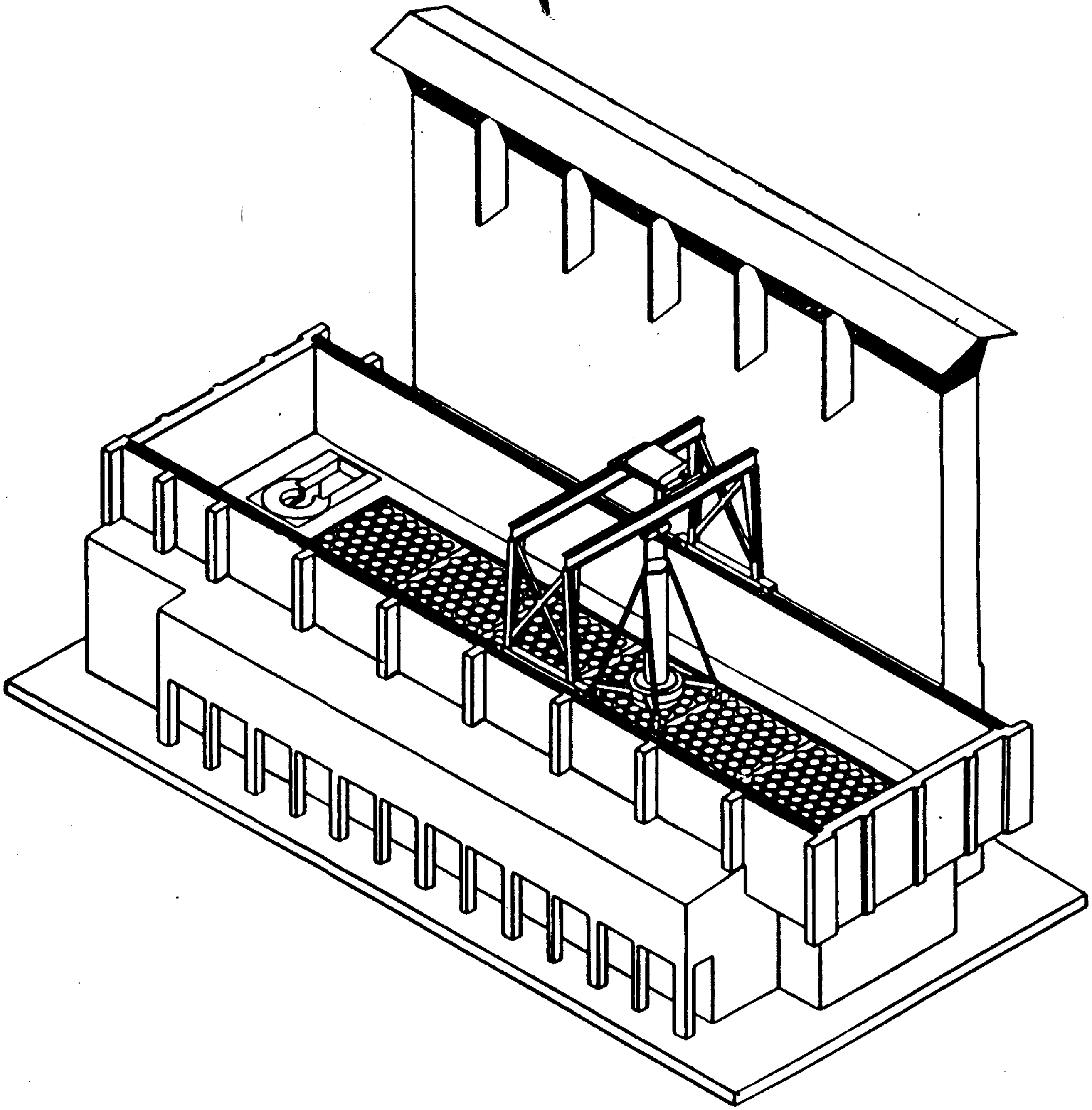
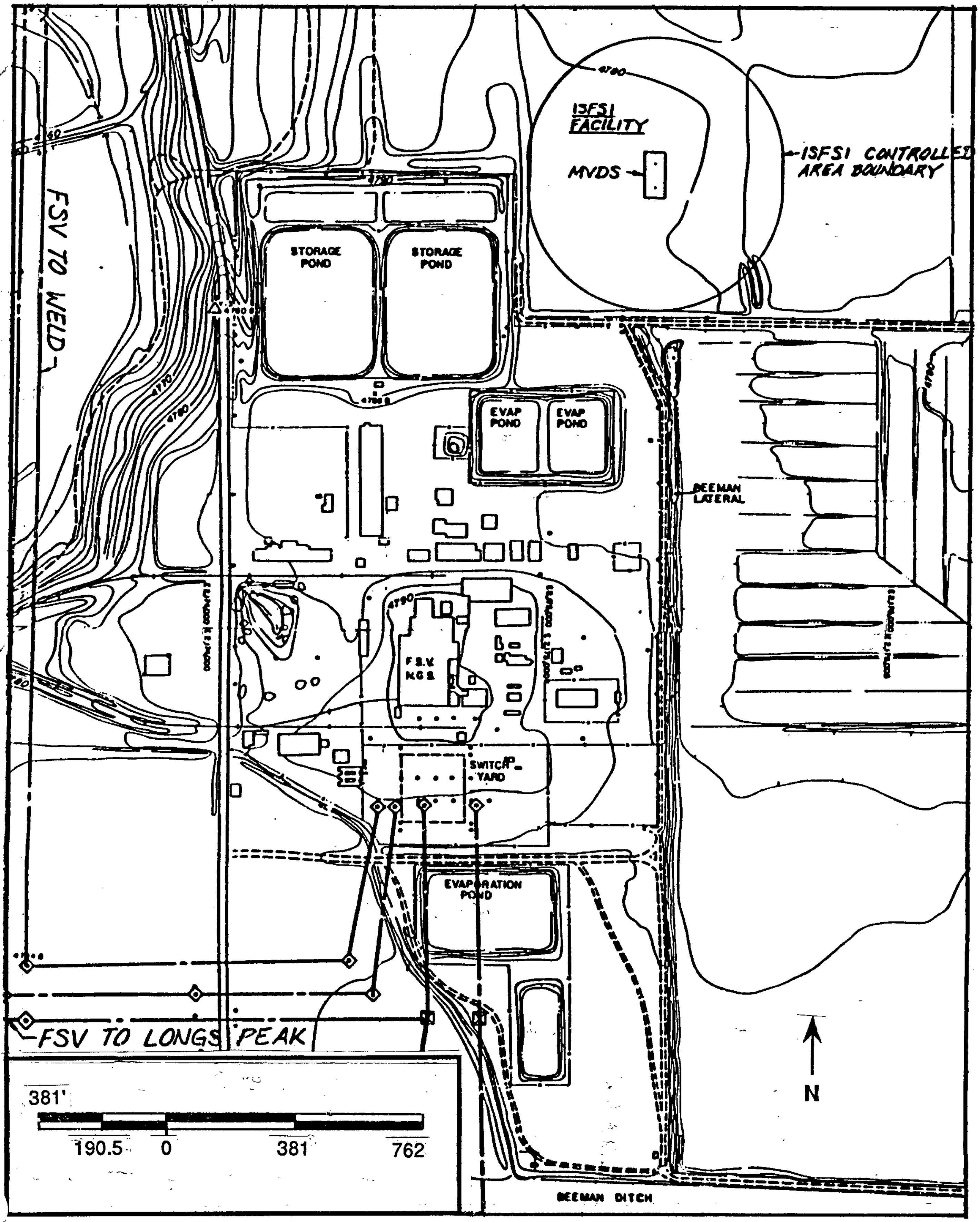


Figure 5.2. Fort St. Vrain ISFSI Modular Vault Dry Storage Facility - Section View



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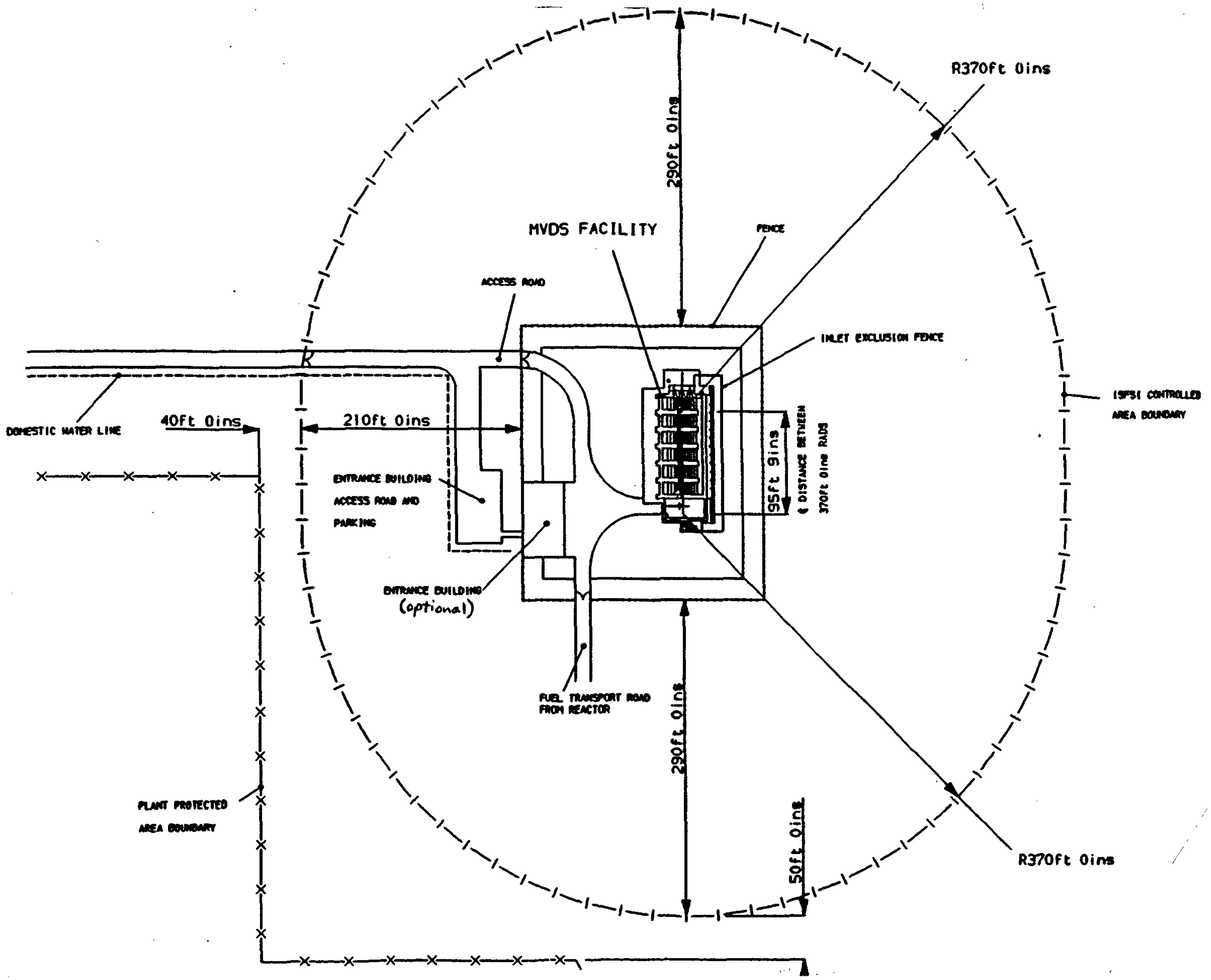

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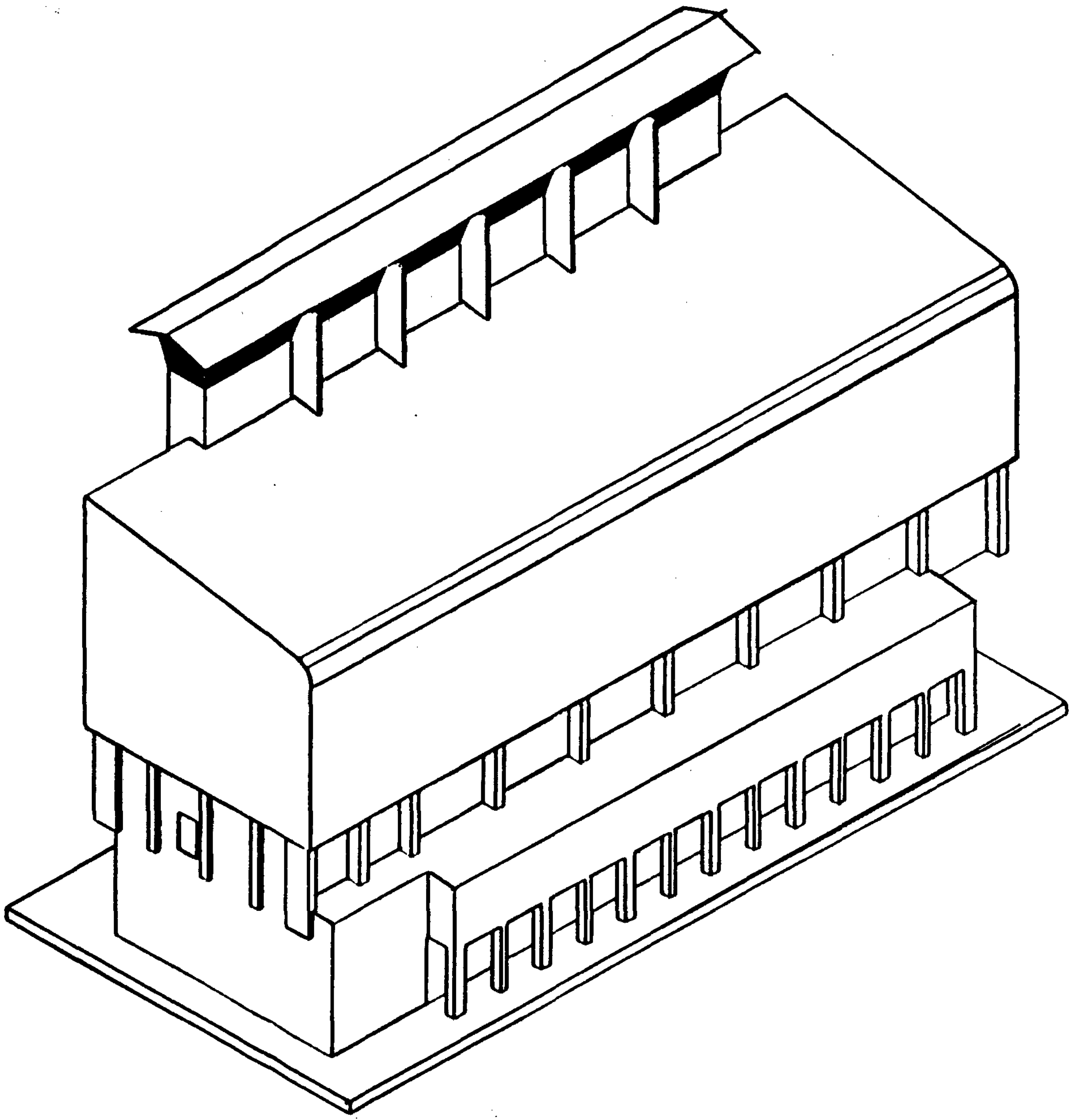

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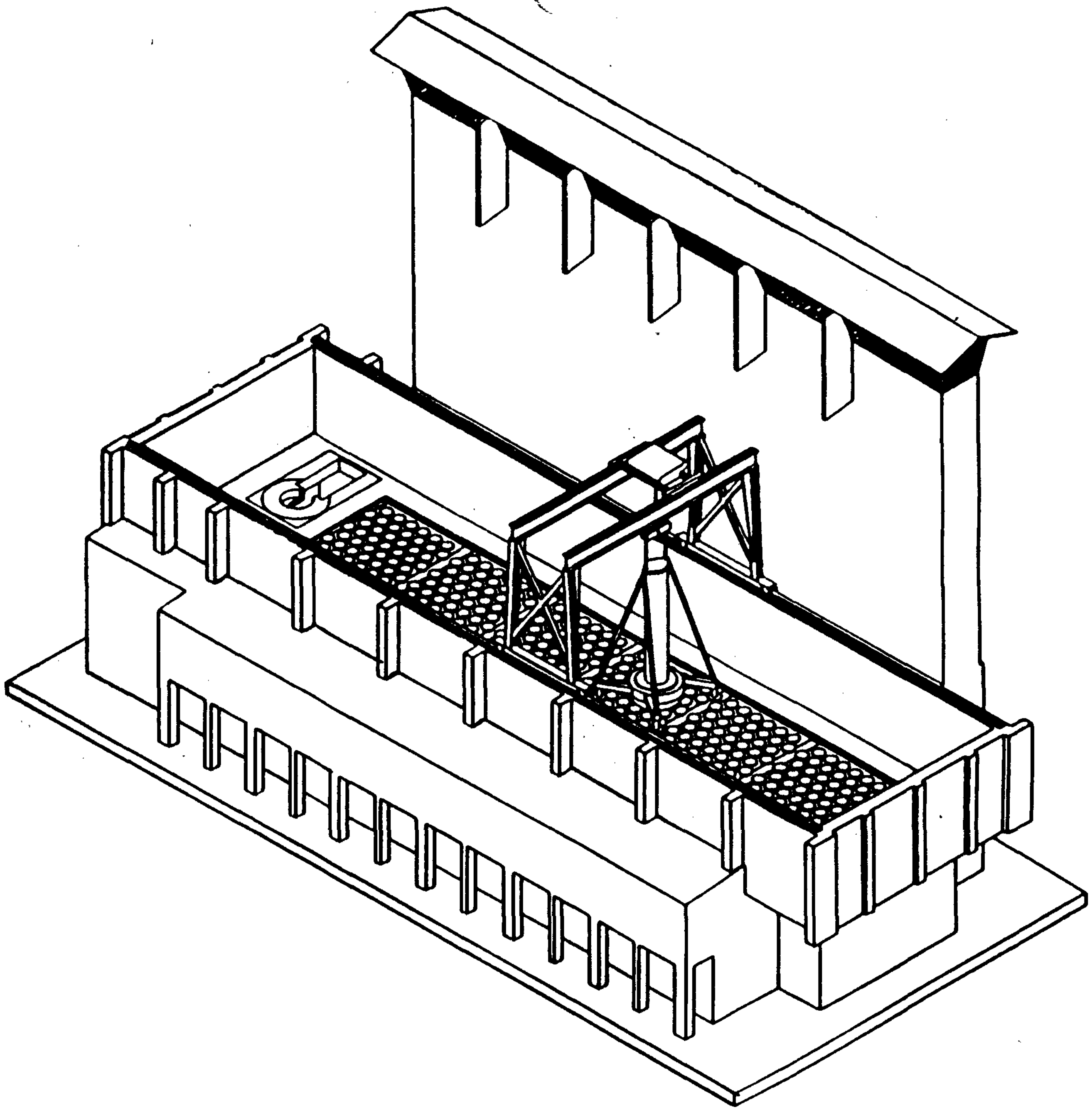

Figure 5.2. Fort St. Vrain ISFSI Modular Vault Dry Storage Facility - Section View