TENNESSEE VALLEY AUTHORITY
APPLICATION FOR SPECIAL NUCLEAR MATERIALS LICENSE
FOR
RECEIPT AND POSSESSION OF UNIT 1 FUEL ASSEMBLIES
BELLEFONTE NUCLEAR PLANT

1.0 General Information

The Tennessee Valley Authority (TVA) hereby applies for a special nuclear materials license to provide for receipt, possession, inspections, storage, and packaging for delivery to a carrier of fully assembled fuel assemblies and up to 100 loose fuel rods for the initial core of the Bellefonte unit 1 reactor. This license is to extend until September 1982, or until the receipt of an operating license for Unit 1.

Corporate Organization

The Tennessee Valley Authority is a corporate agency of the Federal Government created by the Tennessee Valley Authority Act of 1933 [48 Stat. 58, as amended, 16 U.S.C. §§ 831-831dd (1970; Supp. V, 1975)].

TVA's activities are conducted primarily in parts of Tennessee, Kentucky, Alabama, Mississippi, North Carolina, Georgia, and Virginia. The offices of the TVA Board of Directors and General Manager are at Knoxville, Tennessee. All of the directors and principal officers are United States citizens.

The names and address of the directors and principals officers are as follows:

Directors	Home Address	Office Address
S. David Freeman (Chairman)	1431 Cherokee Trail Unit 122 Knoxville, TN 37919	400 Commerce Avenue, E12A7 Knoxville, TN 37902
Robert N. Clement (Director)	4420 East Brookfield Nashville, TN 37205	400 Commerce Avenue, E12A9 Knoxville, TN 37902
Richard Freeman (Director)	1539 G Coleman Road Knoxville, TN 37857	400 Commerce Avenue, E12A11 Knoxville, TN 37902
Officers	**Home Address**	**Office Address**
William F. Willis (General Manager)	8125 Hayden Drive Knoxville, TN 37919	400 Commerce Avenue, E12B16 Knoxville, TN 37902

8003050307

Thomas H. Ripley (Manager of Natural Resources)	7134 Cheshire Drive Knoxville, TN 37919	Office of Natural Resources Tennessee Valley Authority Forestry Building Norris, TN 37828
Sharlene P. Hirsch (Manager of Community Development)	2911 Fairmont Blvd. Knoxville, TN 37919	200 Liberty Building Knoxville, TN
Charles Bonine, Jr. (Manager of Management Services	1101 Heritage Drive Maryville, TN 37801	400 Commerce Avenue Knoxville, TN 37902
Herbert S. Sanger, Jr. (General Counsel)	5100 Malibu Drive Knoxville, TN 37918	400 Commerce Avenue, E11B33 Knoxville, TN 37902
Lewis B. Nelson (Manager of Agricultural and Chemical Development)	1918 Courtney Avenue Florence, AL 35630	A214 National Fertilizer Development Center Muscle Shoals, AL 35660
George H. Kimmons (Manager of Engineering Design and Construction)	Williams Road, Route 3 Concord, TN 37720	400 Commerce Avenue, W12A9 Knoxville, TN 37902
Hugh G. Parris (Manager of Power)	9211 Pleasant Lane Ooltewah, TN 37363	500C Chestnut Street Tower II Chattanooga, TN 37401

The applicant is not owned, controlled, or dominated by an alien, a foreign corporation, or a foreign government.

Agency

The applicant is not acting as agent or representative of another person in filing this application.

1.1 Reactor and Fuel

1.1.1 The Reactor

The Bellefonte Nuclear Plant is located on a site of approximately 1500 acres in Jackson County, Alabama on a peninsula extending along the west of the Guntersville reservoir at Tennessee River Mile 391.5.

The site is approximately 6 miles northeast of Scottsboro, Alabama, and approximately 38 miles east of Huntsville, Alabama.

Bellefonte is presently under construction as authorized by Construction Permits CPPR-122 and CPPR-123, Dockets Nos. 50-438 and 50-439 issued by the Atomic Energy Commission on December 24, 1974. On April 1, 1976, the NRC assigned reporting identification symbol XLE to Bellefonte unit 1.

1.1.2 Fuel Assemblies

Fuel-handling operations and fuel inspection will be performed by TVA, Division of Nuclear Power personnel. The technical qualification of TVA personnel are given in Section 13.1 and 13.2 of the Bellefonte FSAR. Detailed administrative control and fuel-handling instructions will be issued by the plant superintendent to assure all conditions of the license issued pursuant to this application are fulfilled.

Fuel assemblies are designed to accommodate expected loads during handling, assembly inspection, fueling operations, and shipping loads.

The initial core consists of 205 fuel assemblies. Each fuel assembly consists of 264 pressurized fuel rods, 24 control rod guide tubes, one instrumentation tube, 8 spacer grids and 2 end fittings. The guide tubes, spacer grids and end fittings form a structural cage to arrange the rods and tubes in a 17 x 17 array. The center position in the assembly is reserved for the instrumentation tube. Depending upon the position of the assembly in the core, the guide tubes are used as core locations for rod cluster control assemblies, neutron source assemblies, and burnable poison rods. Otherwise, the guide tubes are fitted with plugging devices (orifice rods) to limit bypass flow. The guide tubes, instrument tubes, and spacer sleeves are made of Zircaloy-4. The end fittings are stainless steel castings. The spacer grid strips are Inconel-718. The length of a fuel assembly is approximately 166 inches. The guide tubes are rigidly attached to the upper and lower end fittings. To accommodate differential growth of the fuel rods, clearance has been allowed between the fuel rod and the fuel assembly end fittings. The use of similar material in the guide tubes and fuel rods results in minimum differential thermal expansion.

The fuel rods for the Bellefonte unit 1 reactor consist of uranium dioxide (UO_2) ceramic pellets contained in slightly cold worked Zircaloy-4 cladding tubing which is plugged and seal welded at the ends to encapsulate the fuel. The fuel pellets are right circular cylinders consisting of slightly enriched UO_2 powder which has been compacted by cold pressing and then sintered to a nominal theoretical density of 95 percent and dimensions of approximately one-third inch in diameter and one-half inch in length. The ends of each pellet are dished slightly to allow greater axial expansion at the center of the pellets.

1.1.3 Uranium Enrichment

The fuel assemblies are grouped into three batches, each batch having a different nominal enrichment: Batch 1 contains a nominal 2.49 wt. percent U-235, Batch 2 contains a nominal 2.88 wt. percent U-235, Batch 3 contains a nominal 3.45 wt. percent U-235. The average core enrichment is approximately 2.94 wt. percent U-235. A nominal enrichment is the design enrichment plus or minus a manufacturing tolerance. The maximum enrichment under this license will be 3.50 percent U-235. Each fuel assembly will contain approximately 472 Kg of uranium.

1.1.4 Number of Fuel Assemblies and Weight of U-235

The maximum quantity of special nuclear material for Bellefonte unit 1 including the initial core of 205 fuel assemblies, 100 loose fuel rods and allowance for extra material onsite will be 3000 Kg of U-235.

A more detailed description of the fuel assemblies to be stored is set forth in Section 4.5 of the Bellefonte FSAR.

1.2 Storage Condition

1.2.1 Storage Area

The fuel storage and handling area are located in the Auxiliary Building. All handling and storage will be within this defined area. The fuel will be inspected and then stored in the new fuel storage vault. Detailed elevation and plan views of the Auxiliary Building showing the fuel-handling areas are shown in Bellefonte FSAR Figures 9.1.1-1 through 9.1.1-7.

There is storage space for 144 fuel assemblies in the new fuel storage vault. New fuel shall be stored dry, but in an array such that K_{eff} will be less than 0.95 even if flooded with unborated water or less than 0.98 if optimally moderated. The new fuel storage facility is designed to withstand loads imposed by the dead load of the fuel assemblies impact, handling, Safe Shutdown Earthquake (SSE), and the Operating Basis Earthquake (OBE).

* The racks are constructed so that it is impossible to insert fuel assemblies except in prescribed locations which have a minimum center-to-center spacing of 21 inches in both directions. The new fuel storage racks are bolted to anchors in the floor of the new fuel vault with shims between racks and wall supports which compensate for manufacturing and installation tolerances plus provide clearances for thermal expansion over the design range temperatures for the facility. The racks have been designed to withstand the dead loads of the fuel assemblies and the SSE, in accordance with NRC Design Criteria 61 and 62.

The storage vault is normally covered by a series of hatches which protects the racks from damage due to falling objects. The layout of the racks in the new fuel vault is shown in Bellefonte FSAR Figure 9.1.1-3, Detail B7. A sketch of the new fuel racks is shown in Bellefonte FSAR Figure 9.1.1-8. The hatch covers, locking bar, and the tamper-proof locks are shown in Figures 1, 2, and 3, respectively.

1.2.2 Storage Area Activities

When the fuel arrives onsite, the shipping containers will be unloaded and placed on the fuel handling floor. During receipt and inspection of the shipping containers, activities will be restricted in the fuel handling area. Activities in other areas of the building will not be restricted, except for those posing a cleanliness problem to the fuel, during this period. Such activities include construction and testing work associated with the completion of the plant. This work will have no effect on the safety of unloading or temporary storage of the fuel assemblies because of the barriers provided by doors, walls, and hatch covers.

The shipping containers will be opened on the fuel handling floor. The fuel will be removed one assembly at a time, inspected and then stored in the new fuel storage vault. New fuel may be removed, at some later time, for installing control components or reinspection in accordance with approved plant procedures. If a fuel assembly fails inspection, it will be repaired onsite, if possible, and reinspected. If the assembly is not repairable onsite, it will be placed back in the shipping container for subsequent shipment back to B & W.

When fuel-handling operations or required maintenance are not being performed and fuel is stored in the storage racks, metal covers will be placed over the new fuel storage vault. During this time, there will be no restriction on activities in the fuel-handling area with the exception that the Auxiliary Building crane will not be permitted to carry loads over the stored fuel. Remaining construction and testing work will not affect the safety of storage because of the protection afforded by the covers over the new fuel vault.

1.2.3 Fuel-Handling Equipment

All fuel handling will be performed with cranes and hoists located in the Auxiliary Building. These will include the Auxiliary Building crane and/or the 6-ton overhead crane in the railroad hatch area. The new fuel assemblies and their inserts are handled with handling fixtures designed specifically for this purpose and with a special sling suspended from the auxiliary building cranes. All handling devices have provisions to avoid dropping or jamming of fuel assemblies during fuel movement. The auxiliary building crane and the associated handling devices are capable of supporting maximum loads under safe shutdown earthquake conditions.

Prior to receipt of unirradiated fuel, construction and/or preoperational testing will be completed for necessary fuel handling equipment. In addition, all equipment will be inspected and tested for safe operation before use in fuel-handling activities.

All fuel handling will be in accordance with detailed approved fuel-handling instructions.

and contamination. Smears shall be checked locally for alpha and beta-gamma radiation.

All significant contamination shall be reported with recommendations for handling the contaminated item. The railroad hatch area will be zoned with radioactive material and regulated area signs.

When the fuel arrives at the site, dose rates at contact and six feet from the truck will be taken. Contact dose rates, dose rate at three feet, and smears will be taken on the external surfaces of the metal shipping containers. After the metal containers are opened, smears will be taken of the fuel assembly covering, several pieces of packing material, and the inside of the container. The dose rate of each fuel assembly will be obtained, and the fuel assembly will be smeared when the polyethylene covering has been removed for inspection. When all fuel containers are removed from the truck, radiation and smear surveys will be taken on the truck before allowing it to leave.

A temporary monitoring station will be installed where personnel exiting from the fuel storage area will be checked for radioactive contamination. Periodic surveys will be performed within the storage areas in accordance with plant instructions.

Upon detection of significant contamination, the area will be posted with contamination area signs. A special work permit will be required to enter the area. The special work permit will describe the protective clothing, dosimetry, and methods to be followed to prevent unnecessary exposure to personnel and to prevent spreading of the contamination. The contaminated area shall be cleaned and items in the area cleaned or bagged for waste disposal before the signs and ropes are removed.

All portable radiation survey instrumentation will be calibrated at least quarterly using standardized sources which are traceable to the National Bureau of Standards. All laboratory radiation instrumentation will be calibrated using the standardized sources and voltage plateau curves run at least once per month.

2.2 Nuclear Criticality Safety

After temporary storage on the fuel handling floor, the metal shipping containers will be opened. Only one container with fuel will be opened at any one time. The fuel assemblies will be removed, one assembly at a time, and inspected. After successful inspection, the fuel will be moved to the storage racks. The fuel may be removed from the storage racks for reinspection or installation of control components.

The new fuel storage racks are installed to provide a nominal center-to-center spacing of fuel assemblies of 21 inches. The fuel racks, including supports, are made of austenitic stainless steel and are constructed so that it is impossible to insert fuel assemblies except in prescribed locations.

The physical integrity of the storage racks has been analyzed for all anticipated conditions, including seismic loading. The storage racks for the new fuel storage vault are described in more detail in the FSAR, Section 9.1. Nuclear safety analyses, including optimum moderation consideration, are included in the same section as well as Subsection 4.3.2.6.

The presence of low-density water was considered in the safety analysis. Moderation control is not necessary for nuclear safety of new fuel stored in the new fuel storage vault. New fuel in the new fuel storage vault shall be stored dry, but in an array such that K_{eff} will be less than 0.95 even if flooded with unborated water or less than 0.98 if optimally moderated. The fuel array in the fully-loaded new fuel vault racks is mainatined such that $K_{eff} \leq .95$ assuming the array is fully flooded with nonborated water, the fuel is new with an enrichment of 3.5 weight percent U-235 or less, and the geometric array is the worst possible considering mechanical tolerances and abnormal conditons. The plastic covering will be opened at the bottom of each fuel assembly so that water will not be retained should flooding and then draining of the fuel storage area occur.

Although moderation control is not necessary, some of our normal operating practices will result in such control. For instance, when fuel handling operations are not being performed and fuel is stored in the racks, metal covers will be placed over the new storage racks, metal covers will be placed over the new fuel storage vault. Although this is primarily for the control of dust and foreign objects, it will also prevent the entry of aqueous foam or mist. No credit was taken for this in the criticality calculations.

The fuel assemblies are assumed to be in their most reactive condition, namely fresh or undepleted and with no control rods or removable neutron absorbers present. Assemblies cannot be closer together than the design separation provided by the storage facility except in special cases such as in fuel shipping containers where analyses are carried out to establish the acceptability of the design. The mechanical integrity of the fuel assembly is assumed. Criticality considerations of fuel assemblies are described in more detail in Bellefonte FSAR, Subsection 4.3.2.6.

Having a maximum of one fuel assembly and 30 loose fuel rods out of storage locations in the criticality safe metal shipping containers, the new fuel vault storage racks, at any one time, precludes the possibility of accidental criticality during receipt, inspection, and handling activities. Accordingly, the monitoring and emergency procedures described in 10 CFR 70.24 are unnecessary and an exemption from the requirements of 10 CFR 70.24 is requested.

2.3 Accident Analysis

Electrical interlocks and/or administrative limits are provided on the auxiliary building crane which prevent movement of heavy loads over the new fuel storage vault. All operations which must be carried out with the crane can be performed without violating these limits. All fuel-handling operations are conducted in accordance with approved detailed instructions, under the direct surveillance of a supervisor. However, an analysis of a fuel-handling accident is given in the Bellefonte FSAR, Subsection 15.4.5.

3.0 Other Materials Requiring NRC License

This application requests no other authorization for special nuclear material or byproduct material requiring an NRC license.

NEW FUEL STORAGE VAULT HATCH COVER

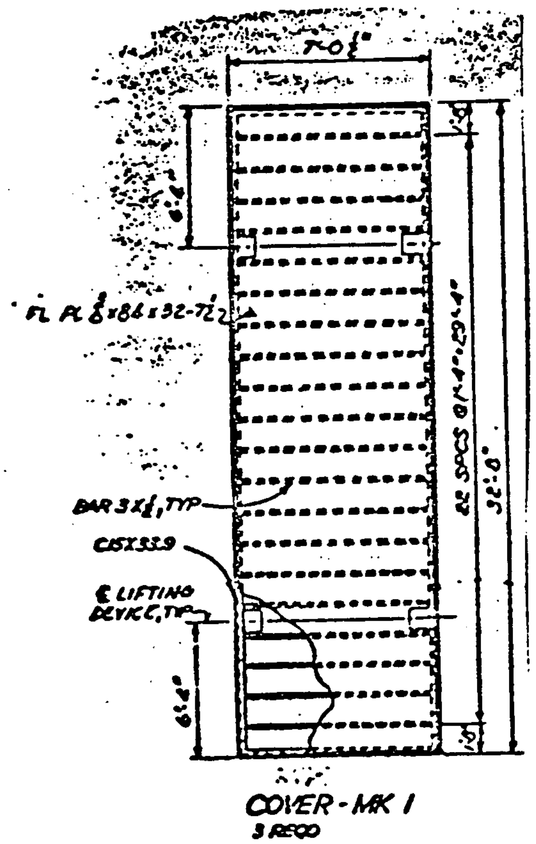
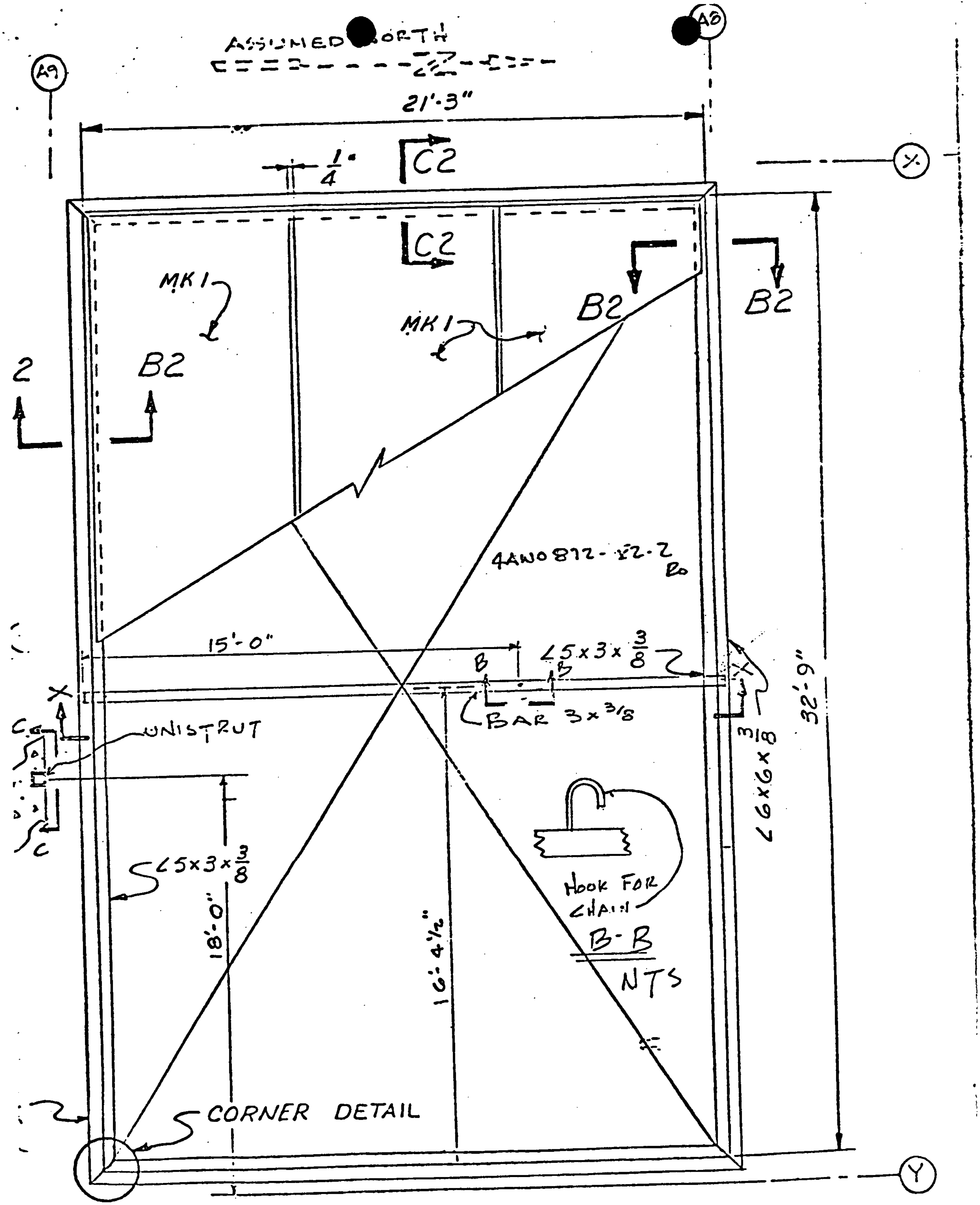


FIGURE 1



LOCKING BAR FRAME DETAIL

Figure 2

NEW FUEL STORAGE VAULT TAMPER PROOF LOCKS

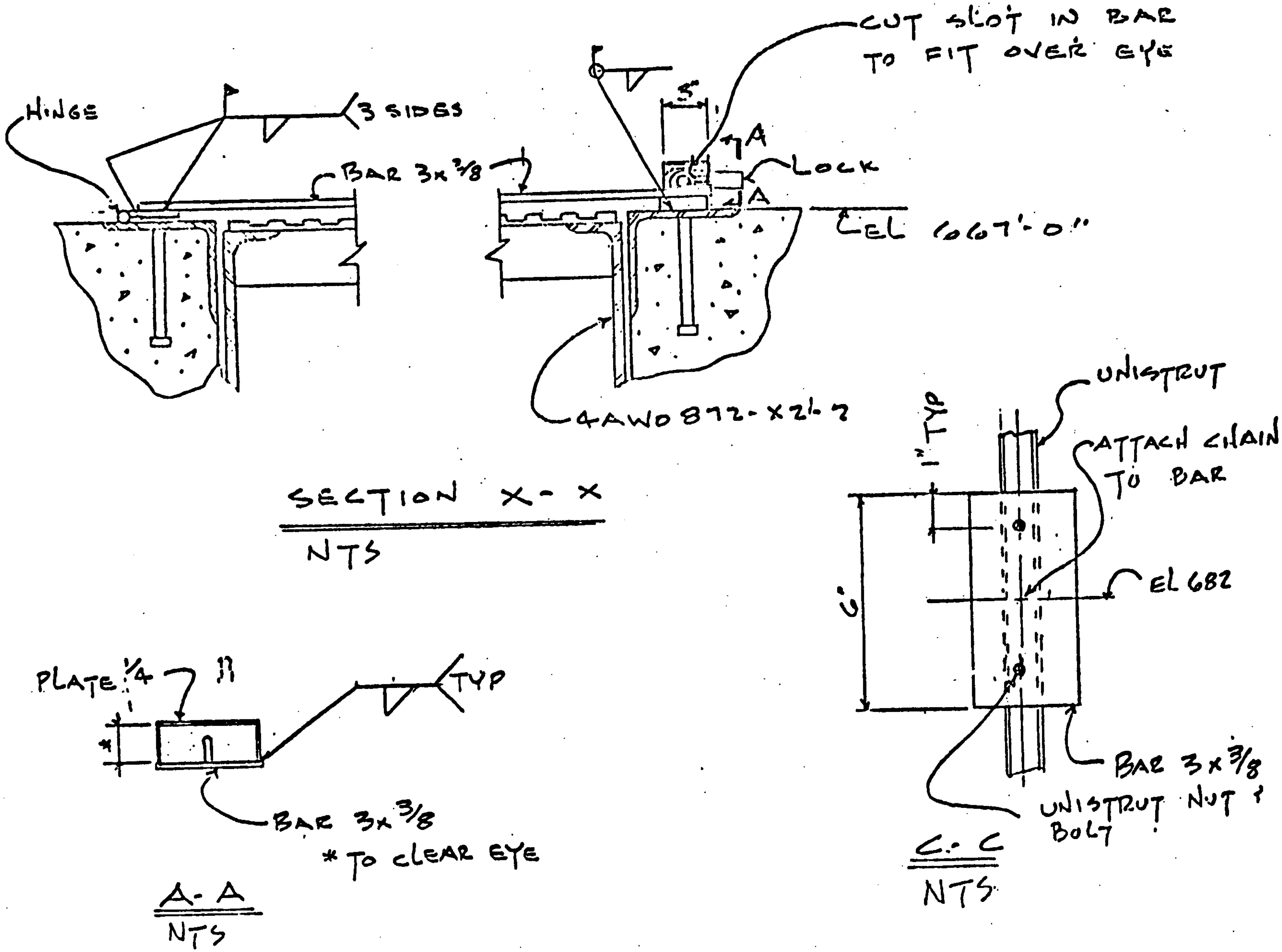


FIGURE 3

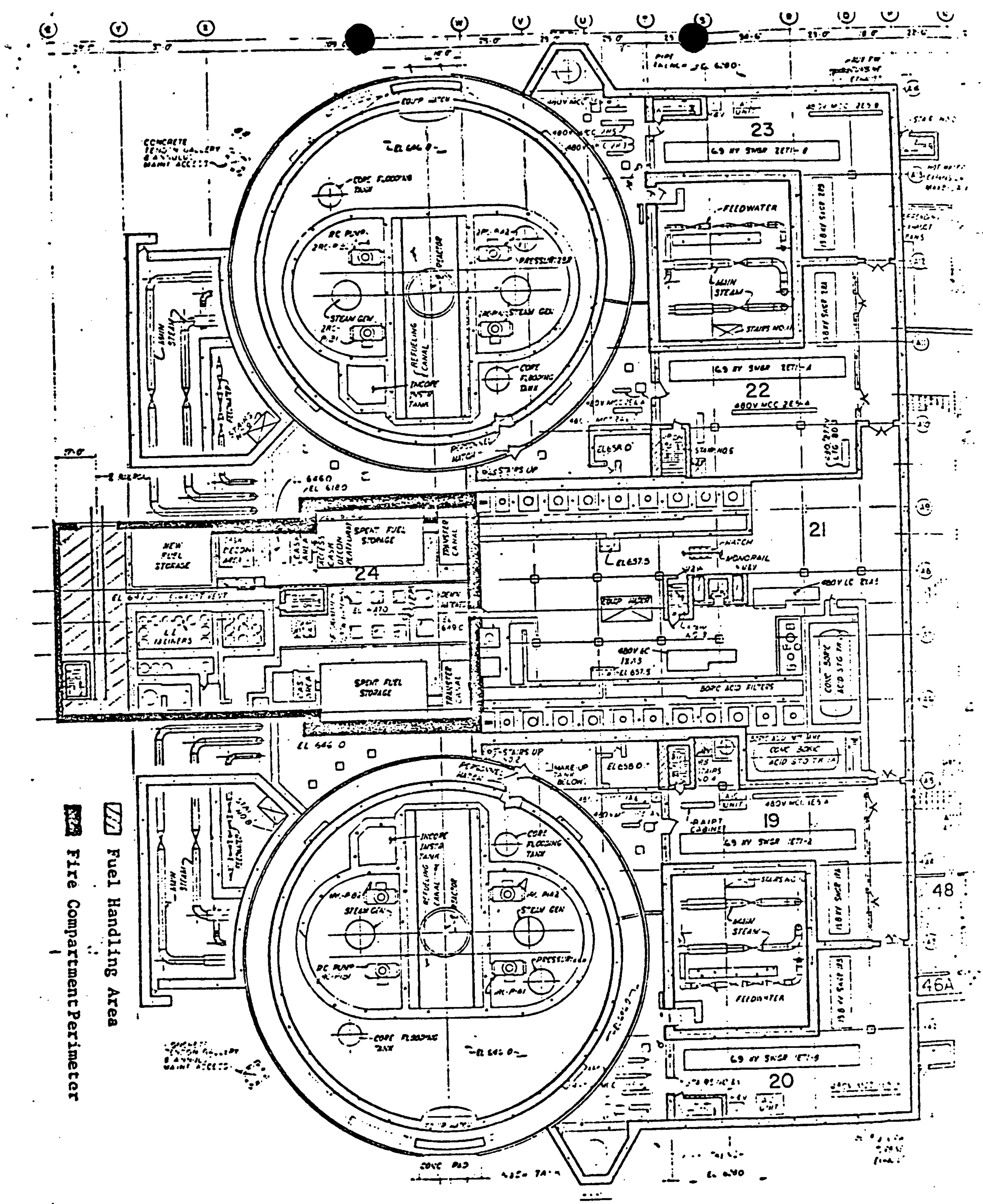
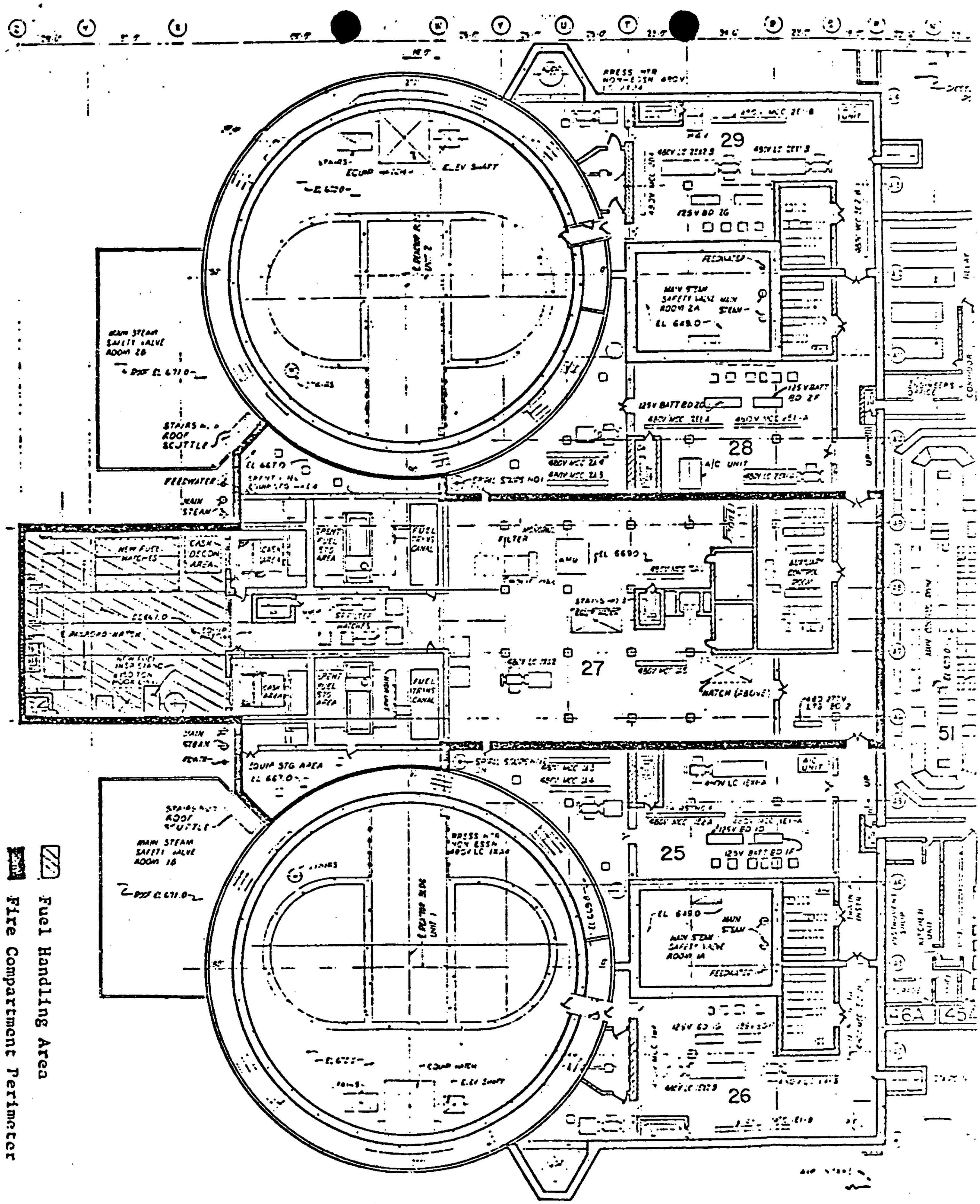

23
22
21
24
19
20
48
46A
SPENT FUEL STORAGE
NEW FUEL STORAGE
TRANSFER CANAL
REFUELING CANAL
REACTOR
STEAM GEN
FEEDWATER
MAIN STEAM
BORIC ACID FILTERS
Fuel Handling Area
Fire Compartment Perimeter

FIGURE 4


29
28
27
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26
51
MAIN STEAM SAFETY VALVE ROOM 2B
MAIN STEAM SAFETY VALVE ROOM 1B
MAIN STEAM SAFETY VALVE ROOM 2A
MAIN STEAM SAFETY VALVE ROOM 1A
FEEDWATER
MAIN STEAM
SPENT FUEL STG AREA
FUEL TRANS CANAL
NEW FUEL HATCHES
CASK DECON AREA
CASK AREA
FILTER
HATCH (ABOVE)
A/C UNIT
Fuel Handling Area
Fire Compartment Perimeter

FIGURE 5