appl #23

FEB 6 1956

2654

Copy in Docket file

SINCLAIR RESEARCH LABORATORIES, INC.

EXECUTIVE OFFICES
600 FIFTH AVENUE
NEW YORK 20, N.Y.

APPLICATION NO. 23

February 3, 1956

Mr. H. L. Price, Director (3)
Division of Civilian Applications
U. S. Atomic Energy Commission
1901 Constitution Avenue
Washington 25, D. C.

Subject: Application for special nuclear material license

Dear Sir:

Attached, in triplicate, is an application for a license to receive, possess, use, and transfer special nuclear material. In this license request we desire authority to procure spent MTR fuel elements for use in petroleum research at our laboratories in Harvey, Illinois.

On August 31, 1955 I wrote to you asking for permission to use these MTR fuel elements for this purpose. Your reply, dated October 20, 1955, stated it was possible to make these elements available after approximately 100 days of cooling.

You will note that in making the attached license application we have indicated a first preference for more radioactive fuel elements, and have requested fuel elements which have operated at 30 megawatts power for 20 days and then have subsequently been cooled for 30 days. If this first preference cannot be granted, we then wish to use the fuel elements originally discussed in my letter and in conversations with Mr. Manly.

The information given in the attached application is based on detailed design work carried on by Sinclair Research and by The Austin Company. This design work is not yet completed and such details as the exact thickness of shielding may be modified at a later date after consultation with the AEC. In making this application, we have assumed that details concerning the mode of delivery of the fuel elements to our Harvey Laboratories can be decided at a later date. This will be dependent upon the AEC's decision as to whether or not we can obtain the fuel elements directly from the reactor or from Argonne, and a review of the possibility of making satisfactory arrangements to share shipping costs of containers with the AEC if we use the containers now owned by the Government.

If further details are needed on the engineering design of our proposed radiation laboratory they can be obtained from Mr. A. H. Eron, Sinclair Research Laboratories, Inc., Harvey, Illinois.

D/3

We would appreciate an opportunity at your earliest convenience to discuss pricing of these elements since we will need this information in preparing our budget for this new activity.

Very truly yours,

W. M. Flowers

W. M. Flowers
President

FRF md
Attachment

FEB 6 1956

SINCLAIR RESEARCH LABORATORIES, INC.

EXECUTIVE OFFICES
600 FIFTH AVENUE
NEW YORK 20, N.Y.

February 3, 1956

Division of Civilian Applications
U. S. Atomic Energy Commission
Washington 25, D. C.

Gentlemen:

Sinclair Research Laboratories, Inc. hereby applies for a license to receive, possess, use, and transfer special nuclear materials.

The attached pages provide information covering this license application in accordance with the Atomic Energy Commission Regulations 10 CFR Part 70.

Yours very truly,

SINCLAIR RESEARCH LABORATORIES, INC.

W. M. Flowers

By

W. M. Flowers
President

FEB 6 1956

Harvey, Illinois
January 31, 1956

ATOMIC ENERGY COMMISSION
(10 CFR PART 70)
SPECIAL NUCLEAR MATERIAL

SECTION 70.22 CONTENTS OF APPLICATIONS

(1) Information regarding applicant

Sinclair Research Laboratories, Inc., a corporation organized and existing under the laws of the State of Delaware, has executive offices at 600 Fifth Avenue, New York 20, New York and general offices at 400 East Sibley Boulevard, Harvey, Illinois.

The officers are elected annually by the Board of Directors of the corporation, and at this time are as follows:

E46

Name	Title	Home Address	Business Address	Citizenship
Vacant	Chairman of Board	--	--	--
W.M. Flowers	President	[redacted]	600 Fifth Ave. New York 20, N.Y.	U.S.A.
H.L. Pelzer	Vice President		801 North Gillette Tulsa, Oklahoma	U.S.A.
E.J. Martin	Vice President		400 East Sibley Blvd. Harvey, Illinois	U.S.A.
M.J. Frazier	Treasurer		400 East Sibley Blvd. Harvey, Illinois	U.S.A.
F.R. Fisher	Secretary		600 Fifth Ave. New York 20, N.Y.	U.S.A.
E.Moran Rowe	Asst.Secretary		801 North Gillette Tulsa, Oklahoma	U.S.A.
J.Von Bevern	Asst.Secretary		600 Fifth Ave. New York 20, N.Y.	U.S.A.
J.E. Black	Asst.Secretary		400 East Sibley Blvd. Harvey, Illinois	U.S.A.

Sinclair Research Laboratories, Inc., is a wholly owned subsidiary of Sinclair Oil Corporation, a domestic corporation, located at 600 Fifth Avenue, New York 20, N.Y. Sinclair Research Laboratories, Inc., carries on research activities for the benefit of the Parent Corporation and its subsidiaries. The capital stock of Sinclair Oil Corporation is so widely held that control by an individual, alien, foreign corporation, or foreign government does not exist at this time.

2. Activity for which Special Nuclear Material is required

Investigation of the effect of gamma rays on large scale petroleum processes such as cracking, hydrocracking, isomerization, hydrogenation, dehydrogenation, dehydrocyclization in the presence and absence of catalysts. Also, investigations will be made of the effect of gamma rays on such processes as polymerization, oxidation and alkylation. Investigation of effect of gamma rays on petroleum products such as greases, lubricating oils, and waxes will be made.

The experiments are to be performed in a new specially designed laboratory building on the premises of Sinclair Research Laboratories, Inc., 400 East Sibley Boulevard, Harvey, Illinois.

Investigation of the effect of gamma rays on the processes described is to be undertaken by obtaining data in a high pressure flow reactor system surrounded by four used MTR fuel elements. Comparisons of data obtained under the same process conditions with and without gamma radiation will be made. Sketches and a description of the proposed experimental arrangement are attached.

3. Period of time for which license is requested

Five (5) years.

4. Financial qualifications of applicant

Sinclair Research Laboratories, Inc., is controlled and supported financially by Sinclair Oil Corporation. Inquiries regarding financial qualifications should be directed to Mr. W.F. Dall, Vice President and Treasurer of Sinclair Oil Corporation, 600 Fifth Avenue, New York 20, New York.

5. Material desired

Application is made for obtaining used fuel elements from the Materials Testing Reactor at Arco, Idaho after operation at approximately 30 megawatts power for 20 days with a cooling time after removal from the reactor of approximately 30 days. Four fuel elements are desired. Time of use desired before replacement is 3 to 4 months.

An alternative which is being considered for initial experiments is use of four fuel elements cooled sufficiently long to give an initial dose of 400,000 - 600,000 roentgens per hour with replacement of these elements when the dose rate has declined to around 250,000 roentgens per hour. Such fuel elements might be obtained as discards from the Argonne National Laboratory. We would prefer, however, the elements described in the first paragraph of this section to obtain the advantages of the higher dose rate.

The physical form in which these elements desired is the same as those in current use at the Argonne National Laboratory with a length of the order of 26".

Estimated date on which first shipment is desired is January, 1957.

6. Material for operation of a Nuclear Reactor

These used fuel elements are not desired for use in a nuclear reactor.

7. Technical qualifications of the staff

There are 564 employees on the Harvey staff of Sinclair Research Laboratories, Inc., including 214 scientists and engineers. The largest proportion of our technical staff consists of Chemists and Chemical Engineers, although we have Physicists, Metallurgists, Mechanical Engineers and Electrical Engineers among our technical group. About 25% of our technical staff have advanced degrees in their specialties. Four of our employees who have had specialized training in the handling of nuclear materials are listed below:

Dr. LaVern H. Beckberger

Education: 1941 B.S. Chemical Engineering, Ohio State University
1943 M.S. Chemical Engineering, University of Wisconsin
1946 Ph.D. Chemical Engineering, University of Wisconsin

Sept. 1951-August 1952 - Oak Ridge School of Reactor Technology
A one-year course in Nuclear Reactor Design.

Experience: 1943-1946 - U.S. Rubber Reserve Co., University of Wisconsin
Research, development and pilot plant operation in the synthetic rubber field.

1946 to Present - Sinclair Research Laboratories, Inc.
Process development, process design, and engineering studies in the fields of petroleum processing and petrochemicals.

Mr. Alan H. Eron

Education: 1940 B.S. Mechanical Engineering, University of Wisconsin

April 25-29, 1955 - Oak Ridge Institute of Nuclear Studies
Lecture course in Industrial Uses of Sealed Radioactive Sources.

Experience: 1940 to Present - Sinclair Research Laboratories, Inc., and Sinclair Refining Co., Research and Development Department.

Director of Engineering Research
Supervises Mechanical, Metallurgical, Electrical, and Chemical Engineers in engineering research and development work including design of laboratory equipment, capital estimating, plant engineering and engineering research.

Dr. William P. Hettinger, Jr.

Education: 1947 B.S. Chemistry, Purdue University
1950 Ph.D. Physical Chemistry, Northwestern University
Jan.7-Feb. 1, 1952 - Oak Ridge Institute of Nuclear Studies
A four-week course in the techniques of using radioisotopes in research.

Experience: 1950 to Present - Sinclair Research Laboratories, Inc.
Research and development work in physical and organic chemistry, including work in the fields of catalytic cracking, catalytic reforming, hydrogenation, and the use of radioisotopes. Supervises a research group working on catalytic reactions.

Dr. Adolph I. Snow

Education: 1943 B.S. Chemistry, Brown University
1950 Ph.D. Physical Chemistry, Iowa State College

Experience: 1943-1950 - Ames Laboratory of the A.E.C., Ames, Iowa
Research in Physical Metallurgy and X-ray Diffraction Studies. Also worked with instruments measuring radiation.

1950-1952 - Institute for the Study of Metals, University of Chicago
Taught X-ray Diffraction Course in Physics Dept. Research on the theory of bonding of solids. Neutron Diffraction Studies at Argonne National Laboratories.

1952 to Present - Sinclair Research Laboratories, Inc.
Research and development in physical chemistry, including radiation chemistry, and technical advisor on use of radioactive isotopes.

8. Description of equipment and facilities

Sinclair is constructing a new single story building on the grounds at its Research Laboratories located at 400 East Sibley Boulevard, Harvey, Illinois for this radiation facility. This building is being designed and built by The Austin Company, Engineers and Builders, Cleveland, Ohio. The location of this building on the property is shown in Figure 1, attached.

The Radiation Room and Hot Cave will occupy a portion of the building which is also to be used for tracer studies and related work. A floor plan of the building is shown in Figure 2, attached. The cave proper will be designed to shield the radiation dosage that would result from four used MTR fuel elements from the experimental reactor from Arco, Idaho, after they have been in the Materials Testing Reactor 20 days at 30 megawatts power and cooled for 30 days subsequent to removal from the reactor.

The shielding is designed so that there will be a maximum of 2 milliroentgens per hour on any vertical surface of the cave and a maximum of 6 milliroentgens per hour on the roof of the cave when the four MTR fuel elements are placed in the cave within 2 feet of any wall. To insure a safe design and adequate construction these limits of radioactivity outside the cave are made a contractual obligation of the builder, and the builder is required to guarantee these levels. In this connection, the builder is making arrangements for the services of Mr. R.C. Goertz, Director of the Remote Handling Division at Argonne National Laboratories, as a consultant to guide them in design and construction of the cave so that the cave guarantee can be safely met. Further, Sinclair Research has engaged the services of Mr. R.A. Blomgren of Argonne National Laboratories to assist in the mechanical and structural design of the cave, and the various handling and shielding problems. A plan of the cave proper is shown in the attached Figure 3 and elevations in the attached Figures 4 and 5.

Access to the cave is obtained through a shielded door of magnatite concrete approximately 4'-6" thick and supported by a manually operated overhead mechanical monorail. Supplementary steel shielding will be embedded at the perimeter of the face of the door and on the adjoining section of the cave as shown. Metal weather doors will be provided as shown in Figure 3 to maintain room temperature conditions when the large access door is open and workmen are assembling experimental apparatus.

A water well for storing the radioactive source will be provided. This well will be 6 ft. by 8 ft. by 18 ft. deep. The tank will be constructed of 1/2 inch carbon steel plate suitably coated on the outside and inside with corrosion protective material, and will be cathodically protected with sacrificial anodes. The water in the well will be continuously passed through a resin bed type demineralizer and a filter. This will insure pure water at all times. The source well will be covered with removable subway grating backed up with lucite sheets to prevent foreign material from falling in the well.

The walls and ceiling of the cave will be lined with 3/16 in. steel plate; the floor will be lined with 1/2 in. thick carbon steel plate, all integrally welded in place and suitably painted with corrosion resistant material.

Two process pipe labyrinths one foot wide by 2 feet high with suitable auxiliary shielding will be provided at one end of the cave to allow the introduction of the liquid and gaseous process materials to be studied, as well as the general utilities required in an operation of this type including gas, water, vacuum, electricity and the like. A dry materials access port will be installed at this location with a remotely operated mechanical conveyor in order to introduce this material into the cave when needed. The panel board for controlling the process reaction vessel will be located outside the cave as shown in Figure 2.

The wall between the laboratory and the cave will be constructed of magnetite concrete approximately 4'-6" thick. A viewing window constructed of multi layered shielding glass and zinc bromide solution will be provided in this wall. The other walls are to be constructed of ordinary concrete approximately 6'-0" thick.

A remotely operated and manually actuated four-way one ton mechanical bridge crane will be provided in the cave. Two Argonne type Model 8 manipulators will also be provided in the cave as shown in Figure 3. A 16 ton manually operated monorail crane will be provided to handle the source shipping container.

The cave will be heated by means of radiant coils embedded in the floor and general vapor proof incandescent and sodium vapor lighting will be provided. Conditioned air will be drawn into the cave through the process utilities labyrinths and exhausted at both the floor and ceiling through a remotely located exhaust fan. Absolute filters will be provided on all exhausts from the building.

A remotely controlled permanent CO_2 flooding system will be installed to serve the cave.

9. <u>Proposed source handling procedures and safety measures</u>

The four fuel elements will be received from Arco, Idaho or the Argonne National Laboratories in an air cooled water jacketed lead container. This container will be the one now in use at Argonne or one of similar design.

The handling procedures for unloading fuel elements on arrival at our radiation cave will be similar to those currently employed at the Argonne National Laboratories gamma radiation facility.

The shipping container will be unloaded from the truck by means of manually operated chain hoists operating from a monorail. The exterior of the shipping container will then be steam cleaned to prevent contamination of the source storage well. The outer sheet metal cover of the shipping container will be removed and the water in the container monitored to determine the extent of its radio-activity. The bolts will be removed from the inner lead shielding cover. The entire container will then be transferred into the cave by means of a monorail hoist, and will be partially lowered into the water well in the cave. It should be noted that there is not a permanent monorail at the shield door location, but will be installed only when necessary to transfer the shipping container in and out of the cave.

The next step will be to pump out the cooling water in the outer jacket of the container, then refill and pump out the container several times with demineralized water from the well. This is to insure that all radioactive water that may have been present when the elements were shipped has been substantially removed. This contaminated water used in washing the vessel will be stored in an adjacent tank for later concentration of radioactive material and disposal.

The container will then be lowered to the bottom of the well and the inside lead cover will be removed using the one ton bridge crane in the cave. The four elements will be removed from the container using manually operated long handled tongs and placed in a cadmium rack adjacent to the shipping container. The empty shipping container will then be removed from the well in a manner similar to the way in which it was brought in. The four elements will then be placed in individual stainless steel finned containers that have a tight fitting gasketed top. A sketch of the container is shown in the attached Figure 6. The four canned elements are then placed in a cadmium clad jig, and the bridge crane hook attached thereto. All operations to this stage will be carried out under water.

The following operations will be handled remotely from the operating area outside the cave. The source will be raised from the well, transferred to the process reaction vessel location and lowered over the vessel by means of the bridge crane. It may be necessary to guide this operation somewhat using the Model 8 manipulators. A sketch showing these elements grouped around the process vessel is shown in the attached Figure 7.

An air blast will be provided at the bottom of the fuel elements directed upward past the fins of the finned container to insure adequate cooling of the elements.

The fuel elements are now in proper position to proceed with the experimental program. The materials to be treated by radiation are then introduced by suitable process piping thru labyrinth to the reactor and after processing returned to the control area. All control for this operation will be remotely handled outside the cave using the panel board shown in Figure 2.

The dry materials access port will be used to introduce any material in the cave that may be needed in connection with experiments. This would include chemicals introduced in the vicinity of reactors to determine dose rates, material for special radiations, etc. The manipulators will be used to facilitate this operation.

At the completion of the experiment the elements will be returned to the well in a manner similar to that in which they were originally removed.

The following safety precautions will be incorporated in the design and operating procedures.

The pH of the well water will be controlled and maintained between 5 and 7 and frequently analyzed to determine the amount of any radioactivity present.

There will be a key interlock system on the cave door to insure that the shield door cannot be closed while the room is occupied. These interlocks will be equipped with signal lights and an annuciator. Telephone communication will be provided within the cave to other portions of the laboratory building. A remotely controlled CO_2 flood system will be provided to take care of any fire hazards from combustible material in the cave.

The top of the water well is flush with the floor of the cave. This will allow accidentally dropped fuel elements to be shoved in the well in event of emergency. This would be carried out using a remotely operated tong vise actuated from the Model 8 manipulators. Mirrors will be installed at various locations in the cave so that substantially all portions of the cave and cave well will be visible from the cave window.

A strippable coating will be applied to the interior of the cave to serve as an aid in decontamination when needed.

There will be a removable plug located in the ceiling of the cave to provide for water flooding of the cave should this ever become necessary. This is a last resort measure and to accomplish this all exterior openings would have to be sealed.

There will be 600 cubic feet per minute of conditioned air supplied to the cave. This air will be exhausted thru absolute filters. These filters will be monitored frequently to determine any build-up in radioactivity.

A continuous monitor will be installed in the cave which will actuate signal lights inside the cave and in the operating area when the source is out of the well. A continuous radioactivity laboratory monitor will be in operation in the operating area outside of the cave. All operating personnel will wear film badges and direct reading ionization dosimeters at all times.

Admission to the cave at all times will be closely controlled by the supervisor in charge of the laboratory. The operating area outside the cave will be completely controlled.

A wash room and shower facilities will be provided in the building with separate locker space for street clothes and laboratory clothing.

The following physical examinations will be given to all operating personnel at the radiation cave initially and semi-annually; complete blood count, urinalysis, chest X-ray plus routine general physical examination.

Respectfully submitted

By W. M. Flowers

W. M. Flowers
President

SINCLAIR RESEARCH LABORATORIES, INC.

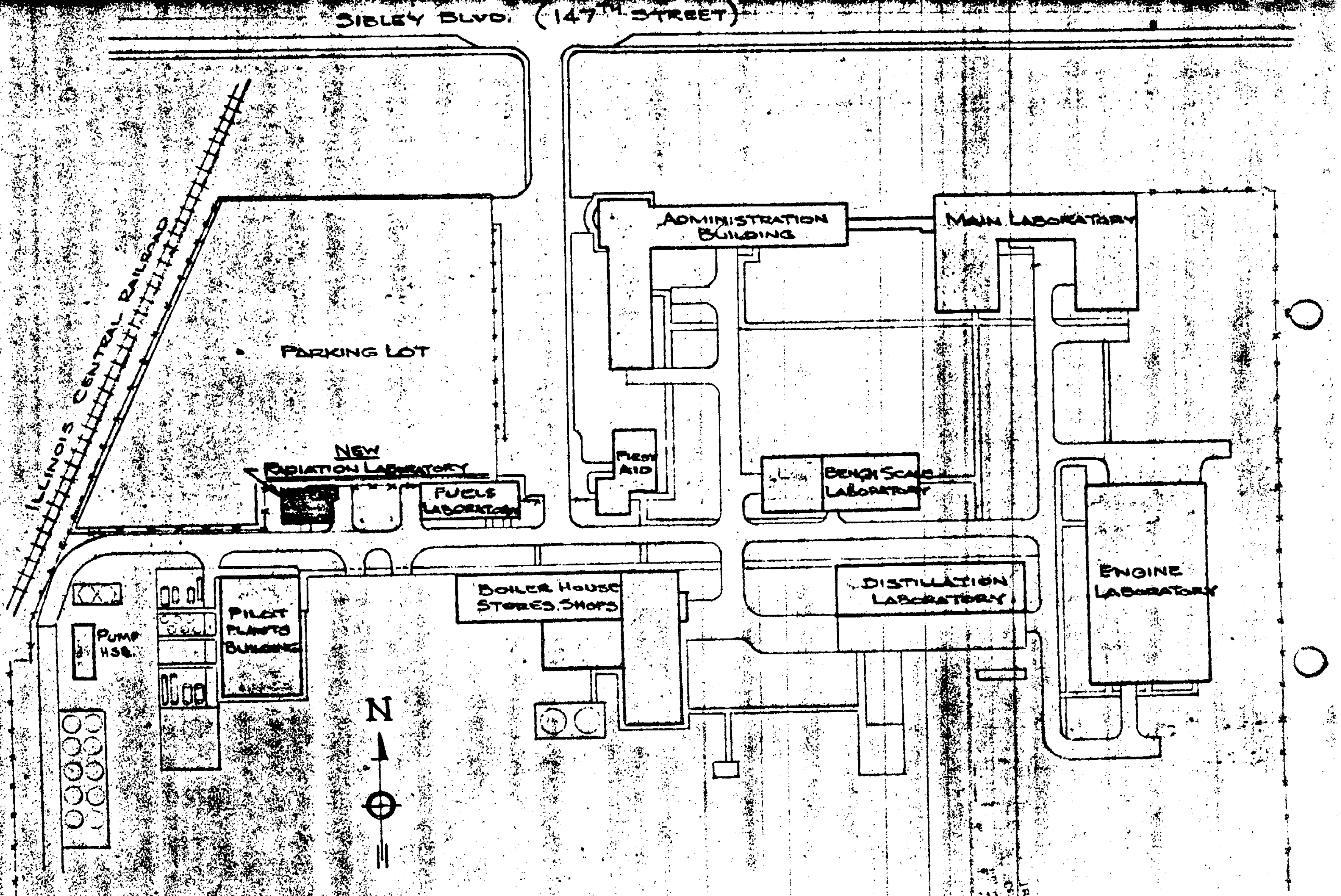
STATE OF NEW YORK)
) SS:
COUNTY OF NEW YORK)

Ex 6

On the 3rd day of February, 1956, before me personally came W. M. Flowers, to me known, who, being by me duly sworn, did depose and say that he resides at [redacted] that [redacted]e is the President of Sinclair Research Laboratories, Inc., the corporation described in and which executed the above application, that the statements therein are true to the best of his knowledge and belief.

James M. Flynn
Notary Public

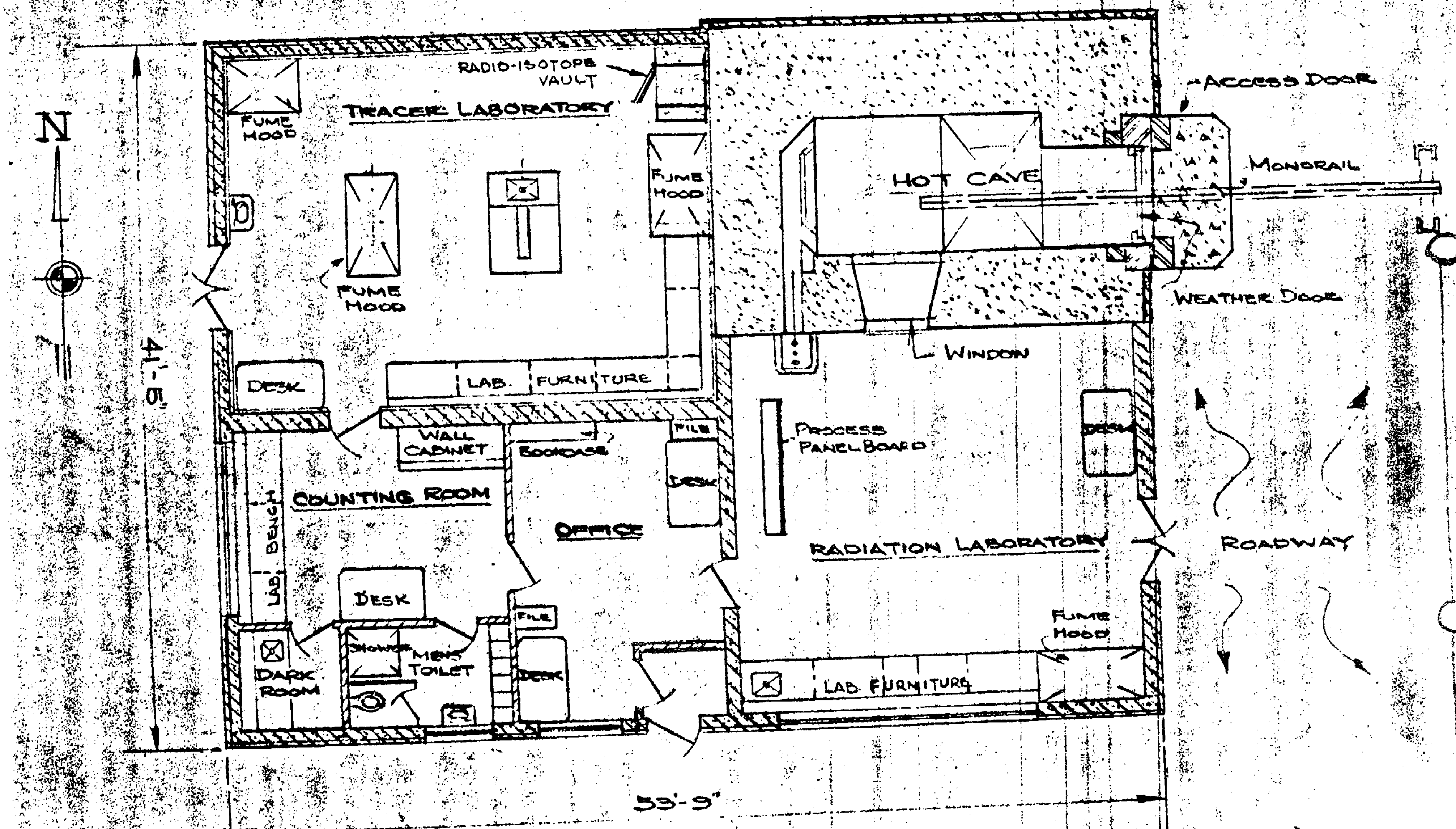
JAMES M. FLYNN
Notary Public, State of New York
No. 41-6342000-Qual. in Queens Co.
Cert. filed with N.Y. Co. Clerk
Term Expires March 30, 1956



PLOT PLAN
RADIATION LABORATORY LOCATION
SINCLAIR RESEARCH LABORATORIES INC.

FIGURE #1

SCALE: $\frac{9}{4}$" = 100'

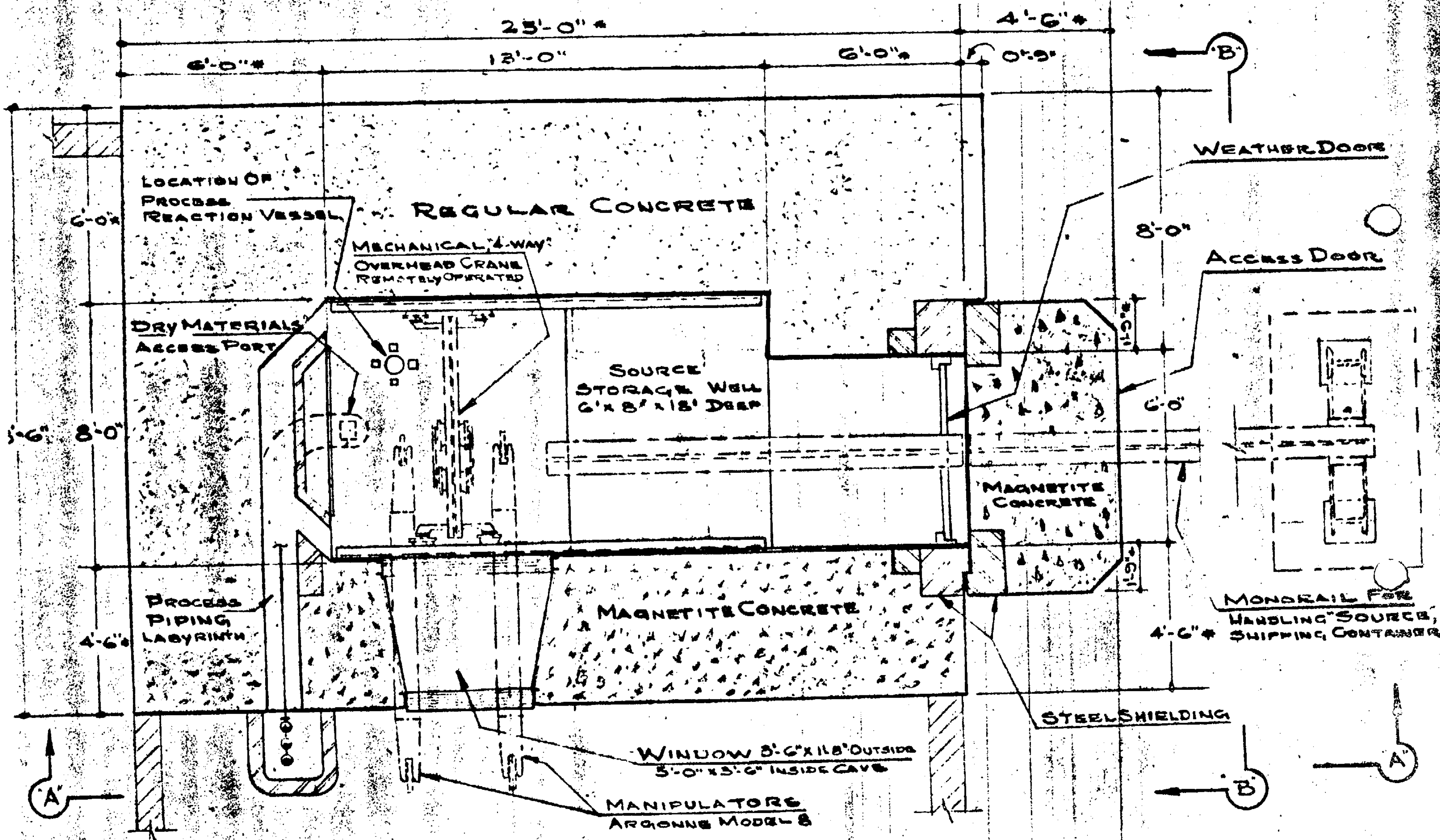


SCALE 1/8" = ONE FT

PLAN OF RADIATION LABORATORY BUILDING
SINCLAIR RESEARCH LABORATORIES INC.
HARVEY, ILLINOIS

FIGURE #2

R.D.D.
1-31-56



* Indicates Approx. Deminsion

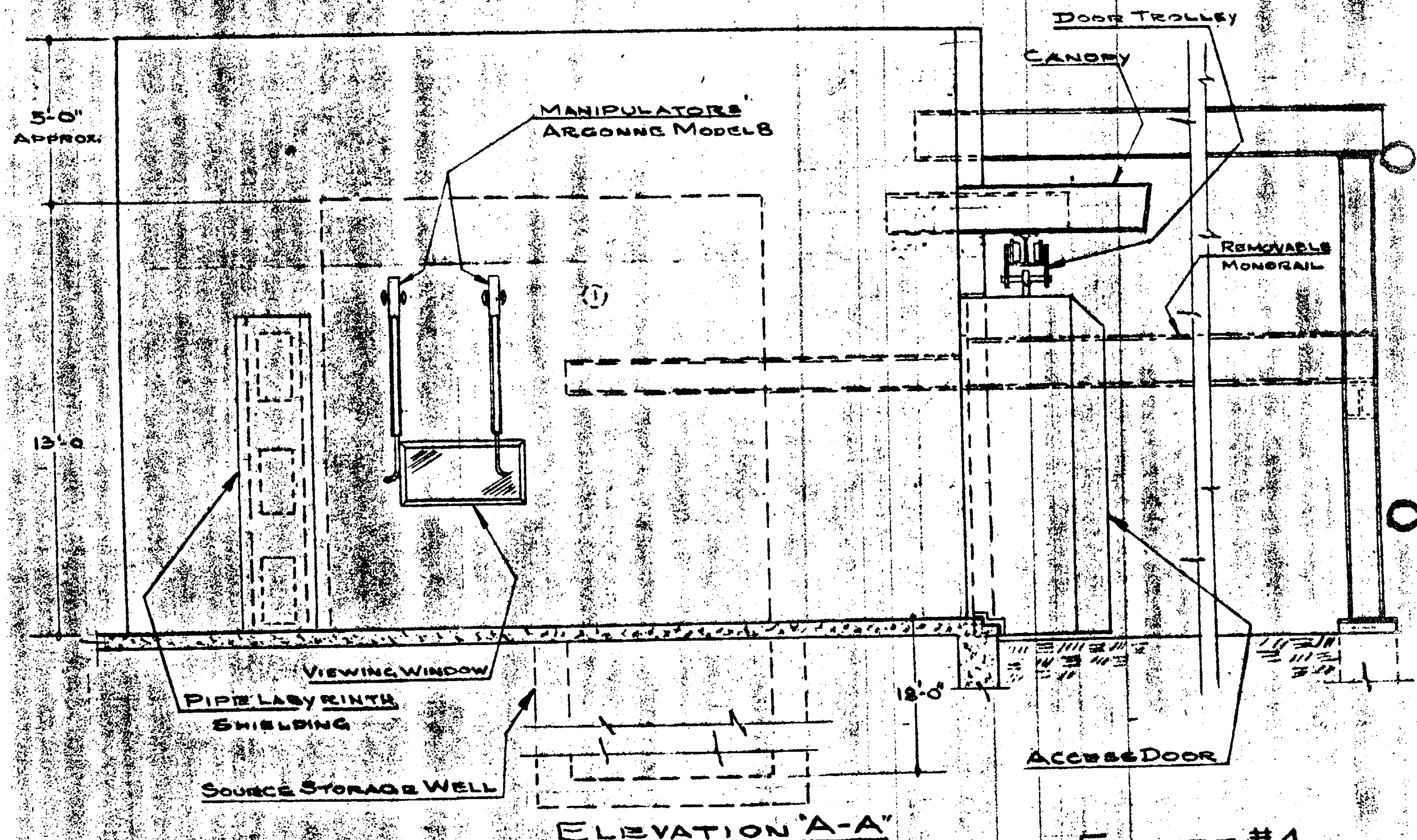
PLAN

RADIATION CAVE

1" = 4'

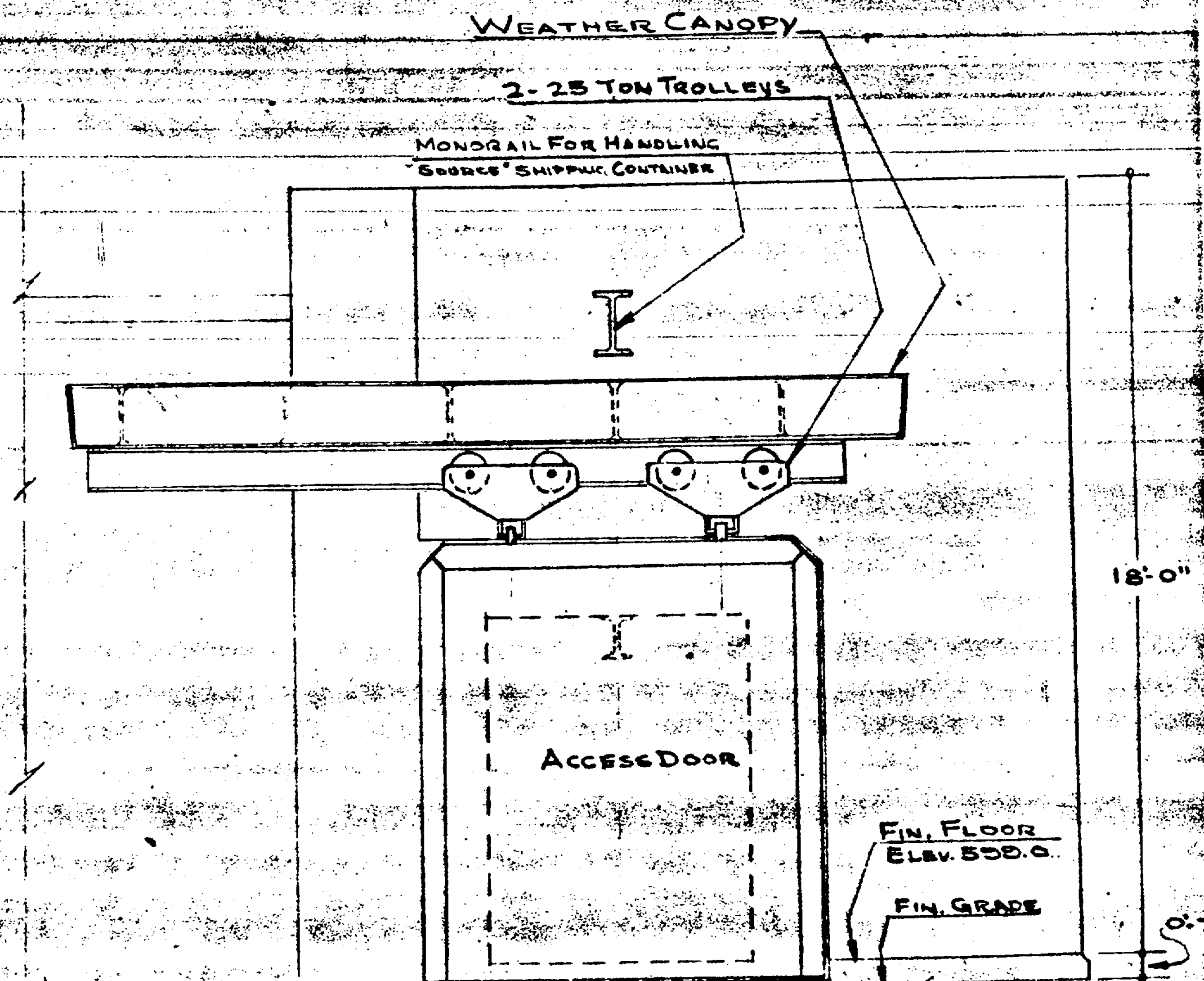
FIGURE #3

S.J.P.



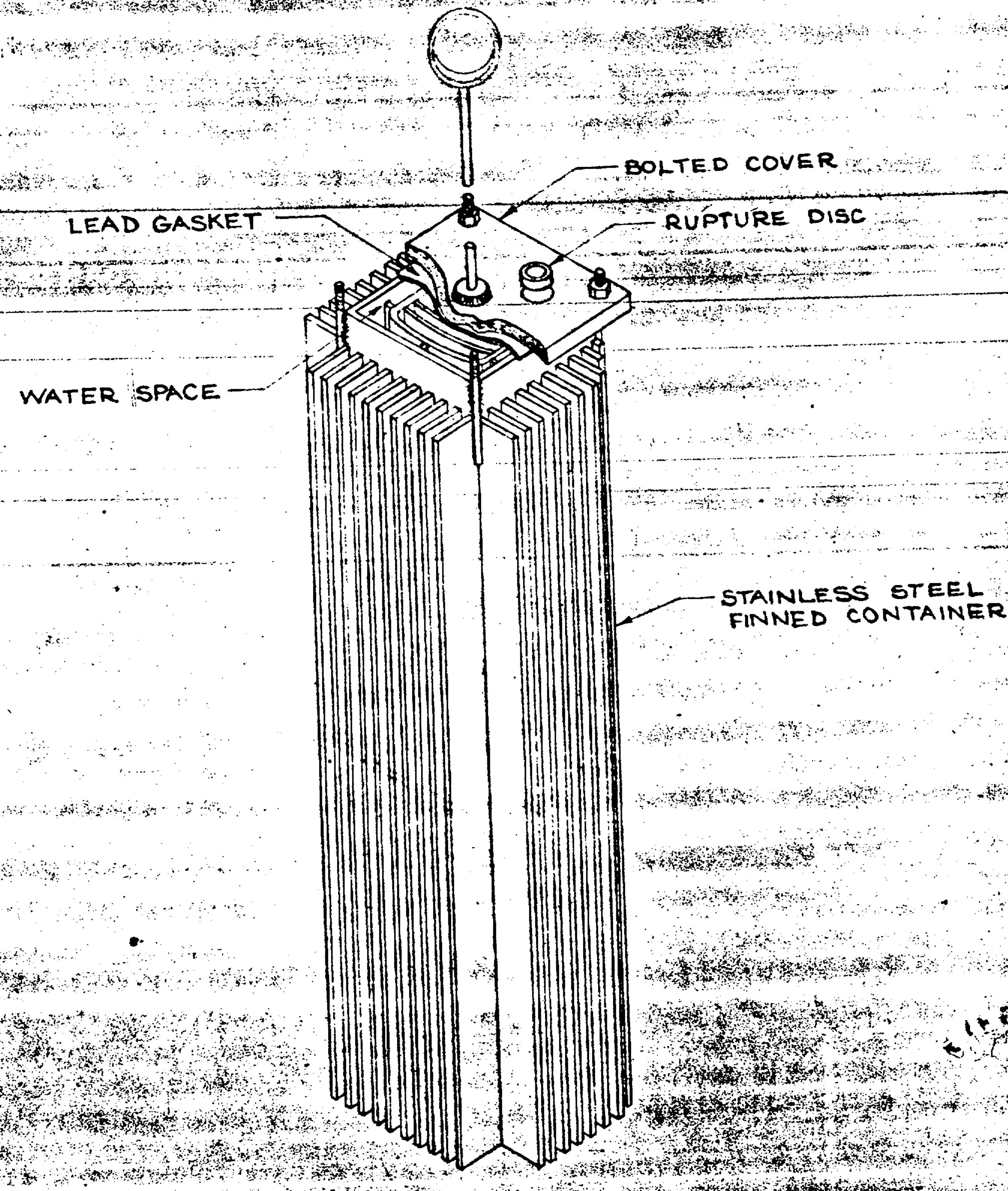
5-0"
APPROX.
13'-0
MANIPULATORS'
ARGONNE MODEL 8
DOOR TROLLEY
CANOPY
REMOVABLE
MONORAIL
VIEWING WINDOW
PIPE LABYRINTH
SHIELDING
SOURCE STORAGE WELL
18'-0"
ACCESS DOOR
ELEVATION "A-A"

FIGURE #4 SJP



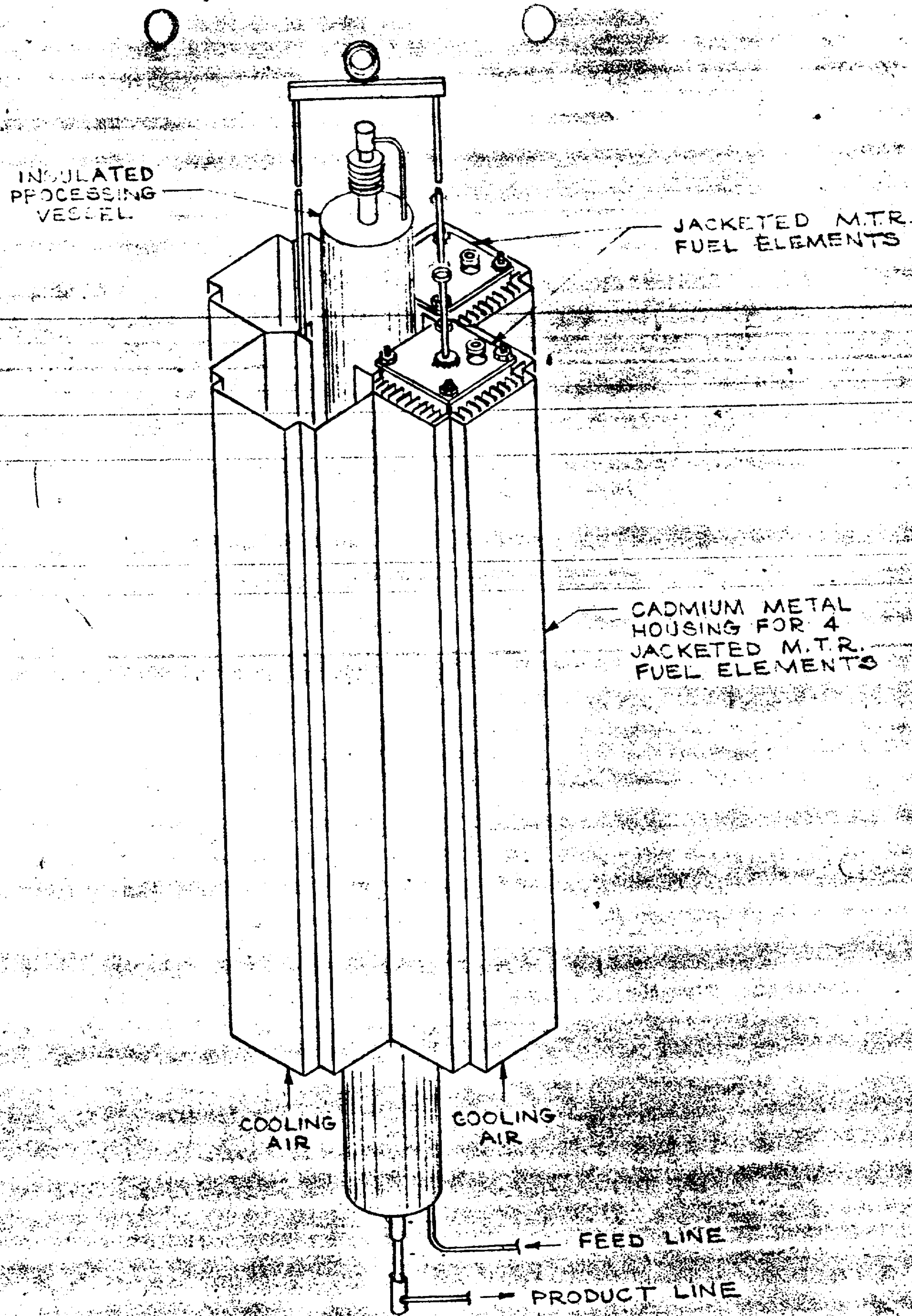
ELEVATION "B-B"

FIGURE # 5



AIR COOLED WATER JACKET FOR
M.T.R. FUEL ELEMENT

FIGURE # 6



M.T.R. FUEL ELEMENTS NESTED AROUND INSULATED PROCESSING VESSEL

FIGURE #7