June 4, 1976

Kerr-McGee Corporation
ATTN: W. J. Shelley, Director
Regulation and Control
McGee Tower
Oklahoma City, Oklahoma 73125

License No. SUB-986
Docket No. 40-8006

Gentlemen:

Thank you for your letter of May 25, 1976, in response to our letter and the attached Notice of Violation dated May 13, 1976. We have no further questions at this time and we will review your corrective action during a future inspection.

Sincerely,

Glen D. Brown, Chief
Fuel Facility and Material
Safety Branch

bcc: w/encl. to IE Mail & File Unit for Distribution 6/4/76
IE Chief, FS&EB
IE Chief, R&EP
IE Reg. Coord., K. Whitt
NMSS/MFCF, Larson
IE Files

Bcc: w/encl. and enforcement correspondence to DAC:ADM for Distribution 6/4/76
Central Files
PDR:HQ
NSIC

OFFICE ▶	IE:IV					
SURNAME ▶	CMW CMWiblin:jam	GDBrown	WEVetter			
DATE ▶	6/4/76	6/4/76	6/ /76			

Form AEC-318 (Rev. 9-53) AECM 0240

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Form AEC-318 (Rev. 9-53) AECM 0240   U. S. GOVERNMENT PRINTING OFFICE: 1974-526-166

1. (A detailed description of your organization, including authority and responsibility of each level of management and/or supervision in regard to development, approval, and adherence of operating procedures.)

The authority and responsibility for developing our operating procedures is assigned to our Technical Services Department. Approvals are required by the Manager, Technical Services; Manager, Plant Engineering; Manager, Manufacturing; Safety Engineer; Manager, Production and General Manager. A safety committee review of the procedure is made prior to approvals.

The General Foremen and line supervisors have the responsibility of assuring adherence to the operating procedures. As an aid to the supervisor, safety inspections are conducted by committees and individuals. Processes are reviewed as required by the Technical Services Department.

2. (The qualifications and experience of the personnel in your organization assigned the responsibility for developing, conducting and administering the radiation safety program for the plant.)

The responsibility for developing, conducting and administering our radiation safety program is with our Radiation Safety Officer. This person is titled "Safety Engineer." He has a degree in chemistry and has several years experience in the inorganic chemical and chemical engineering fields. He has over 7 years experience in Safety Engineering. He has received formal training in the field of health physics from the U.S. Department of Health Education & Welfare by completing their courses titled "Basic Radiological Health" and "Occupational Radiation Protection".

Reporting to the Safety Engineer is a "Radiation Hygenist". This person has received formal training in health physics by completing courses in radiation detection and measurements and radioisotope chemistry at Aurora College, Aurora, Illinois.

We use the services of a consulting organization named "Health Physics Associates Ltd".

Our supervisors have a minimum of a high school education and report to chemists or chemical engineers. Supervisors receive Safety and Radiation Protection training.

3. (A description of the area in which the plant is located, including the size of nearby inhabited areas, location of wells, streams and rivers, flood stage levels of streams and rivers, and sources of water supply for the plant. A topographical map with the above identification is preferred.)

A composite USGS topographical map is attached as Exhibit I. The map is made up of portions of the West Chicago and Naperville, Illinois quadrangles in which the City of West Chicago and properties of the Rare Earth Division, American Potash & Chemical Corporation lie. The extent of the latter properties and the location of municipal and Division water supply wells are delineated on a transparent overlay positioned on the map.

The Division's physical plant is located on the southwest side of the City of West Chicago. Several private homes border the property on the north and east, and the Elgin, Joliet & Eastern RR borders it on the west. Other private homes are located to the west of the railroad property.

The elevation above sea level of the municipality ranges from 730 feet to 784 feet, the latter being the elevation at the West Chicago City Hall. The elevation of the Division's property is from 750 feet at the main plant location, on the north, to slightly under 730 feet in the disposal area, on the south.

The principal streams within a five mile radius of the plant are the Du Page River (west branch) on the east and Kress Creek on the west and south. The latter flows into the Du Page about two miles south of the plant. At their closest points, the Du Page River is one mile from the Division's disposal ponds and Kress Creek, one half mile. Both streams flow in a southerly direction.

The streams have no history of serious flooding. According to one authority (U.S. Corps of Engineers) the highest level or elevation on record for the Du Page River as measured at the gaging station at U. S. Highway 64, two miles north of the City, is 728.1 feet reached in June, 1967. There are no corresponding figures available for the Du Page at the sewage treatment plant, southeast of the City, or at its confluence with Kress Creek, but the same authority estimated that these would have been much lower.

4. (A description of the method for restricting both the plant and waste disposal area from unauthorized entry.)

Our plant and waste disposal areas are surrounded by cyclone type fencing. Gates in the fence are kept locked except when in use. Our employee and visitor entrance doors are open during business hours and a clerk-receptionist controls the entry of individuals. These doors are locked after business hours and only responsible persons can gain entry by using special keys issued for this purpose. Watchman tours are conducted during non-business hours. Watchclock key stations are located within the plant, out-of-doors, and in various out buildings. A record of the watchman tours is obtained from the wr ch-clock tape.

5. (A description of your waste disposal procedures. Where retention systems such as levees, dikes, ponds, etc., are used to prevent the release of liquid or solid waste containing radioactive material to offsite areas, describe the retention capability and integrity of the system, conditions that might lead to accidental release of the waste, the environmental effects of such a release and your program of inspection and maintenance to prevent such accidental occurences. This description should also include drawings showing the layout, heights, top width, side slopes, freeboard, seepage control, protection of embankment surfaces, foundation design, typical cross-sections, characteristics of fill material and a discussion of construction methods and specifications.)

Solid trash type waste which may be contaminated with Thorium material is kept separate from non-contaminated refuse. Monazite ore bags and a very small amount of other combustible material are burned in our incinerator. Non-contaminated refuse and scrap, and decontaminated scrap, are removed from our premisis by a scavenger service.

All scrap equipment which has been used in Thorium processing operations is surveyed and if needed, decontaminated to levels below the limits set forth in an A.E.C. document titled "Radioactivity Contamination Limits for Abandonment of Facilities and Equipment" as follows:

<u>RADIOACTIVITY CONTAMINATION LIMITS FOR ABANDONMENT OF FACILITIES AND EQUIPMENT</u>

1. The maximum amount of fixed alpha radioactivity in disintegrations per minute per 100 square centimeters on buildings or equipment should not exceed 25,000.

2. The average amount of fixed alpha radioactivity in disintegrations per minute per 100 square centimeters on buildings or equipment should not exceed 5,000.

3. The maximum amount of removable (capable of being removed by wiping the surface with a filter paper or soft absorbent paper) alpha radioactivity in disintegrations per minute per 100 square centimeters on buildings or equipment should not exceed 1,000.

4. (a) The maximum level at one centimeter from the most highly contaminated surface of a building or piece of equipment measured with an open-window beta-gamma survey meter through a tissue equivalent absorber of

not more than seven milligrams per square centimeter should not exceed one millirad per hour.

(b) The average radiation level at one centimeter from the contaminated surface of the building or equipment measured in the same manner should not exceed 0.2 millired per hour.

5. The contamination limits for abandonment of facilities involving U-233, or Plutonium should not exceed 1/10 of the limits in items 1, 2 and 3 above.

Solid chemical residue composed mainly of Silica, unreacted Monazite, Zercon, Rutile, Calcium and Barium sulfate, and other gangue is piled on the ground in our waste disposal area at the south west corner. This material is of a very sticky, pasty nature which dries to a hard cake. It does not have a tendency to dust or dry to a powder and is extremely insoluble. This pile does emanate some radiation. Survey meter readings taken at the fence line adjacent to the pile have never exceeded 2.5 mr per hour. The areas south and west of the fence are not inhabited. Parallel to, and about 25 ft. from the west fence is a railroad right-of-way. X

The radiation dosage to anyone on a passing train is negligible. Observations over a period of several years has shown that pedestrians very seldom use the railroad right-of-way. However, if it is assumed that a person makes four trips per day every day at three miles per hour along the 400 ft. of fence in question and that the dose rate is 2.5 mr/hr. The dose received would be less than 0.1 rem per year.

[Pursuant to section 20.105 (a) we request allowance to produce a radiation level in the unrestricted area at the southwest boundary of our waste disposal area of not more than 2.5 mr per hour.] X

Attached as Exhibits II and III are Drawings C-11083-2 and B-12016. These show the Division's property and plant in some detail, and graphically describe liquid waste disposal methods and procedures.

Inorganic liquid wastes generated in plant operations are discharged into surface trenches within the enclosed plant area. These discharge into an underground conduit which in turn discharges into a collecting basin or sump (Bldg. 14). Automatically operated pumps transfer the waste via underground and surface piping to a series of three settling and seepage ponds located approximately 750 feet south of the main plant area. X

Pond No. 1, the largest, is used primarily for settling entrained solids and post precipitates, and receives the pumped waste directly from Bldg. 14. Clarified waste is pumped to either or both Pond Nos. 2 and 3 for seepage and disposal. The level in Pond No. 1 is automatically maintained by the pump, and levels in the other ponds are controlled below the established free board point by manually valving off individual transfer lines.

Surface trenches within the enclosed plant area are constructed of concrete and lined with acid brick. Trenches are generally covered.

Underground conduit, in the most part, consists of 54 inch diameter reinforced concrete pipe lined with acid brick. In transition zones and a few other areas, the conduit is rectangular and again constructed of concrete lined with brick.

The collecting basin or sump is approximately 20 feet deep and has a holding capacity of 50,000 gallons. It is constructed of reinforced concret. and lined with acid brick.

The underground transfer line from the sump (Bldg. 14) to the disposal ponds is a 6 inch rubber-lined, steel pipe. It outcrops in the vicinity of Pond No. 2 and is connected to a 6 inch reinforced rubber hose laid above ground and discharging into Pond No. 1. Similar hoses run from the pumping station on Pond No. 1 to the other ponds.

Pond construction, holding capacity and other data are as shown in Exhibit III, Drawing B-12016.

All parts of the liquid waste disposal system are well inspected and maintained. Trenches, conduit and sump are cleaned and inspected annually, and repaired as indicated. Pumps and piping are checked daily, and transfer lines and ponds are inspected at least once every 8 hour work shift. Ponds are dredged annually to remove accumulated sludges.

6. (A description of the geological and hydrological characteristics which may affect the degree and mode by which liquid wastes may reach underground and/or surface waters. This should include estimates of local evaporation and seepage rates, depth of the local water table and premeability characteristics of underlying material.)

X As shown on the attached Exhibits II and III and described under "No. 5", inorganic liquid wastes are essentially all disposed of in seepage ponds. Some evaporation of the ponded waste takes place but because of climate and humidity conditions it is doubtful that the amount is significant. X

The ground in which the ponds are located consists of several strata of soils having varying degrees of permeability. The most permeable is the coarse sand and gravel stratum which forms the base or floor of the ponds. The uppermost or topsoil has fair to poor permeability, and the clay stratum underlying the gravel has very poor permeability. It is doubtful that much seepage takes place in either of these strata.

Seepage rates vary from 0.2 to 0.5 gal/sq.ft/hour. These appear to be low, considering the permeability of the gravel, but sludge settled in Pond No. 1 or small amounts that may be carried over into the other ponds impede outflow to some degree. Ground water levels also affect seepage. The current ground water elevation, as reported by the Illinois State Water Survey, averaged 726 feet in the West Chicago area. This will vary according to seasons and will be lowest in the fall and highest in the spring of the year.

7. (A description of the liquid effluent survey program[assuming plant effluents reach subterranean or surface water supplies], including the number, location and frequency of check samples and procedures for the sample analysis of natural Thorium and Radium-228.)

Liquid effluent samples are obtained daily. A one quart grab sample is obtained from the overflow hose which drains the settling pond (Pond #1). The sample is taken at the discharge end of the hose immediately before it enters the seepage pond (Pond #2). The seven samples per week are composited into a weekly sample.

The composite sample is allowed to stand until the very little amount of solids settle to the bottom of the jar. A 1 ml sample of the clear liquid is evaporated in a 1.25 inch stainless steel planchet for alpha counting. This sample contains the soluble radioactive material, if any.

The composite sample is then thoroughly stirred, suspending the solids. While stirring, a 1 ml sample is taken and dried in a planchet. This sample contains the soluble and insoluble radioactive material,-if any.

The samples are alpha counted (windowless) for 1 hour. A one hour background is counted immediately before each sample, and another background is counted after each sample. Assuming the before and after background counts are reasonably the same, the average background count is determined and deducted from the sample count. Should the before and after background counts not reasonably agree the counting is repeated.

The corrected counts of the sample "soluble only" is deducted from the corrected counts of the sample "soluble and insoluble" the difference being considered to be "insoluble only".

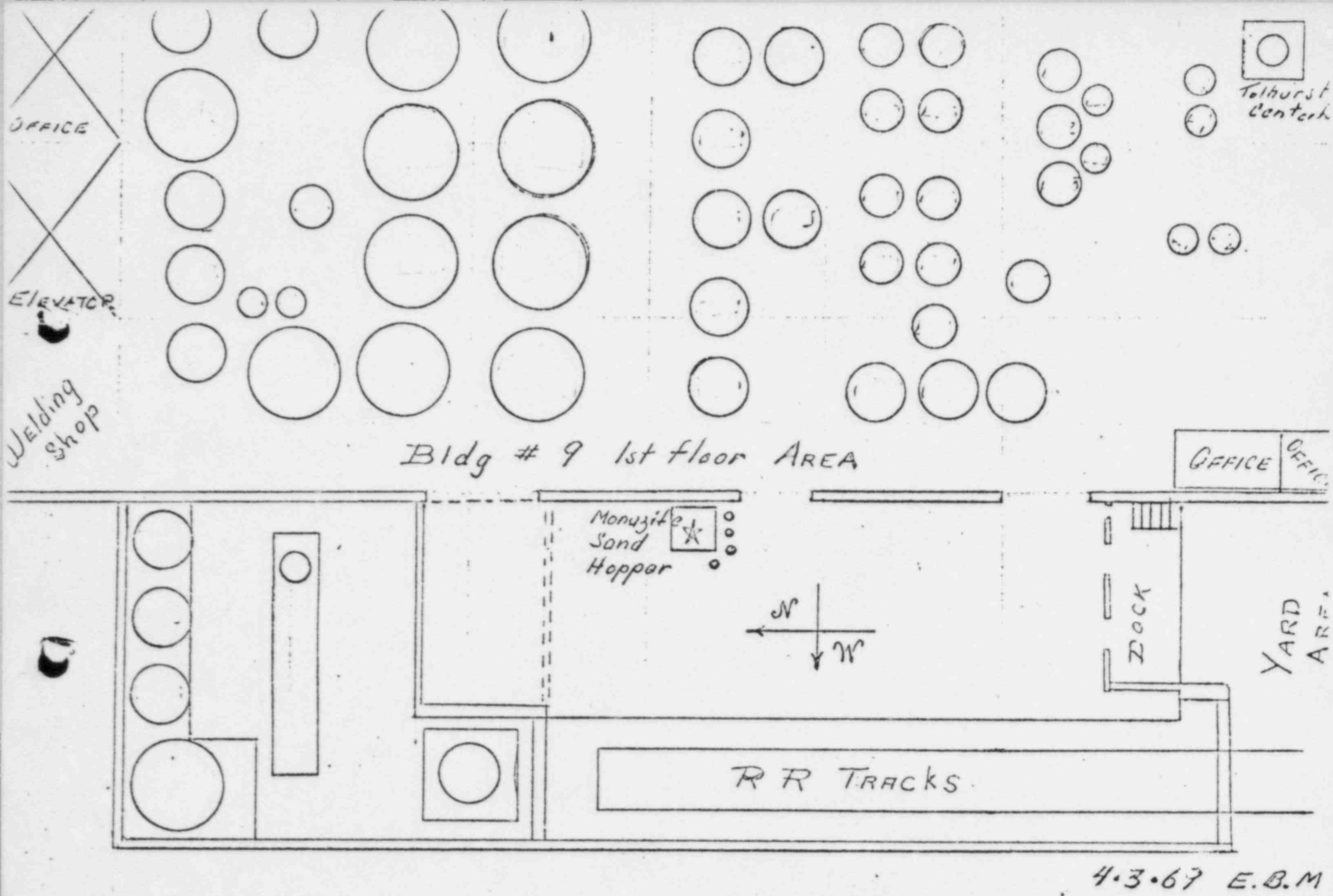
Aged thorium nitrate is dissolved in water to a concentration of 10^{-6}uci/ml. One ml of this solution is dried in a planchet. One hour before and after backgrounds are alpha counted with the thorium reference sample between.

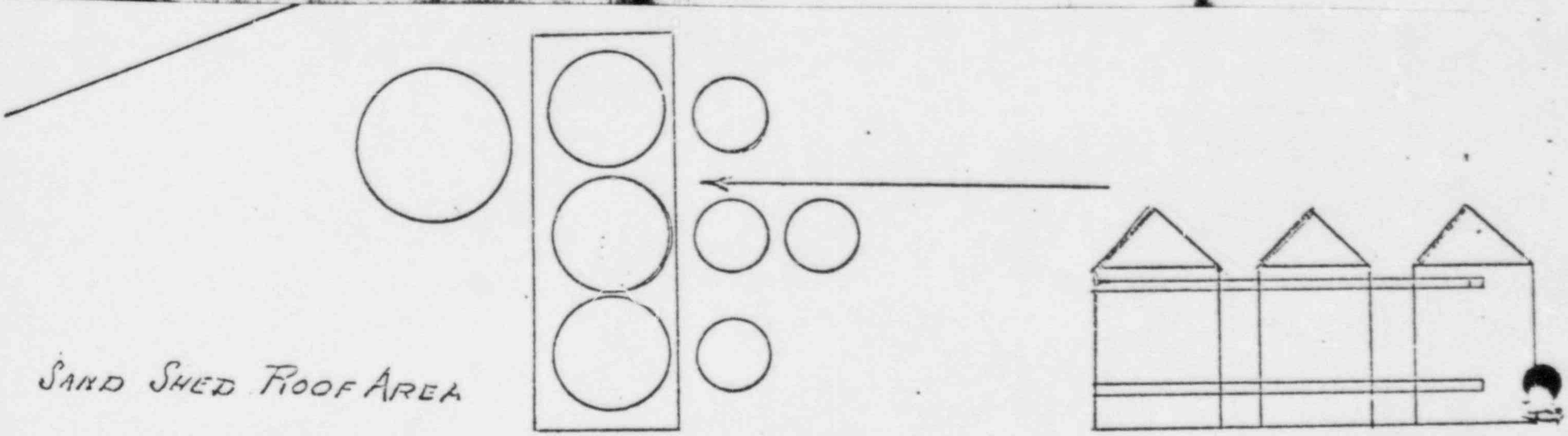
The water sample counting data is corrected for background and divided by the corrected reference sample counts. Results are reported as uci/ml thorium (nat.).

Th nat.
Table II
Col 2.
Sol: 10^{-6}
Insol = 10^{-5}

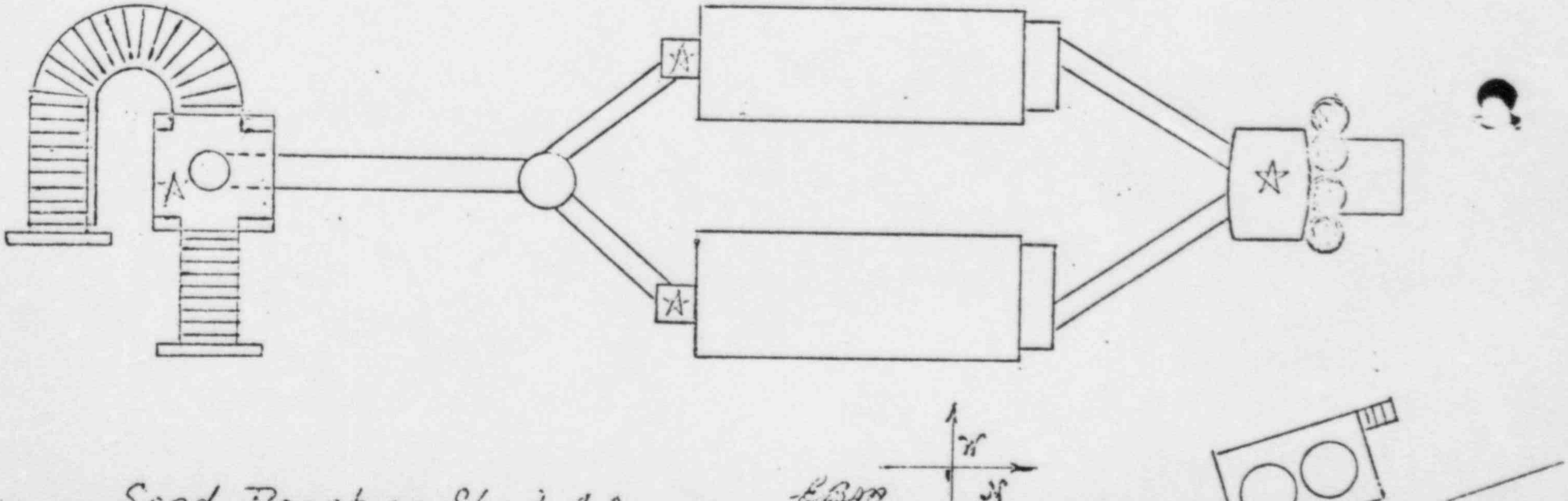
For a period of over a year during 1967 and 1968, waste effluent was radio assayed on a daily basis. Of 475 daily samples assayed for soluble radioactivity 306 were reported as N.D. and the average concentration was 0.12×10^{-6} uci/ml. The insoluble portion was assayed as well. 285 of the samples for insoluble radiation were N.D. and the average concentration was 0.36×10^{-6} uci/ml.

Most N.D. results reported are equal or very nearly equal to background. Results less than 10^{-7} uc/ml are also reported as N.D.

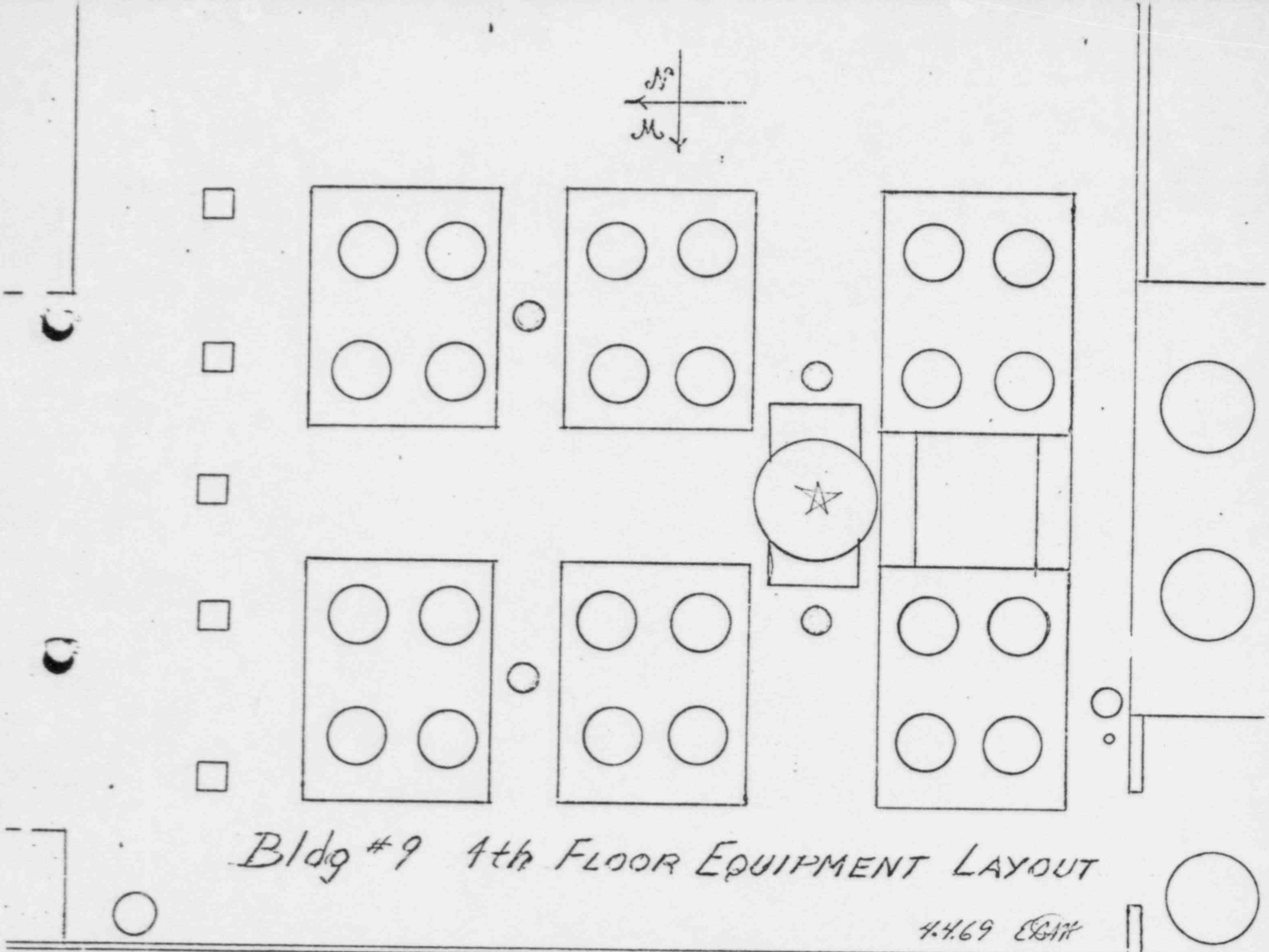

OFFICE
ELEVATOR
Welding Shop
Tolhurst Centerh
Bldg # 9 1st floor AREA
OFFICE
OFFIC
Monazite Sand Hopper
N
W
DOCK
YARD ARE
R R TRACKS
4-3-67 E.B.M



SAND SHED ROOF AREA

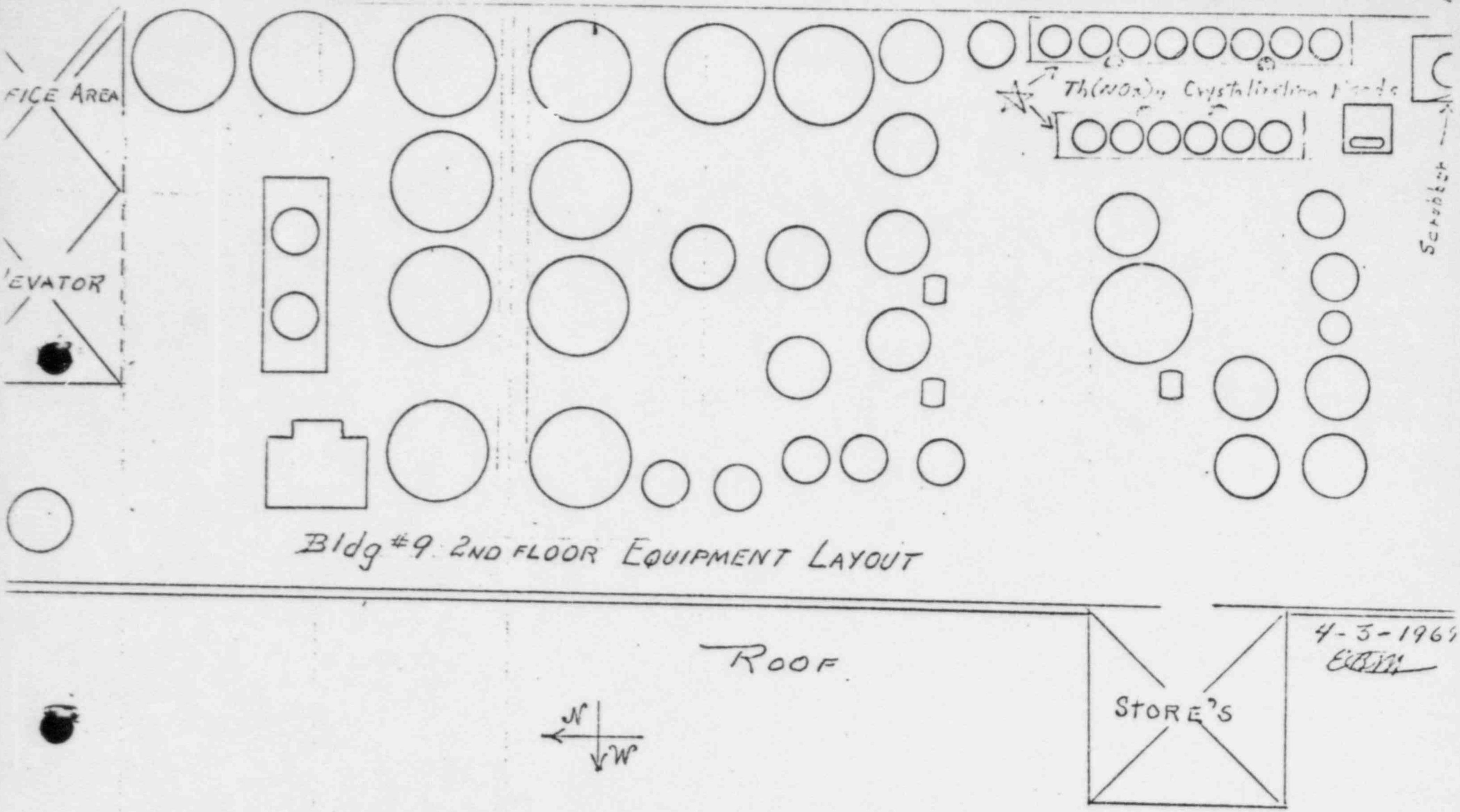


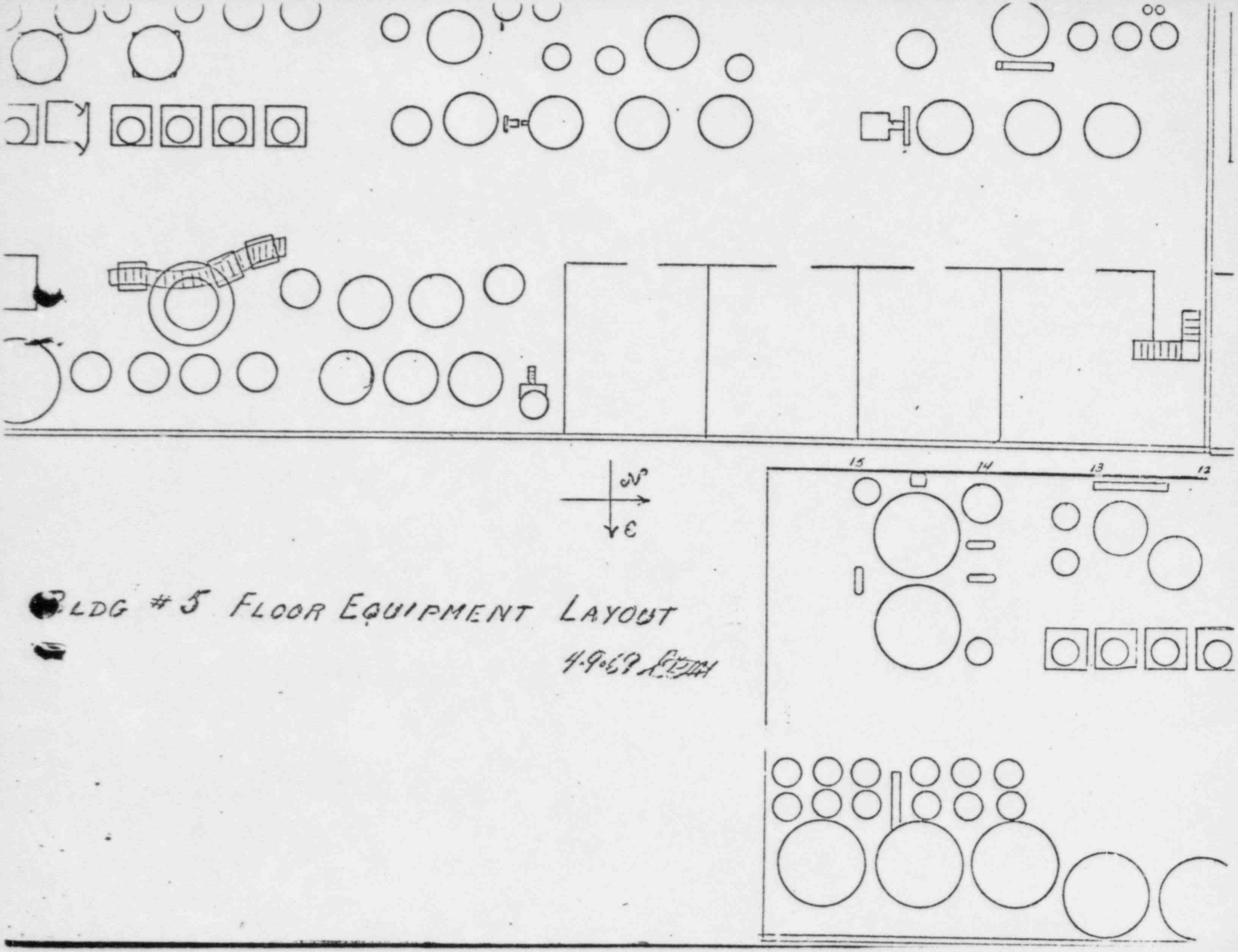
Sand Roasting Shed



Bldg #9 4th FLOOR EQUIPMENT LAYOUT

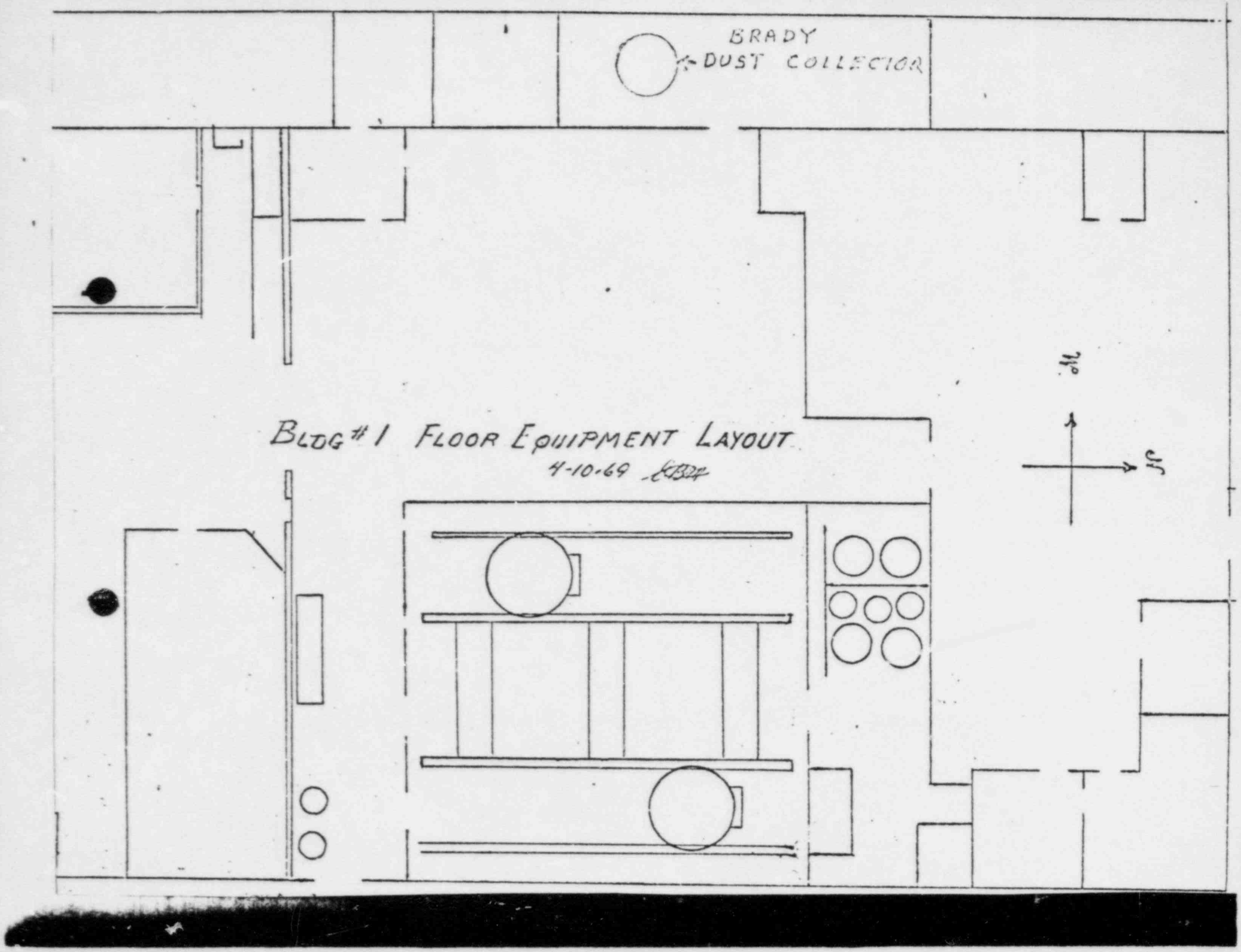
4.4.69 EGH


FICE AREA
EVATOR
Th(NO3)4 Crystallization Tanks
Scrubber
Bldg #9 2ND FLOOR EQUIPMENT LAYOUT
ROOF
N
W
STORE'S
4-3-1969

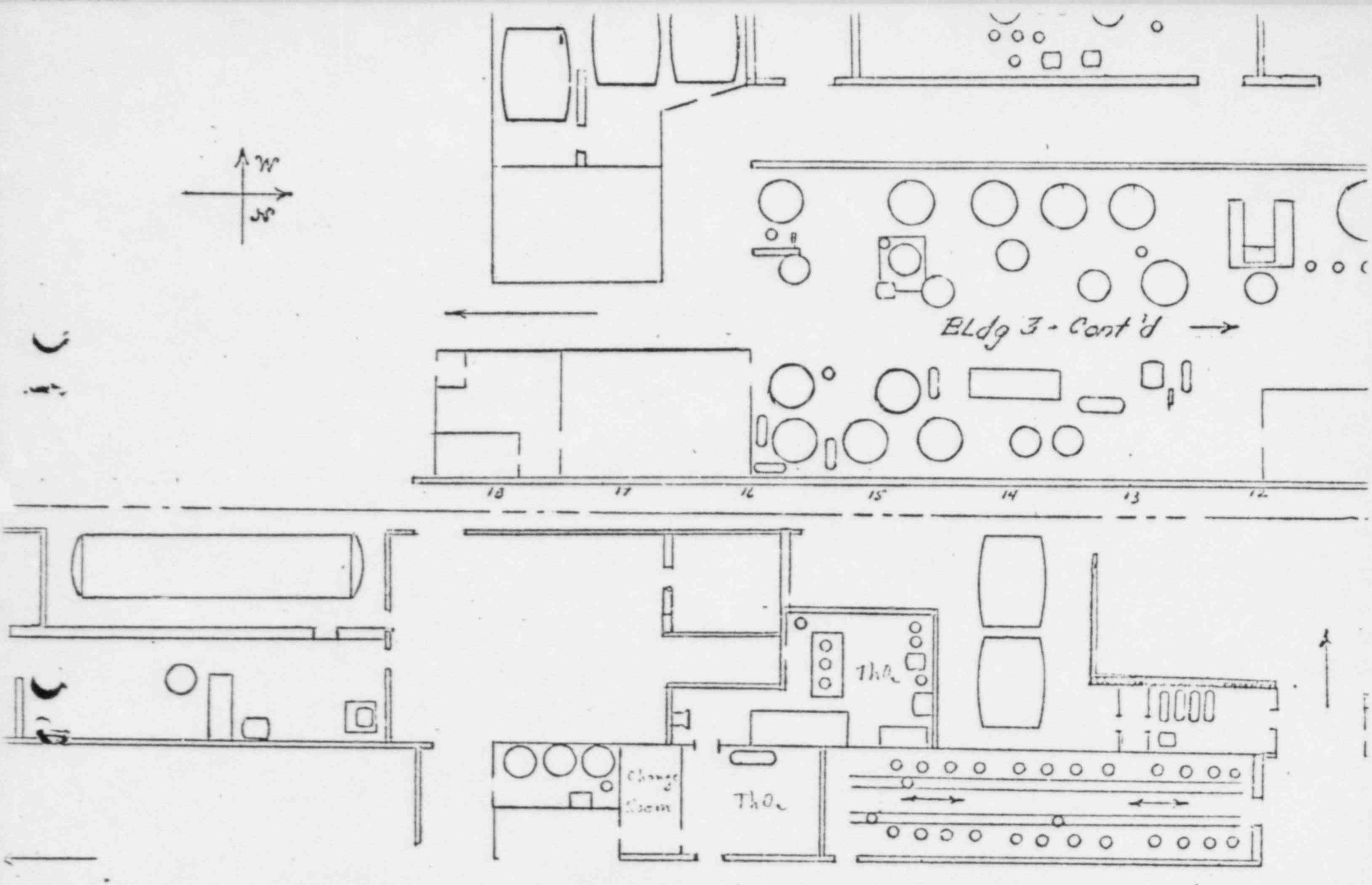


BLDG # 5 FLOOR EQUIPMENT LAYOUT

4-9-69



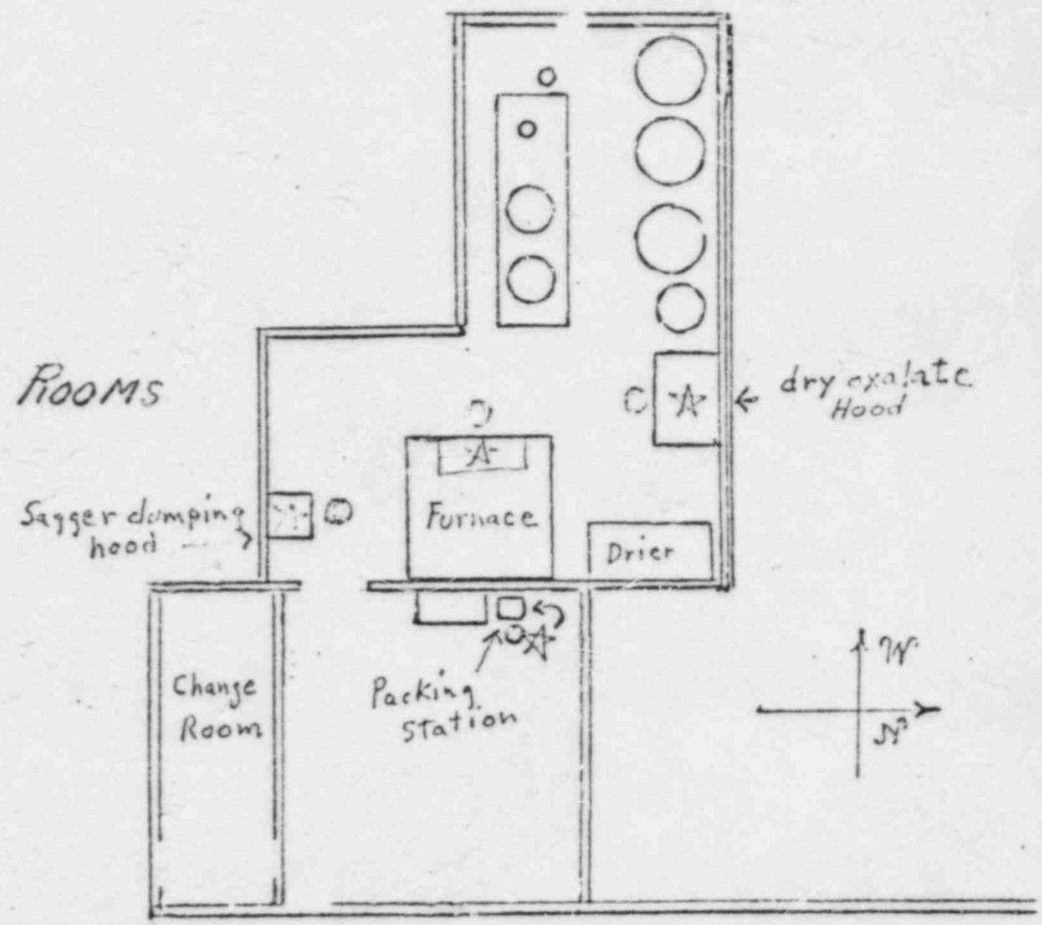
BRADY
DUST COLLECTOR
BLDG #1 FLOOR EQUIPMENT LAYOUT
4-10-69
N
W.

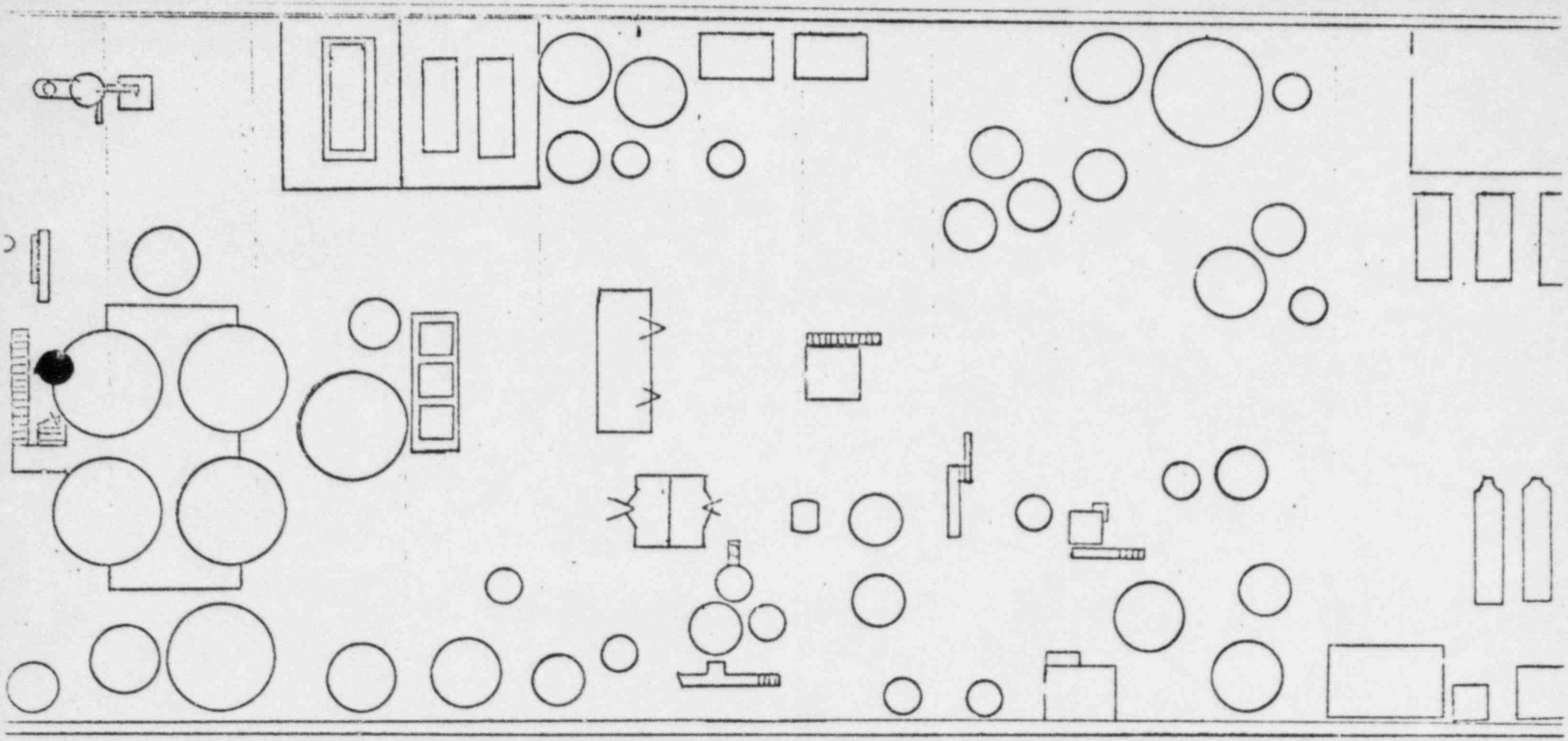


EQUIPMENT LAYOUT FOR Bldg #3
4-13-67

EQUIPMENT LAYOUT OF THORIUM OXIDE ROOMS

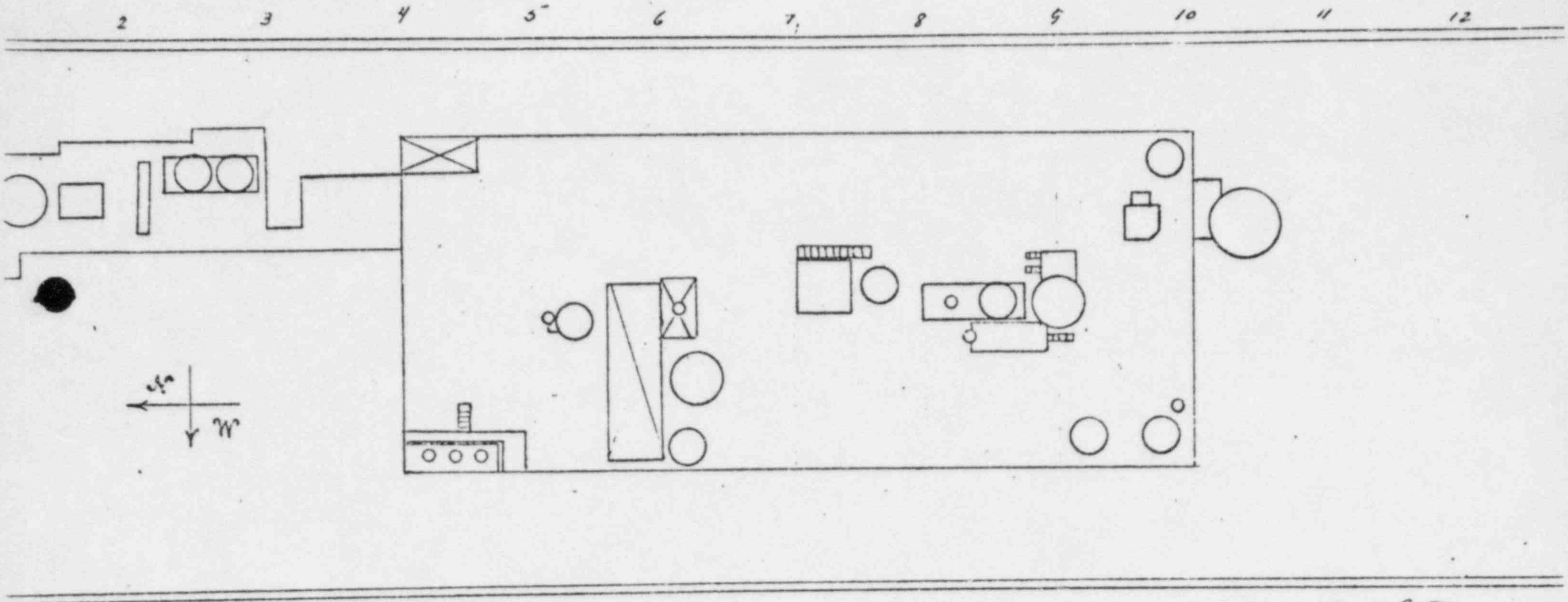
BLGD # 3 4-15-69 [signature]





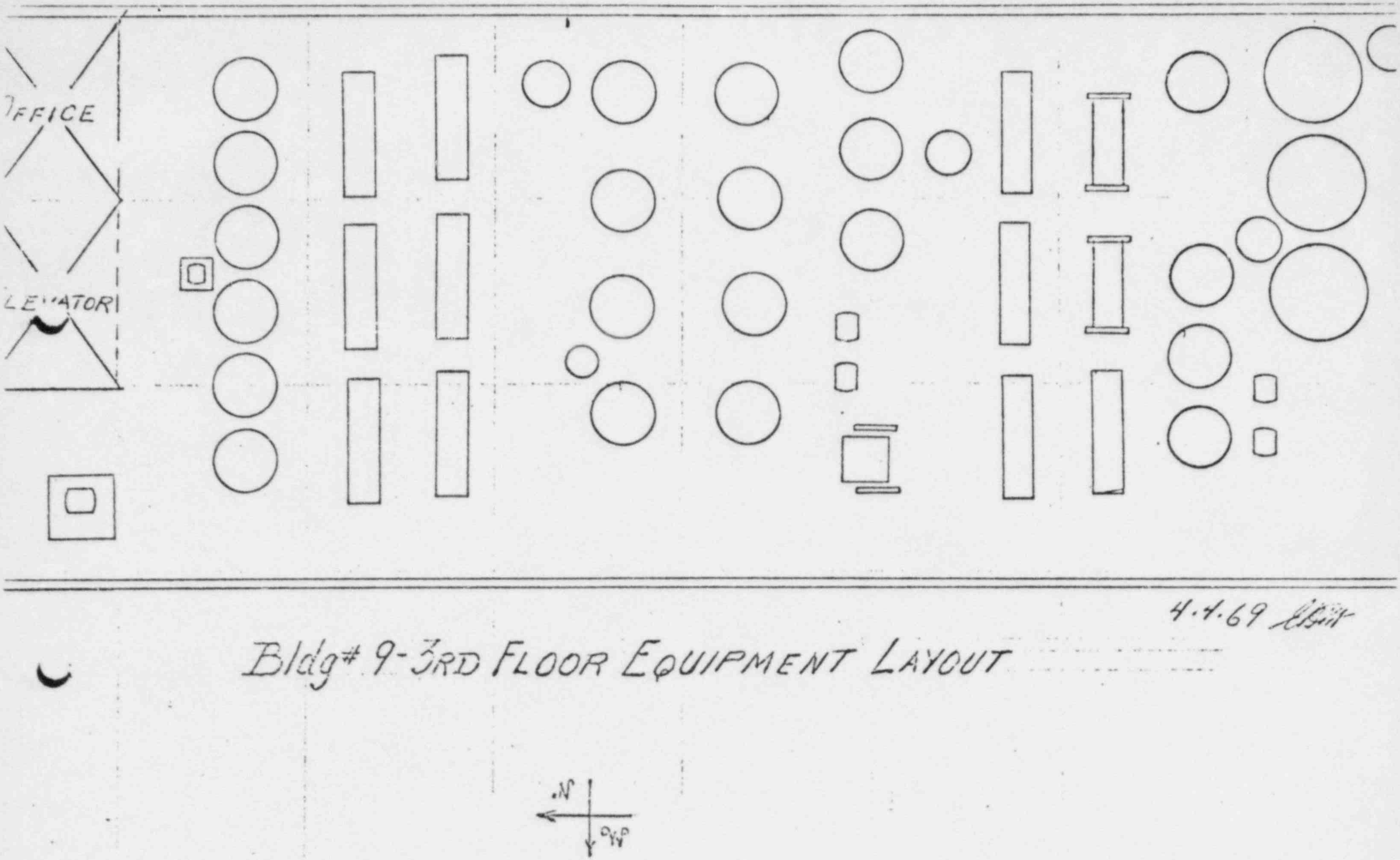
4·7·69 [signature]

BLDG #2 MAIN FLOOR EQUIPMENT LAYOUT



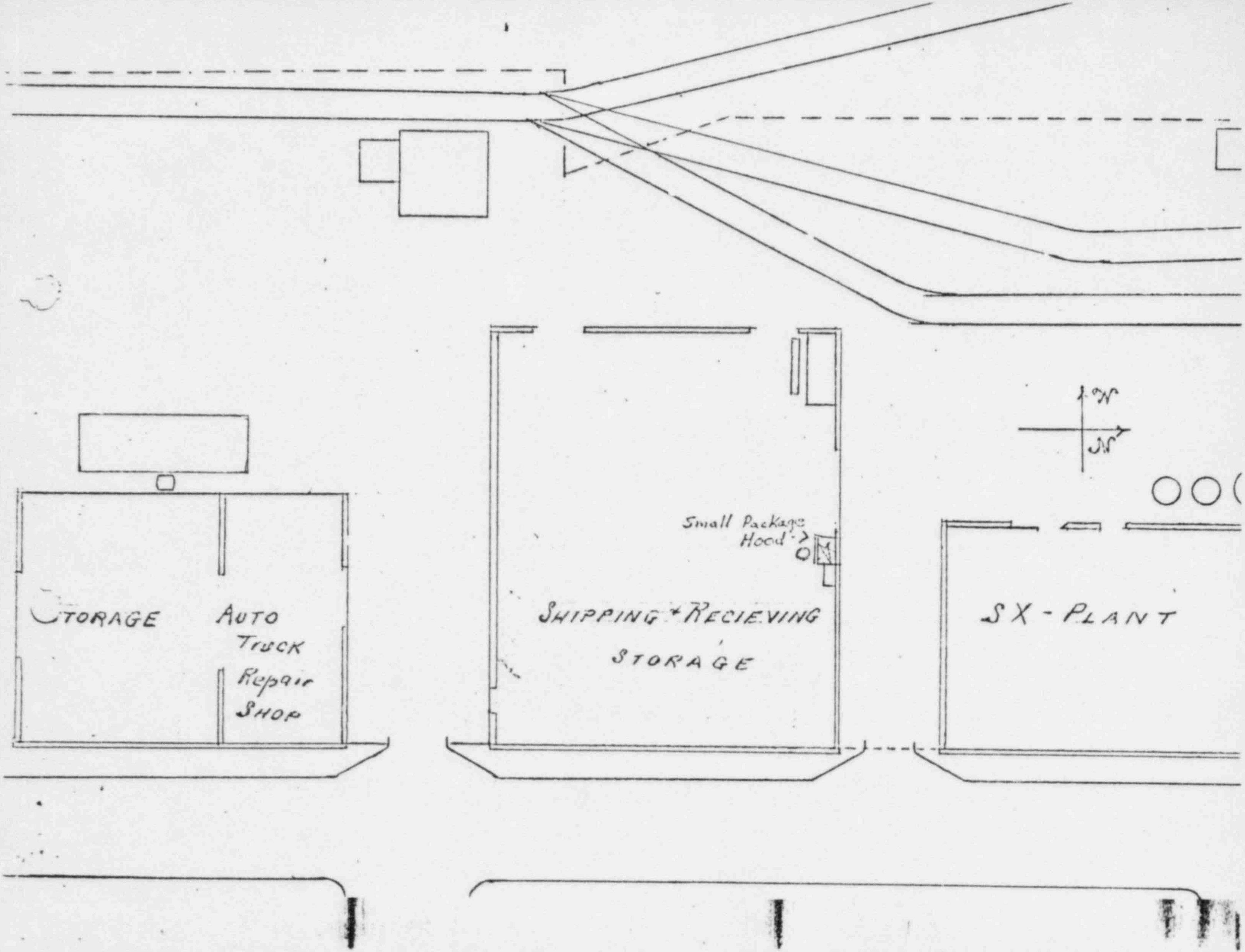
4.7.69 EBN

BLDG #2 BALCONY EQUIPMENT LAYOUT



4.4.69

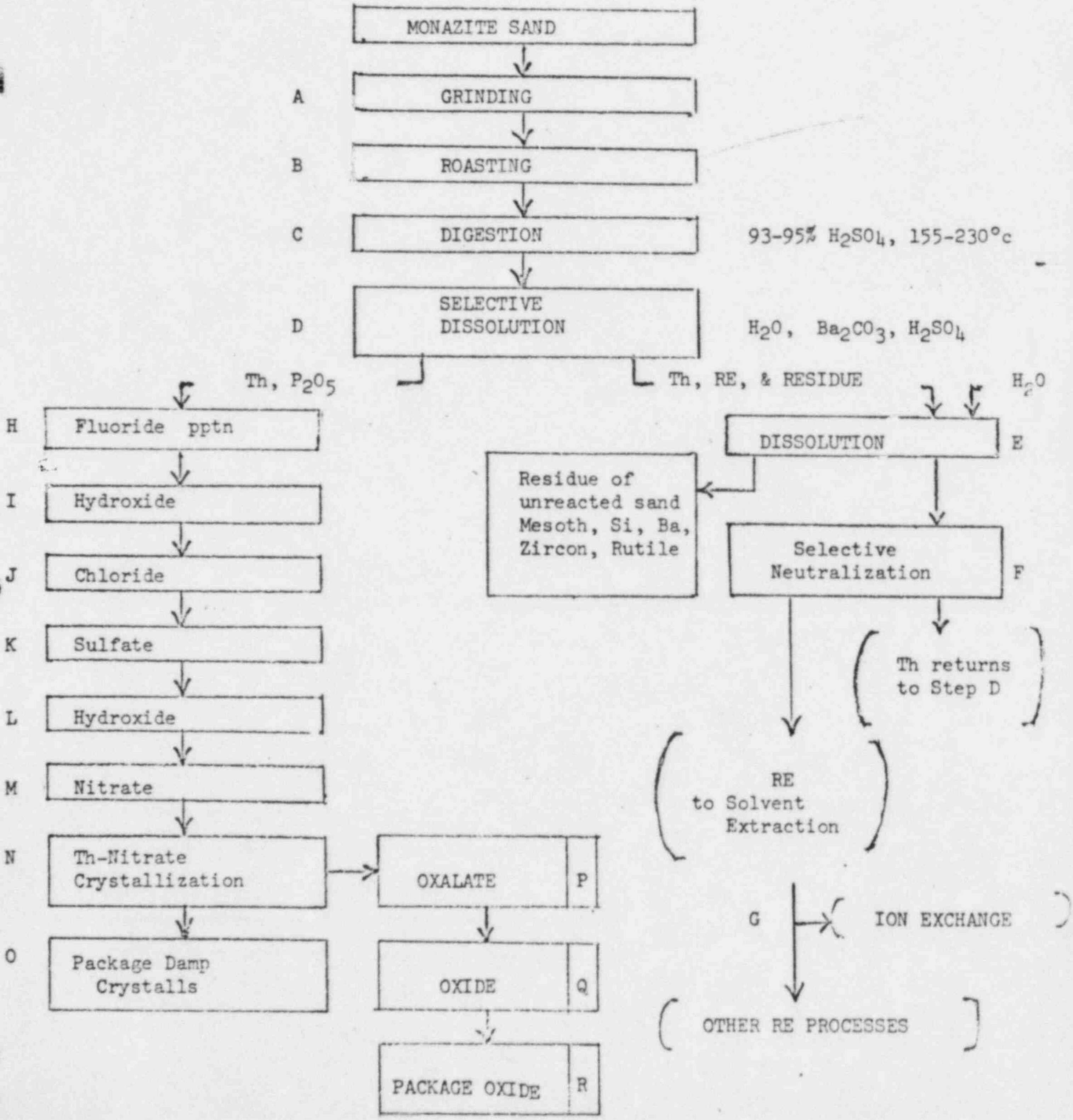
Bldg# 9-3RD FLOOR EQUIPMENT LAYOUT



N
N
Small Package Hood
Storage
Auto Truck Repair Shop
Shipping + Recieving Storage
SX - Plant

8. (A flow diagram (the plant production operation, and a diagram of the plant layout, indicating areas and points in the process where dust is generated).

Our process is essentially the sulfuric acid method for extracting Thorium from Monazite ore.



9. (A description of dust collection and ventilation equipment that are utilized during plant operation, including type, capacity and location of such equipment, eg., ore transfer points, crushing, grinding, etc., and an analysis of the efficiency of the equipment as designed to control or prevent the release of airborne radioactivity to the environs.)

Dust collection equipment is indicated on the floor plans by a star (*). The star indicates the point of operation where airborne radioactivity is generated and thence collected.

A. At present we do not grind the ore, however we may at a future date. The grinding operation will be provided with veniliation control and dust collecting equipment which will prevent an airborne radioactivity exposure in excess of part 20 limits for the operator or operators who attend the operation and for unrestricted areas.

B. At present we do not roast the ore, although we do have equipment for doing this, and we may roast the ore in the future. (See floor plan titled "Sand Roasting Shed-Bldg. 4A". A Dracco 52 bag collector and a Schneible Multiwash Scrubber are located on the roof of Building 4A. Dust laden air is filtered through the bag collector. The filtered air then passes through the scrubber and the dust free air is then discharged to the atmosphere. The system loading is approximately 12,500 C.F.M. The air relocities at the various hoods (*) have a minimum of 125 F.P.M. Capture velocity is approximately 100 F.P.M. During past operations several hundred air samplings have been taken resulting in no overexposures for any of our personnel.

C-1 Roasted, or non-roasted ore is placed into a Monazite sand hopper (See floor plan titled "Bldg. 9 1st Floor Area"). The ore is lifted to the 4th floor by a bucket elevator. The sand hopper is hooded and ducted to a Dracco 3-compartment No. 40 bag collector which is located on the 4th floor roof.

The elevated ore is discharged into a surge bin. (See floor plan "Bldg. 9 Forth Floor Equipment Layout"). The surge bin discharges into charging buckets positioned on a weighing scale. This operation is enclosed in a hood ducted to the dust collector.

Air velocities at the face of the hoods are:

1. 1st Floor Sand Hopper Hood 135 F.P.M.
2. 4th Floor Weighing Station 110 F.P.M.

Capture velocity is approximately 75-100 F.P.M., and the system loading is approximately 8,000 C.F.M.

Hundreds of air samplings have shown no excessive exposures to airborne radioactivity for our personnel working at the sand hopper or weighing station.

C-2 The charging buckets are emptied into reaction pots containing sulfuric acid and this forms a wet paste. Acid vapors and gasses from the reaction are ventilated from the pots, scrubbed in Ducon type VW-3 centrifugal wet scrubbers and then passed through a water scrub shelf tower before being discharged to the atmosphere.

From this point through many process steps there is no significant airborne radioactivity problem.

K (Flow diagram Step K - Thorium Sulfate)

This part of the process is described here because we propose to install an additional scrubber in our system to eliminate a minor air-pollution problem.

Thorium sulfate is slowly crystalized from a Thorium Chloride solution using mild air agitation. Water vapor containing a small amount of hydrochloric acid is evolved. This vapor has been ventilated to the atmosphere through our general purpose process exhaust system which discharges 80 ft. above ground.

Once the scrubber is installed our general plant exhaust system discharge will be almost completely water vapor and air.

N. (Flow diagram Step N - Thorium Nitrate)

This part of the process is serviced by a scrubber. (See floor plan "Bldg. 9 2nd Floor Equipment Layout")

Thorium nitrate feed solution is evaporated in kettles to concentrate the solution. Upon cooling, crystals of thorium nitrate are formed. During the evaporation water vapor containing oxides of nitrogen are evolved. The kettles are completely enclosed in a hood which is ventilated to a packed tower scrubber with a caustic scrub to remove the small amount of nitrogen oxides. The scrubber discharges into our general process exhaust system.

The scrubber loading is 4300 C.F.M. and air velocities measured at the opened inspection door in the hood panel are greater than 200 F.P.M.

P,Q & R (Flow diagram Steps P, Q & R - Thorium Oxide)

(See floor plan "Thorium Oxide Rooms - Bldg. 3")

Damp thorium nitrate crystals are dissolved in water and oxalic acid added to precipitate thorium oxalate. This slurry is filtered and the damp cake is spred on trays and dried in a tray drier. The water vapor is vented directly to atmosphere.

The trays of dried oxalate are placed under a hood and the chemical is scooped into ceramic ignition saggers. The saggers are placed into a muffle furnace where the oxide is formed. A slot hood shroud is fixed around the furnace door to remove dust which may occur during loading and unloading the furnace.

After ignition and cooling the saggers are dumped into a blending drum. A slot hood removes dust generated when dumping. After blending, the blending drum outlet valve is alternately opened and closed to fill the final package. A dust vent removes dust during packaging.

The various hoods and vent used in these operations are ducted to a Brady Dust Filter Model 1375.

The air velocities at the face of the various hoods is as follows:

Dried Oxalate Hood	300 FPM
Furnace Slot Hood	300 FPM
Saggers Dumping Hood	130 FPM
Packaging Dust Vent	Above 300 FPM

System loading is approximately 6100 CFM.

The Brady dust filter collector is located 60 yards north of the Building 3 thorium oxide room. It is contained in a separate room as shown on the drawing titled "Bldg. #1 Floor Equipment Layout".

10 & 11 (A description of the survey program which is followed to determine concentrations of airborne radioactivity within the plant, including the make, model number and capacity of sampling devices, and your procedure for sample analysis. Include a description of :-

a. Each sampling location in respect to operating personnel.
b. Each sampling location in respect to process operation.
c. The frequency (for a & b)
d Surveys made during maintenance operations.)

Concentrations of airborne radioactivity within the plant are determined for the following:

A. Breathing zone of the operator while at the point of operation where dusty radioactive material is handled.(5 minute air sample)

B. Specific work area the operator occupies when not at the point of operation. (1 hour air sample)

C. General plant areas which the operator or others may occasionally or frequently occupy. (1 hour air sample)

D. During maintenance of thorium processing equipment containing dusty material.

Many of our operations are quite sporadic. Air samplings are not taken at the point of operation during down time. General air samples are obtained however, in each building and on each building floor which contains thorium operations, unless these areas are shut-down and only rarely occupied. A general air sampling is also made in a non-thorium operating area for "background" information. General air samples are taken monthly.

Breathing zone, point of operation air samples are indicated by solid circles on the attached floor plans. These samples are taken at one-half of the points shown every other week in such a manner that a sample is taken at each point once each four weeks, except at those points where no operations are conducted during the four week period.

A specific work area sample is taken whenever a breathing zone sample is found to contain more than 3 x 10-11 uc/ml natural Th, 7 x 10^{-10} uc/ml Ra224, 1 x 10^{-7} uc/ml Bi212, or 3 x 10^{-7} uc/ml Rn220. Under these circumstances we document the operators time in the various areas he occupies, and calculate his potential 40 hour exposure.

Upon learning that maintenance work is needed on equipment containing radioactive material an assessment is made of the particular job in question. If it is determined that a potential airborne contamination problem could exist then an air sampling program is established after all efforts are made to minimize the problem.

We have three air sampling devices which were designed and constructed by our personnel. Each sampler has a timer, an air pump, flow meter,

air flow adjustment, and a filter paper holder. The air flow meter is calibrated using a gas meter. The air sampler is set to draw 35 liters of air per minute through a Whatman No. 41 paper which is 1.25 inch in diameter.

We use a gas flow proportional alpha counter in the "windowless" position to analyze our air samples.

Alpha counting is done as follows:

I. In cases where daughter activity is more than negligible and at any new point of operation.

A. The sample is counted 1 hour after sampling.

Our standard formula for computing activity is:

$uc/ml \times 10^{-11} = C/M \times d/c \times 1.29/T \times 1/.7$

Where C/M = counts per minute from the sample.

d/c = disintegrations per count (from alpha standard source)

$1.29\ (x10^{-11}) = 1/22.2 \times 10^{6}$ d/m/uci $\times 3.5 \times 10^{4}$ ml/min

T = Sampling time (minutes)

1/.7 = Filter paper absorption factor

At this point in time the Rn^{220} has died off and most of the alpha count is due to Bi^{212}.

Using the standard formula compute the gross activity.

B. The sample is counted again 10.6 hours after sampling. This is a half-life of Pb 212 and half of the Bi212 is also gone both of which at this point are the result of 1/2 of the Rn220 originally present.

1. The standard formula times 2 = Rn220 activity

2. To obtain the Bi212 activity the standard formula calculation is multiplied by 0.9 and this product is subtracted from the gross activity found in A, and the difference is multiplied by 2.

C. The sample is counted again 106 hours after sampling.

This is 10 half-lives of Pb212 and all of the short lived daughters originally present are gone.

The standard formula is calculated and divided by 1.7=Ra224 activi

D. The sample is counted again 465 hours after the sample was taken. At this point an apparent equilibrium has been established and we have nearly 6 alpha activity which is close to the amount at secular equilibrium.

$$\text{Th(nat)activity} = \frac{\text{Standard formula} - .1\ \text{Ra224 activity}}{5.9}$$

II. In cases where daughter activity is negligible counting is done 106 hours after the sample was taken.

The standard formula is divided by 6 to obtain the Th(nat)activity.

III. Each day the alpha standard is counted to assure that the counter is reliable.

Sample and background counts are properly taken to assure a 95% confidence level. We should detect a minimum of $9X10^{-11}$ uc/ml Rn220 and/or Bi212. For Th(nat) we should detect 2×10^{-12} uc/ml, and for Ra224 7×10^{-11} ux/ml. This applies to a 5 minute sample time. An hour sample would show at least 10 times greater sensitivity.

12. (A description of the procedure followed in determining the average daily and weekly exposures to airborne radioactivity for each employee who frequently or occasionally occupies areas where air contamination exceeds M.P.C. values specified in 10CFR 20)

We are not now using any operation which continuously causes an airborne concentration in excess of 3×10^{-11} uc/ml of natural thorium in a restricted area during a 40 hour work week outside of ventilation control equipment.

There are a few operations which may for short periods of time exceed 3×10^{-11} uc/ml of natural thorium in the air at the point of operation. Thus there is a possibility that on a 40 hour basis an airborne concentration greater than 1 M.P.C. might exist.

Whenever a 5 minute operators breathing zone sample shows greater than 3×10^{-11} uc/ml of natural Th the operators time at the point of operation is calculated. A 1 hour air sample is taken in the environs of the area where the operator spends most of his time. The time weighted exposure including the breathing zone sample and general air sample is calculated. If the calculations show that an average of 1 M.P.C. could be exceeded during a 40 hour work week then immediate steps are taken to correct the problem. If ventilation control equipment is found deficient it is repaired. If the operators handling methods are improper he is re-instructed. As a last resort employee rotation may be used.

It is extremely rare that a general area air sample exceeds 1 M.P.C. and these operating areas are occupied so little by personnel, other than the operator, that we do not propose to document the time of an occasional occupant.

13. (If treatment or disposal of licensed material by incineration is anticipated, an application should be made in accordance with 10CFR20 sec. 20.305).

In conformance with 10CFR20.305 we request that our license include a provision enabling us to incinerate Monazite ore bags and other combustable trash.

We are confident we will not exceed the airborne concentration limits for unrestricted areas for natural thorium when averaged over a year.

We will use a hand fed Model Co-200 multiple chamber incinerator equipped with a gas after burner which was built by the C.O. Hendrikson Company. The following data applies:

a. Trash burning capacity of incinerator - 200 lbs/hr.
b. Exhaust gas volume in stock corrected to 70°F - 300 C.F.M.
c. Stack height - 30 ft.
d. Particulate emission-0.17 grains per standard cubic foot.
e. Expected maximum operating time - 10 hrs/wk.
f. Micro curies (Th(nat) of exhaust gas within stack-$8x10^{-12}$ uc/ml (corrected to 70°F)
g. Expected yearly average concentration of Th(nat) within stack gas - 0.46 M.P.C. (Background neglected).
h. Ash & residue (Monazite sand) - 20% of trash weight.
i. Thorium content of ash & residue - 6% (1.2% of trash weight).

Before incineration the operator will clean out the ash from the previous days burning. This will assure that the ask is cold thereby minimizing airborne material. The ash & residue will be placed in boxes or drums and stored on our property for possible reclaiming of values.

The operator will then load and operate the incinerator.

X [An hour air sample will be taken in the general breathing zone area of the operator during the time he is cleaning the incinerator, packaging the ash, and operating the incinerator. We will monitor the exhaust discharge by isokinetic sampling within the stack and record the results.] X

In the beginning the air sampling will be done each time the incinerator is used. After sufficient data is obtained, the sampling frequency may be reduced. The reduced frequency will be adequate to assure compliance of the regulations.

14. (A description of plant discharge stacks including stack heights, types and concentrations of effluents discharged, method for controlling release of radioactive material, and methods for determining the concentration of radioactive material released to the environs.)

We have a total of 10 stacks which service our Thorium operations. These are:

1. Bldg. 9-General purpose process exhaust system, 3rd floor roof
This stack is 80 ft. from ground level. Many processing tanks are connected to the general exhaust system. These tanks are all part of the "wet" process. On an average, only trace amounts of SO_2, HF, NO_x, NH_3, H_2S are present. When the new scrubber is installed (as described in Section 9K) the minor air pollution problem with HCl and Cl_2 will be eliminated. The discharge from this stack will then be almost entirely air and water vapor..

2. Bldg.9-Dracco Dust Collector Stack, 4th floor roof
This stack is approximately 130 ft. high. This equipment is described in Section 9C-1 of this letter.

During operation, once every other week, hour long air samples are taken at the point of discharge and other areas on the roof. Most of the time the air sample results are well below 1 M.P.C. Th(nat) for unrestricted areas. On a rare occasion it will be discovered that the discharge shows higher radioactivity than usual and corrective maintenance is then done to correct the situation.

3. Bldg. 9-Water Scrub Shelf Tower, 4th floor roof
This equipment is described in Section 9C-2 of this letter. The discharge from this tower is 120 ft above ground level. A trace of SO_2 may be evolved from this tower.

4. Bldg. 3-Thorium Oxide Process Oxalate Precipitation
The kettles used to dissolve damp nitrate and precipitate the oxalate are enclosed in a hood which is vented by a stack 30 ft. high. The stack discharges water vapor. (See Section 9 P,Q,&R).

5. Bldg. 3-Thorium Oxalate Drier
The oxalate drier (See Section 9 P,Q,&R) stack vents water vapor and products of natural gas combustion at a height of 30 ft. from ground level.

6. Bldg. 3-Muffle Furnace
The furnace (See Section 9 P,Q,&R) exhaust stack discharges CO_2 and gas combustion products at a height of 30 ft.

7. Dust Collector for ThO_2 Process - Bldg. 3
The collector stack discharges at a height of 40 ft. above ground level. Air sampling similar to that described above (2) for the Dust Collector stack on the 4th floor roof is performed.

8. Ore Roasting - Bldg. 4A
As described in 9B, the ore roasting equipment is serviced by a dust collector and a wet scrubber. This combination very effectively removes dust before the ventilation air is discharged from the scrubber stack which is approximately 60 ft. in the air. Air samples are obtained on the roof of this building.

9. Incinerator
See Section 13 for details.

10. Shipping Warehouse Small Package Station
Occasionally we need to make small packages of Th nitrate or oxide. The radioactive material is handled within a dust collector hood with the operator outside. The collector is a Torit Model 124 bag collector. The clean air discharged 10 ft. above ground through a wall of the building. Loading is 2800 C.F.M.

As a double check on our dust collection effectiveness we take air samples around the periphery of our plant property. This is done four times a year and at least six air samples are taken. Also, on a weekly basis outside air samples are collected east and west of our plant at a distance of approximately one-half mile.

Roof top samples, fence line samples and remote samples over the past few years indicate we are not exceeding regulations covering airborne radioactivity in unrestricted areas.

15. (A description of the method for determining exposures of employees to external radiation. For film badge studies, indicate number and category of personnel involved in the program.)

A film badge program is used to determine the exposure of employees to external radiation.

All Chemical operators, laborers, maintenance men, and immediate supervisors of these employees are required to use film badges. Laboratory and other personnel who either work with or frequently visit areas where radioactive material is handled or stored also are required to use film badges. Persons whose duties are not likely to involve them with radioactive material handling, and who seldom visit operating or storage areas are not required to use film badges.

Chemical operators and laborers who are considered "thorium handlers" are on a weekly badge service to minimize the possibility of over-exposure. All other personnel in the film badge program are on a monthly badge service schedule.

(4/69) 23 weekly 105 monthly

We currently have 23 persons on weekly badge service and 105 on monthly service. These numbers will vary depending on production manpower requirements.

At a minimum, Gamma meter surveys are conducted during the time that monthly general air samples are obtained. Records of these surveys are made.

16. (A description of your methods for contamination control, including provisions for monitoring and the levels of contamination at which decontamination is performed.)

Our housekeeping program includes wet scrubbing of the floors daily in areas where thorium containing material is handled. In the case of a spill, the operator is instructed to clean it up as soon as practical. The level at which decontamination is necessary is that amount which is visible to the eye. A monitoring survey for surface contamination, therefore, is essentially a visual inspection. Survey meters are used to distinguish between radioactive and non-radioactive contamination.

Personal protective equipment provided for employee use when needed includes hard hats, safety glasses, chemical goggles, face shields, plastic jackets and pants, rubber safety shoes or boots, assorted glove types and styles, dust and fume respirators, and other miscellaneous equipment.

Shower and locker room facilities are available for all operating personnel. A clothes washer and dryer is also available. These people are instructed to bathe or wash thoroughly after their work shift. They are also instructed to promptly wash off any thorium material which may accidently spill on their skin.

17. (A copy of the written radiological safety operation instructions supplied to employees. These instructions should include provisions for personal hygiene, including washing prior to eating or leaving the plant, instructions for wearing personnel monitoring devices, and instructions for cleaning up dust and spills within the plant.

See enclosed "Radioactivity Statement" and Page 18 of booklet titled "General Safety Rules and Safe Procedures".

RADIOACTIVITY STATEMENT

General Instructions for Handling Radioactive Materials in the West Chicago Plant

Employees of American Potash & Chemical Corp. are hereby informed of the occurrence of radioactive materials and radiation in the West Chicago Plant.

The Corporation is required by law to explain the safety problems associated with handling radioactive materials. In a sense there are no safety problems concerning radioactivity in the plant. That is, careful observations have failed to show any employee has ever been injured by radioactive material during the nearly sixty years this plant has operated. The reason for this is that radioactivity is present at levels very low compared to those known to be harmful. The exact level at which radioactivity becomes harmful has not yet been determined. Scientists are in universal agreement that exposure of normal persons to radioactive material produces no beneficial results. Consequently, the Atomic Energy Commission (AEC) has set very low levels of radiation and of airborne concentrations of radioactive material to which persons handling licensed material such as thorium may be exposed. The Corporation provides equipment such as hoods with forced draft ventilations, dust masks, gloves, etc., and follows good housekeeping procedures such as sweep-downs and wash-downs. No employee exercising common sense should ever receive radiation in excess of the limits permitted by the AEC, or be present in concentrations of airborne radioactivity in excess of permissible limits.

By observing some simple rules, an employee can keep his exposure well below even the very low limits allowed by the AEC. The basic principle is to avoid unnecessary contact with radioactive materials, such as monazite ore or thorium concentrates. Following are some of the ways of cutting down on exposure:

1. Most Important— Avoid any dust unnecessarily.
2. Wear a dust mask faithfully on the operations and at the times required. Your foreman will instruct you as to when to wear, how to wear, and how to care for your mask.
3. Do not make unauthorized visits to dusty operations.
4. Do not rest on monazite bags or drums of thorium or even stay next to them unnecessarily.
5. If material is accidentally spilled, clean it up as soon as practical; or if you are in doubt as to proper procedure, tell your foreman. If the material can be recovered by sweeping it up, avoid raising dust. Spilled solutions are to be hosed down. If a thorium solution or powder is accidentally spilled on your skin, wash it off before doing anything else. Other material should be washed off as soon as practical. Spilled thorium oxide powder is a special case and is to be vacuumed up, unless the amount is so large as to make this impractical. For example, if a bottle of thorium oxide should break, it would be better to carefully shovel the bulk of it up while wearing a dust mask and gloves. After vacuuming, the area is to be wet-mopped with soap and water. Discharge the used water to the waste drain.
6. When you leave your work station, wash your hands thoroughly, especially before eating.
7. Your badge measures the radiation you receive from external sources. Wear your badge faithfully. Avoid splashing material on it.

Should you ever be exposed to more radioactivity in this plant than permitted by the AEC, you and the AEC will be so informed in writing by the Corporation as required by law. Such notice will not indicate that you have been injured in any manner. If there are any over-exposures in this plant, they will be slight. Also, the AEC has stated that considerably higher exposure limits than those permitted would not result in excessive hazards. The notifications serve as checks on the efficiency of our radiation protection program. It is good common sense for you to do your part to limit your exposure and that of your fellow worker to such low levels that we never have an over-exposure.

AMERICAN POTASH & CHEMICAL CORPORATION

I have read the above statement concerning radioactivity at the West Chicago Plant.

Date:______________________ Signature:______________________

1. (A detailed description of your organization, including authority and responsibility of each level of management and/or supervision in regard to development, approval, and adherence of operating procedures.)

The authority and responsibility for developing our operating procedures is assigned to our Technical Services Department. Approvals are required by the Manager, Technical Services; Manager, Plant Engineering; Manager, Manufacturing; Safety Engineer; Manager, Production and General Manager. A safety committee review of the procedure is made prior to approvals.

The General Foremen and line supervisors have the responsibility of assuring adherence to the operating procedures. As an aid to the supervisor, safety inspections are conducted by committees and individuals. Processes are reviewed as required by the Technical Services Department.

2. (The qualifications and experience of the personnel in your organization assigned the responsibility for developing, conducting and administering the radiation safety program for the plant.)

The responsibility for developing, conducting and administering our radiation safety program is with our Radiation Safety Officer. This person is titled "Safety Engineer." He has a degree in chemistry and has several years experience in the inorganic chemical and chemical engineering fields. He has over 7 years experience in Safety Engineering. He has received formal training in the field of health physics from the U.S. Department of Health Education & Welfare by completing their courses titled "Basic Radiological Health" and "Occupational Radiation Protection".

Reporting to the Safety Engineer is a "Radiation Hygenist". This person has received formal training in health physics by completing courses in radiation detection and measurements and radioisotope chemistry at Aurora College, Aurora, Illinois.

We use the services of a consulting organization named "Health Physics Associates Ltd".

Our supervisors have a minimum of a high school education and report to chemists or chemical engineers. Supervisors receive Safety and Radiation Protection training.

3. (A description of the area in which the plant is located, including the size of nearby inhabited areas, location of wells, streams and rivers, flood stage levels of streams and rivers, and sources of water supply for the plant. A topographical map with the above identification is preferred.)

A composite USGS topographical map is attached as Exhibit I. The map is made up of portions of the West Chicago and Naperville, Illinois quadrangles in which the City of West Chicago and properties of the Rare Earth Division, American Potash & Chemical Corporation lie. The extent of the latter properties and the location of municipal and Division water supply wells are delineated on a transparent overlay positioned on the map.

The Division's physical plant is located on the southwest side of the City of West Chicago. Several private homes border the property on the north and east, and the Elgin, Joliet & Eastern RR borders it on the west. Other private homes are located to the west of the railroad property.

The elevation above sea level of the municipality ranges from 730 feet to 784 feet, the latter being the elevation at the West Chicago City Hall. The elevation of the Division's property is from 750 feet at the main plant location, on the north, to slightly under 730 feet in the disposal area, on the south.

The principal streams within a five mile radius of the plant are the Du Page River (west branch) on the east and Kress Creek on the west and south. The latter flows into the Du Page about two miles south of the plant. At their closest points, the Du Page River is one mile from the Division's disposal ponds and Kress Creek, one half mile. Both streams flow in a southerly direction.

The streams have no history of serious flooding. According to one authority (U.S. Corps of Engineers) the highest level or elevation on record for the Du Page River as measured at the gaging station at U. S. Highway 64, two miles north of the City, is 728.1 feet reached in June, 1967. There are no corresponding figures available for the Du Page at the sewage treatment plant, southeast of the City, or at its confluence with Kress Creek, but the same authority estimated that these would have been much lower.

4. (A description of the method for restricting both the plant and waste disposal area from unauthorized entry.)

Our plant and waste disposal areas are surrounded by cyclone type fencing. Gates in the fence are kept locked except when in use. Our employee and visitor entrance doors are open during business hours and a clerk-receptionist controls the entry of individuals. These doors are locked after business hours and only responsible persons can gain entry by using special keys issued for this purpose. Watchman tours are conducted during non-business hours. Watchclock key stations are located within the plant, out-of-doors, and in various out buildings. A record of the watchman tours is obtained from the watch-clock tape.

5. (A description of your waste disposal procedures. Where retention systems such as levees, dikes, ponds, etc., are used to prevent the release of liquid or solid waste containing radioactive material to offsite areas, describe the retention capability and integrity of the system, conditions that might lead to accidental release of the waste, the environmental effects of such a release and your program of inspection and maintenance to prevent such accidental occurences. This description should also include drawings showing the layout, heights, top width, side slopes, freeboard, seepage control, protection of embankment surfaces, foundation design, typical cross-sections, characteristics of fill material and a discussion of construction methods and specifications.)

Solid trash type waste which may be contaminated with Thorium material is kept separate from non-contaminated refuse. Monazite ore bags and a very small amount of other combustible material are burned in our incinerator. Non-contaminated refuse and scrap, and decontaminated scrap, are removed from our premisis by a scavenger service.

All scrap equipment which has been used in Thorium processing operations is surveyed and if needed, decontaminated to levels below the limits set forth in an A.E.C. document titled "Radioactivity Contamination Limits for Abandonment of Facilities and Equipment" as follows:

RADIOACTIVITY CONTAMINATION LIMITS FOR ABANDONMENT OF FACILITIES AND EQUIPMENT

1. The maximum amount of fixed alpha radioactivity in disintegrations per minute per 100 square centimeters on buildings or equipment should not exceed 25,000.

2. The average amount of fixed alpha radioactivity in disintegrations per minute per 100 square centimeters on buildings or equipment should not exceed 5,000.

3. The maximum amount of removable (capable of being removed by wiping the surface with a filter paper or soft absorbent paper) alpha radioactivity in disintegrations per minute per 100 square centimeters on buildings or equipment should not exceed 1,000.

4. (a) The maximum level at one centimeter from the most highly contaminated surface of a building or piece of equipment measured with an open-window beta-gamma [illegible]

not more than seven milligrams per square centimeter should not exceed one millirad per hour.

(b) The average radiation level at one centimeter from the contaminated surface of the building or equipment measured in the same manner should not exceed 0.2 millired per hour.

5. The contamination limits for abandonment of facilities involving U-233, or Plutonium should not exceed 1/10 of the limits in items 1, 2 and 3 above.

Solid chemical residue composed mainly of Silica, unreacted Monazite, Zercon, Rutile, Calcium and Barium sulfate, and other gangue is piled on the ground in our waste disposal area at the south west corner. This material is of a very sticky, pasty nature which dries to a hard cake. It does not have a tendency to dust or dry to a powder and is extremely insoluble. This pile does emanate some radiation. Survey meter readings taken at the fence line adjacent to the pile have never exceeded 2.5 mr per hour. The areas south and west of the fence are not inhabited. Parallel to, and about 25 ft. from the west fence is a railroad right-of-way. X

The radiation dosage to anyone on a passing train is negligible. Observations over a period of several years has shown that pedestrians very seldom use the railroad right-of-way. However, if it is assumed that a person makes four trips per day every day at three miles per hour along the 400 ft. of fence in question and that the dose rate is 2.5 mr/hr. The dose received would be less than 0.1 rem per year.

[Pursuant to section 20.105 (a) we request allowance to produce a radiation level in the unrestricted area at the southwest boundary of our waste disposal area of not more than 2.5 mr per hour.] X

Attached as Exhibits II and III are Drawings C-11083-2 and B-12016. These show the Division's property and plant in some detail, and graphically describe liquid waste disposal methods and procedures.

Inorganic liquid wastes generated in plant operations are discharged into surface trenches within the enclosed plant area. These discharge into an underground conduit which in turn discharges into a collecting basin or sump (Bldg. 14). Automatically operated pumps transfer the waste via underground and surface piping to a series of three settling and seepage ponds located approximately 750 feet south of the main plant area. X

Pond No. 1, the largest, is used primarily for settling entrained solids and post precipitates, and receives the pumped waste directly from Bldg. 14. Clarified waste is pumped to either or both Pond Nos. 2 and 3 for seepage and disposal. The level in Pond No. 1 is automatically maintained by the pump, and levels in the other ponds are controlled below the established free board point by manually valving off individual transfer lines.

Surface trenches within the enclosed plant area are constructed of concrete and lined with acid brick. Trenches are generally covered.

Underground conduit, in the most part, consists of 54 inch diameter reinforced concrete pipe lined with acid brick. In transition zones and a few other areas, the conduit is rectangular and again constructed of concrete lined with brick.

The collecting basin or sump is approximately 20 feet deep and has a holding capacity of 50,000 gallons. It is constructed of reinforced concrete and lined with acid brick.

The underground transfer line from the sump (Bldg. 14) to the disposal ponds is a 6 inch rubber-lined, steel pipe. It outcrops in the vicinity of Pond No. 2 and is connected to a 6 inch reinforced rubber hose laid above ground and discharging into Pond No. 1. Similar hoses run from the pumping station on Pond No. 1 to the other ponds.

Pond construction, holding capacity and other data are as shown in Exhibit III, Drawing B-12016.

All parts of the liquid waste disposal system are well inspected and maintained. Trenches, conduit and sump are cleaned and inspected annually, and repaired as indicated. Pumps and piping are checked daily, and transfer lines and ponds are inspected at least once every 8 hour work shift. Ponds are dredged annually to remove accumulated sludges.

6. (A description of the geological and hydrological characteristics which may affect the degree and mode by which liquid wastes may reach underground and/or surface waters. This should include estimates of local evaporation and seepage rates, depth of the local water table and premeability characteristics of underlying material.)

X As shown on the attached Exhibits II and III and described under "No. 5", inorganic liquid wastes are essentially all disposed of in seepage ponds. Some evaporation of the ponded waste takes place but because of climate and humidity conditions it is doubtful that the amount is significant. X

The ground in which the ponds are located consists of several strata of soils having varying degrees of permeability. The most permeable is the coarse sand and gravel stratum which forms the base or floor of the ponds. The uppermost or topsoil has fair to poor permeability, and the clay stratum underlying the gravel has very poor permeability. It is doubtful that much seepage takes place in either of these strata.

Seepage rates vary from 0.2 to 0.5 gal/sq.ft/hour. These appear to be low, considering the permeability of the gravel, but sludge settled in Pond No. 1 or small amounts that may be carried over into the other ponds impede outflow to some degree. Ground water levels also affect seepage. The current ground water elevation, as reported by the Illinois State Water Survey, averaged 726 feet in the West Chicago area. This will vary according to seasons and will be lowest in the fall and highest in the spring of the year.

7. (A description of the liquid effluent survey program[assuming plant effluents reach subterranean or surface water supplies], including the number, location and frequency of check samples and procedures for the sample analysis of natural Thorium and Radium-228.)

Liquid effluent samples are obtained daily. A one quart grab sample is obtained from the overflow hose which drains the settling pond (Pond #1). The sample is taken at the discharge end of the hose immediately before it enters the seepage pond (Pond #2). The seven samples per week are composited into a weekly sample.

The composite sample is allowed to stand until the very little amount of solids settle to the bottom of the jar. A 1 ml sample of the clear liquid is evaporated in a 1.25 inch stainless steel planchet for alpha counting. This sample contains the soluble radioactive material, if any.

The composite sample is then thoroughly stirred, suspending the solids. While stirring, a 1 ml sample is taken and dried in a planchet. This sample contains the soluble and insoluble radioactive material, if any.

The samples are alpha counted (windowless) for 1 hour. A one hour background is counted immediately before each sample, and another background is counted after each sample. Assuming the before and after background counts are reasonably the same, the average background count is determined and deducted from the sample count. Should the before and after background counts not reasonably agree the counting is repeated.

The corrected counts of the sample "soluble only" is deducted from the corrected counts of the sample "soluble and insoluble" the difference being considered to be "insoluble only".

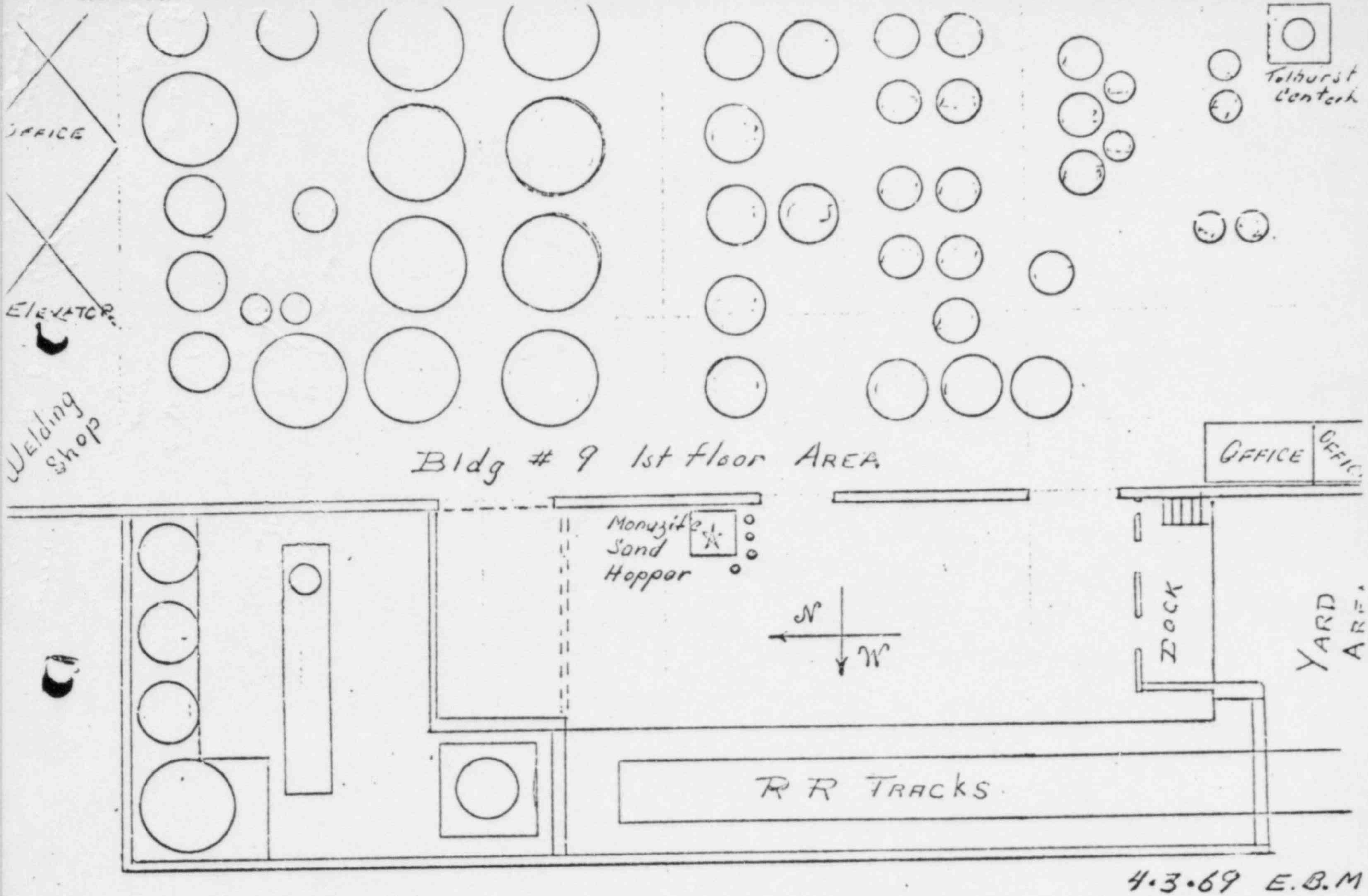
Aged thorium nitrate is dissolved in water to a concentration of 10^{-6}uci/ml. One ml of this solution is dried in a planchet. One hour before and after backgrounds are alpha counted with the thorium reference sample between.

The water sample counting data is corrected for background and divided by the corrected reference sample counts. Results are reported as uci/ml thorium (nat.).

Th nat.
Table II
Col 2.
Sol: 10^{-6}
Insol: 10^{-5}

For a period of over a year during 1967 and 1968, waste effluent was radio assayed on a daily basis. Of 475 daily samples assayed for soluble radioactivity 306 were reported as N.D. and the average concentration was 0.12×10^{-6} uci/ml. The insoluble portion was assayed as well. 285 of the samples for insoluble radiation were N.D. and the average concentration was 0.36×10^{-6} uci/ml.

Most N.D. results reported are equal or very nearly equal to background. Results less than 10^{-7} uc/ml are also reported as N.D.


OFFICE
ELEVATOR
Welding Shop
Tolhurst Centerk
Bldg # 9 1st floor AREA
OFFICE
OFFIC
Monuzite Sand Hopper
N
W
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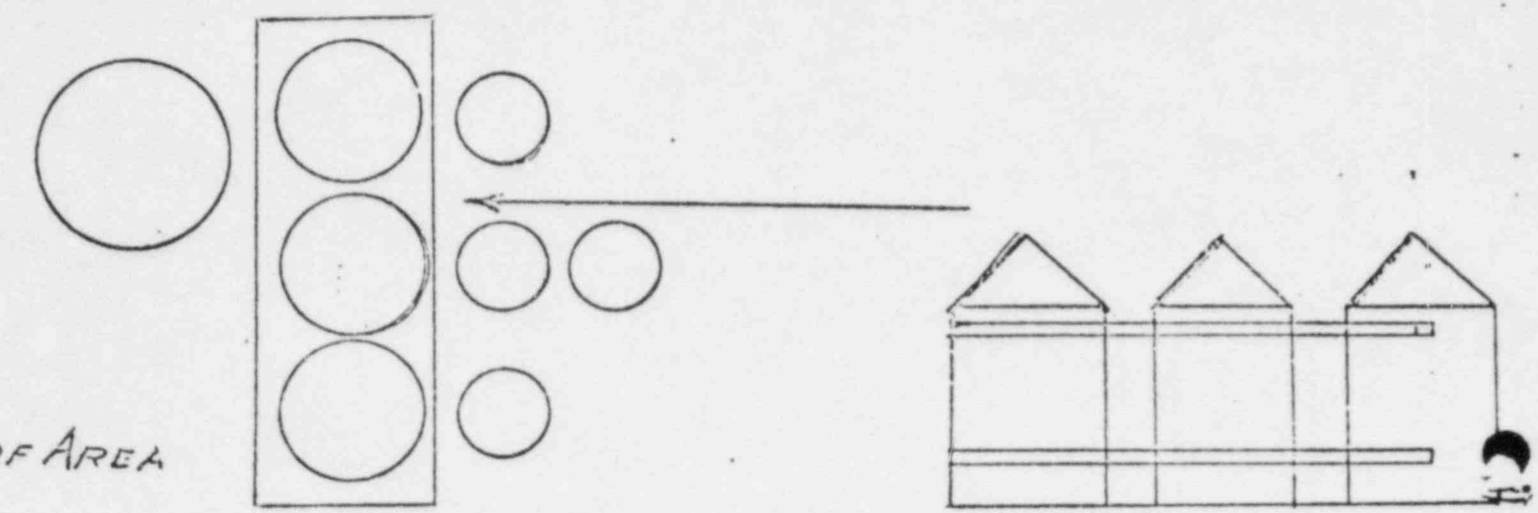
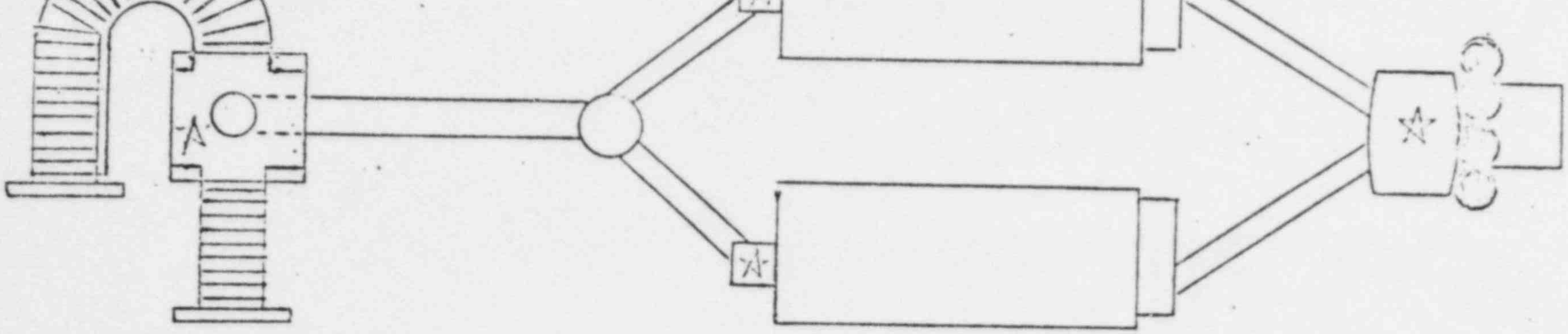
YARD ARE
RR TRACKS
4·3·69 E.B.M

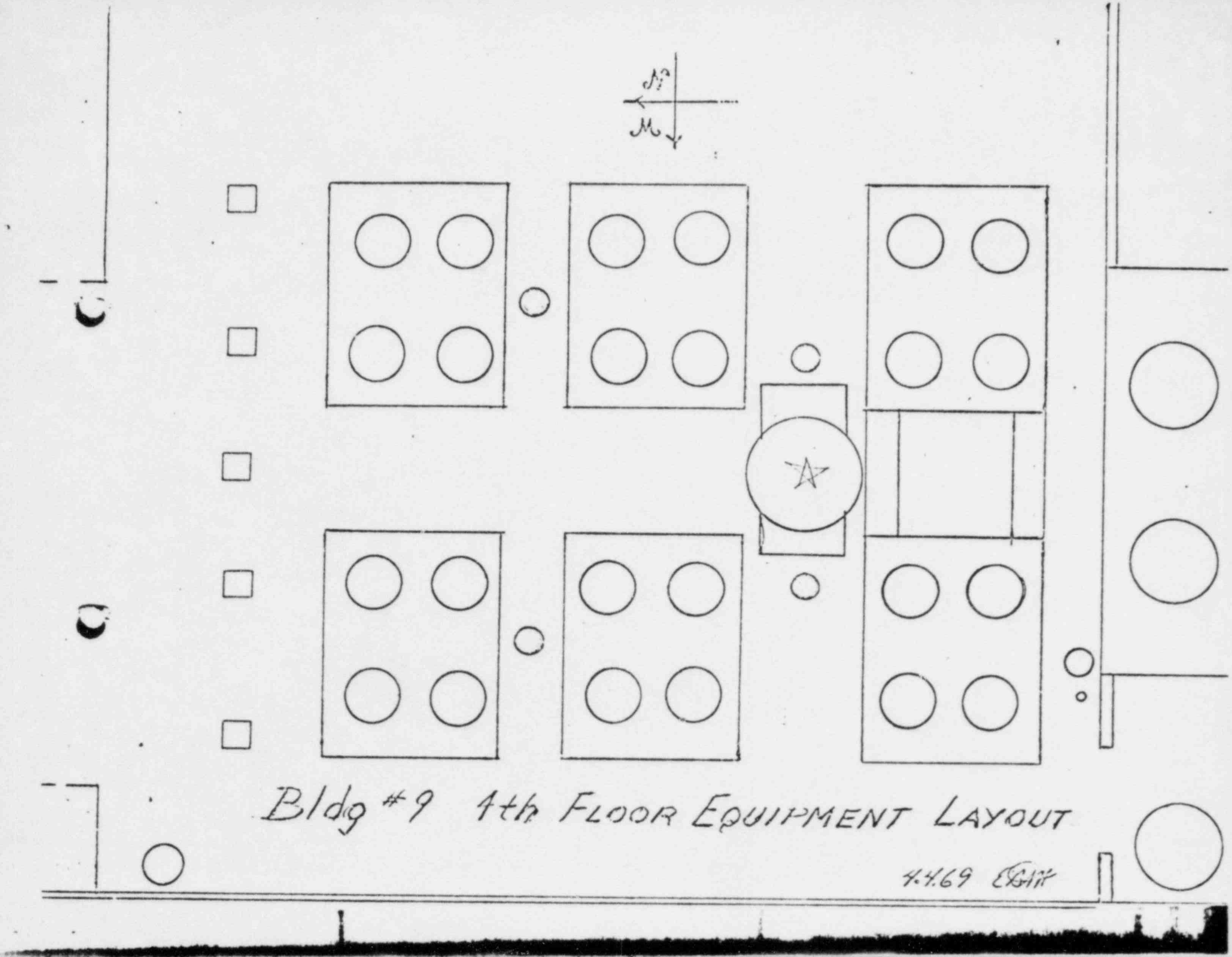


SAND SHED ROOF AREA

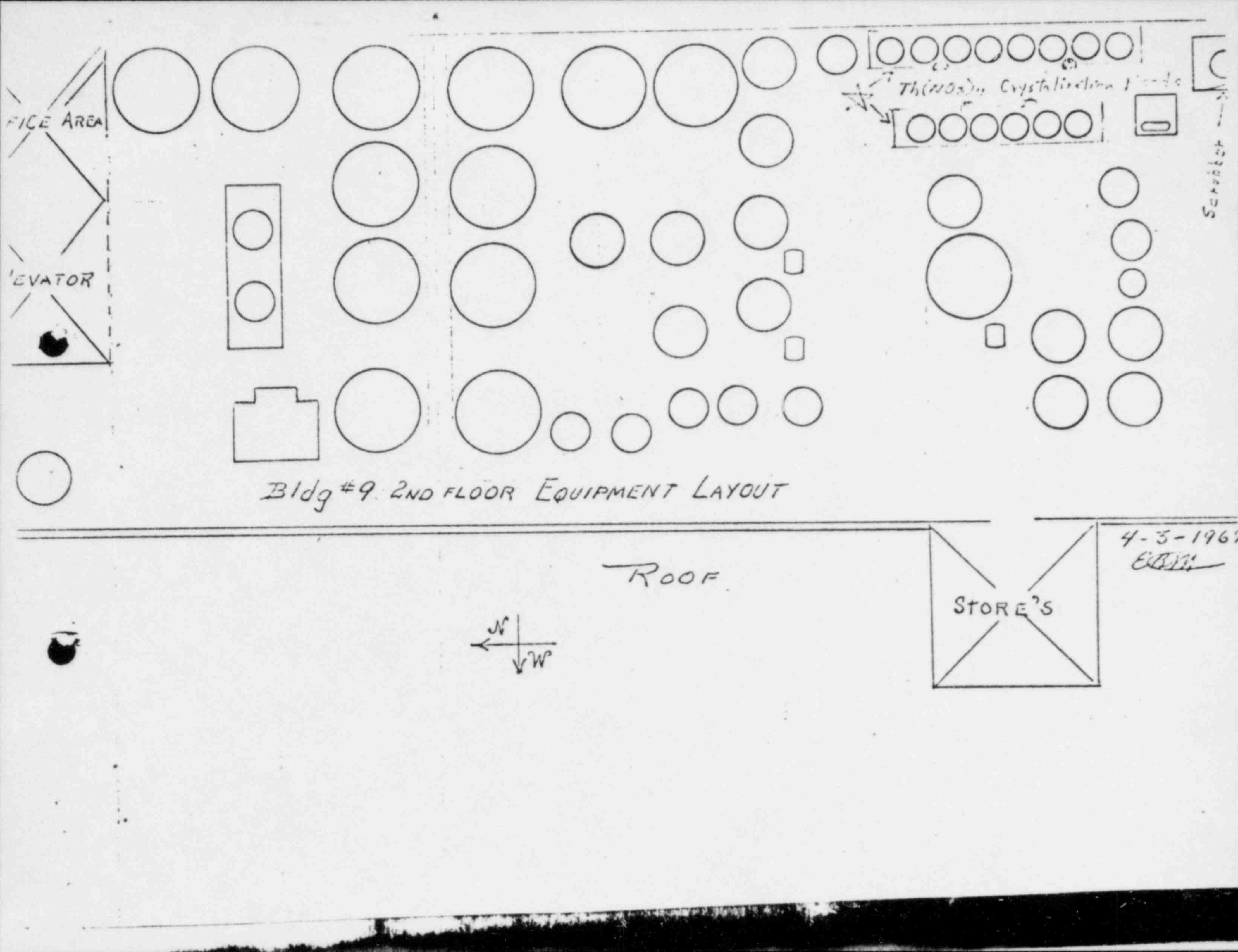


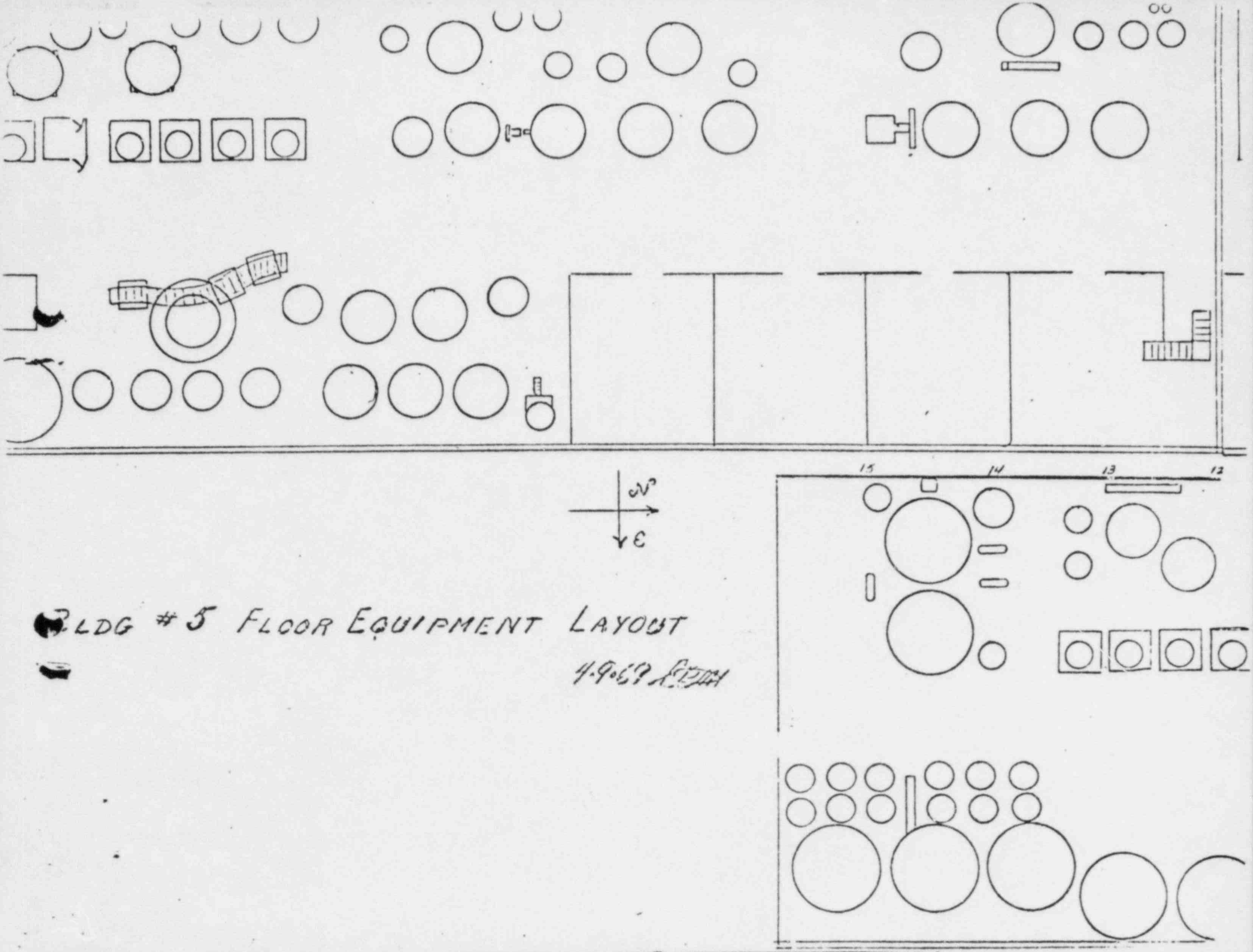
Sand Roasting Shed

-EBM



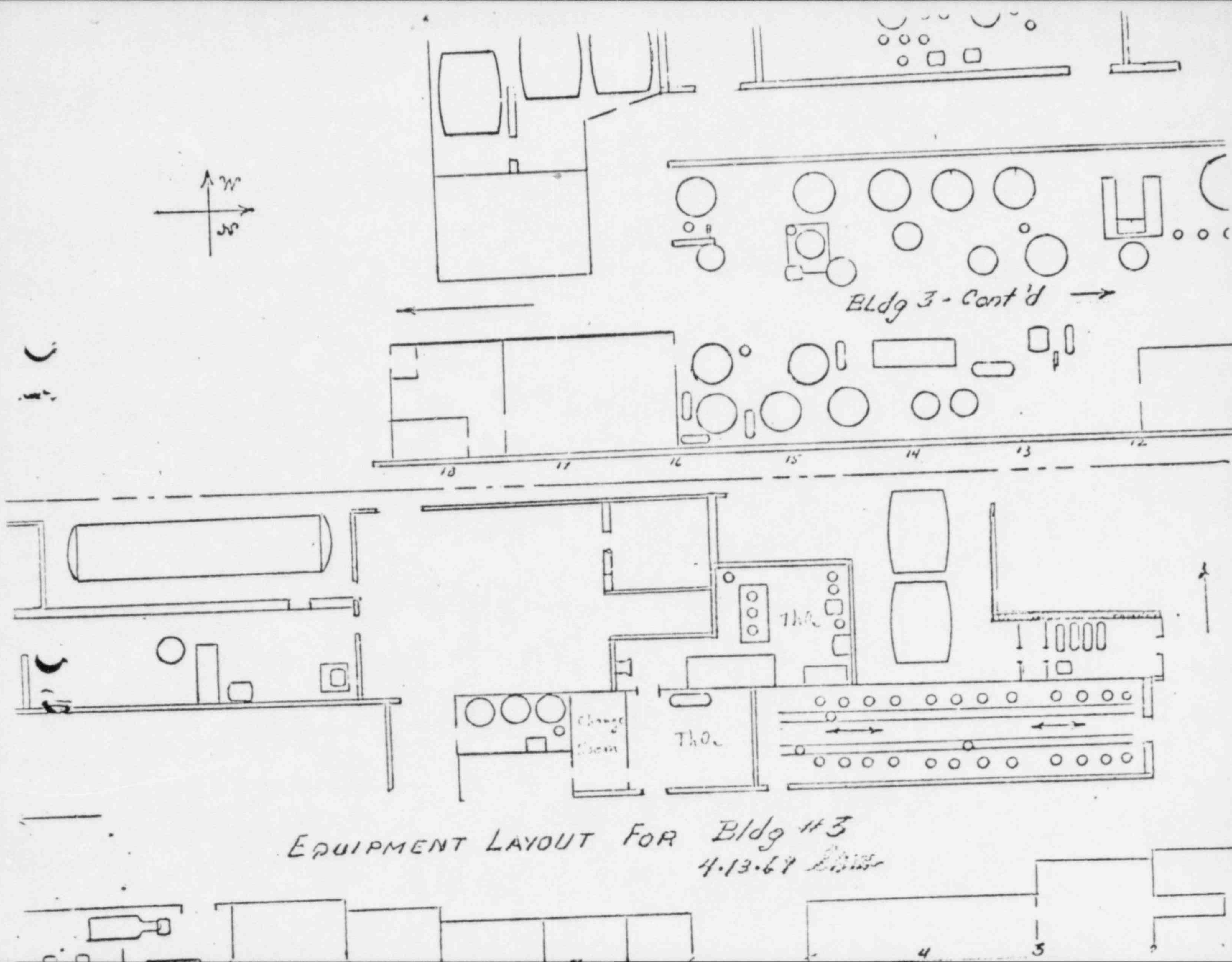
Bldg #9 4th Floor Equipment Layout


FICE AREA
EVATOR
Th(NO3)4 Crystallization
Scrubber
Bldg #9 2ND FLOOR EQUIPMENT LAYOUT
ROOF
N
W
STORE'S
4-3-1967

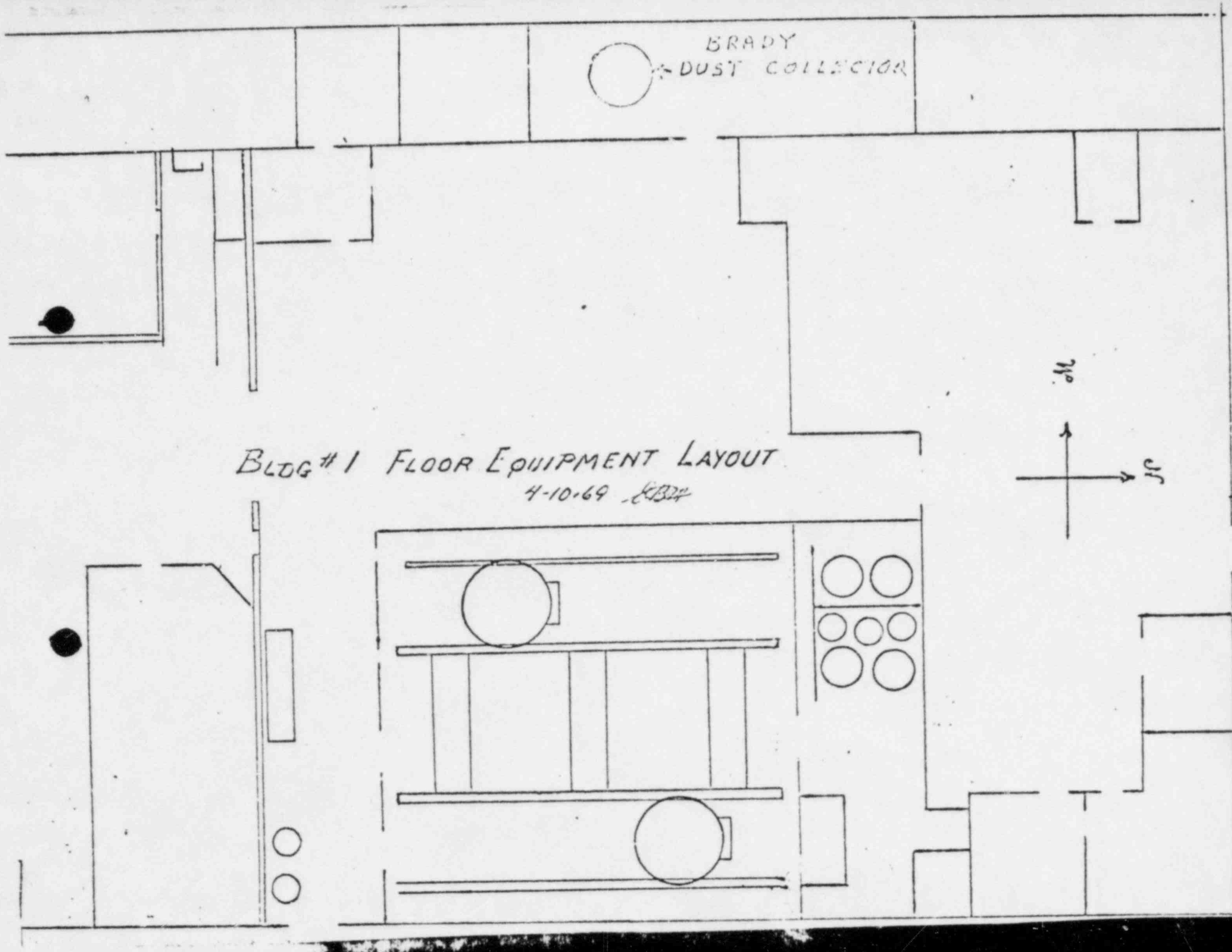


BLDG # 5 FLOOR EQUIPMENT LAYOUT

4-9-69



EQUIPMENT LAYOUT FOR Bldg #3
4-13-67


BRADY
DUST COLLECTOR
BLDG #1 FLOOR EQUIPMENT LAYOUT
4-10-69
N
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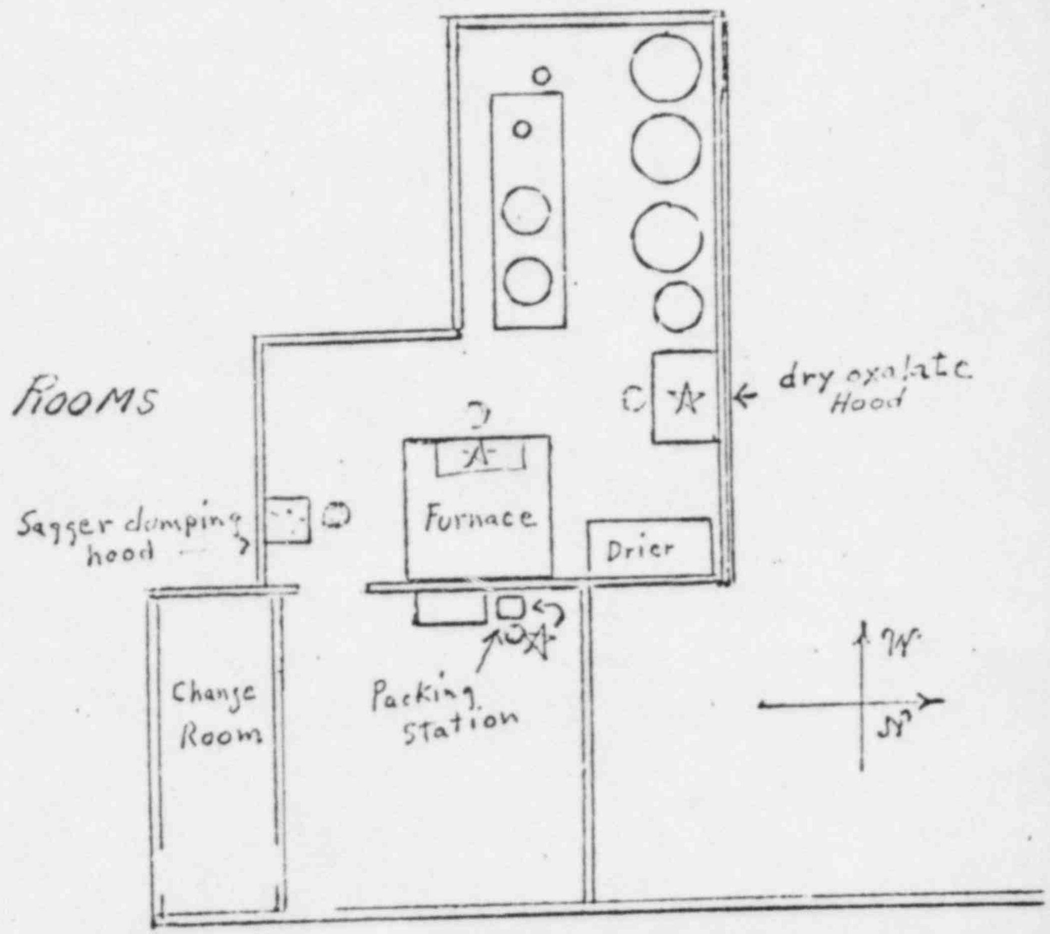
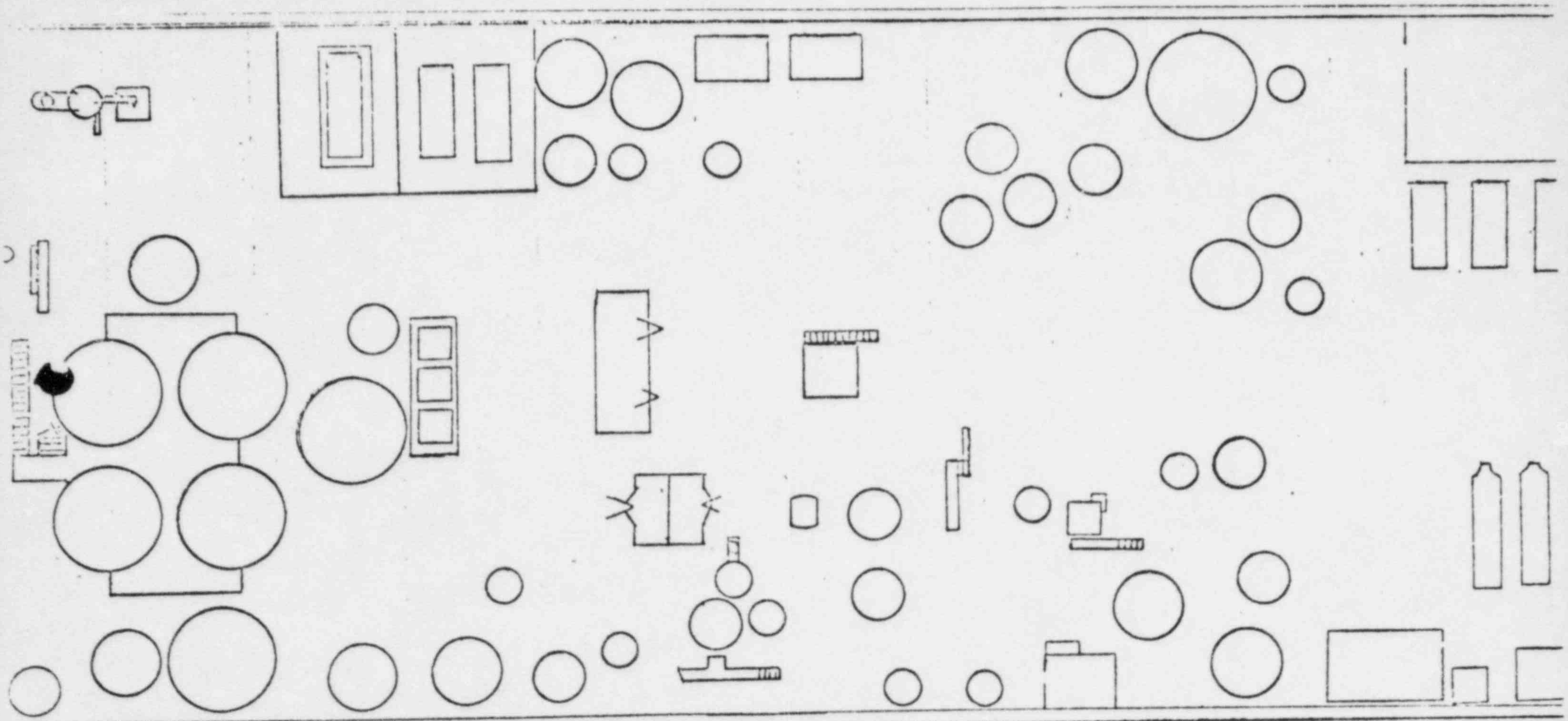
EQUIPMENT LAYOUT OF THORIUM OXIDE ROOMS

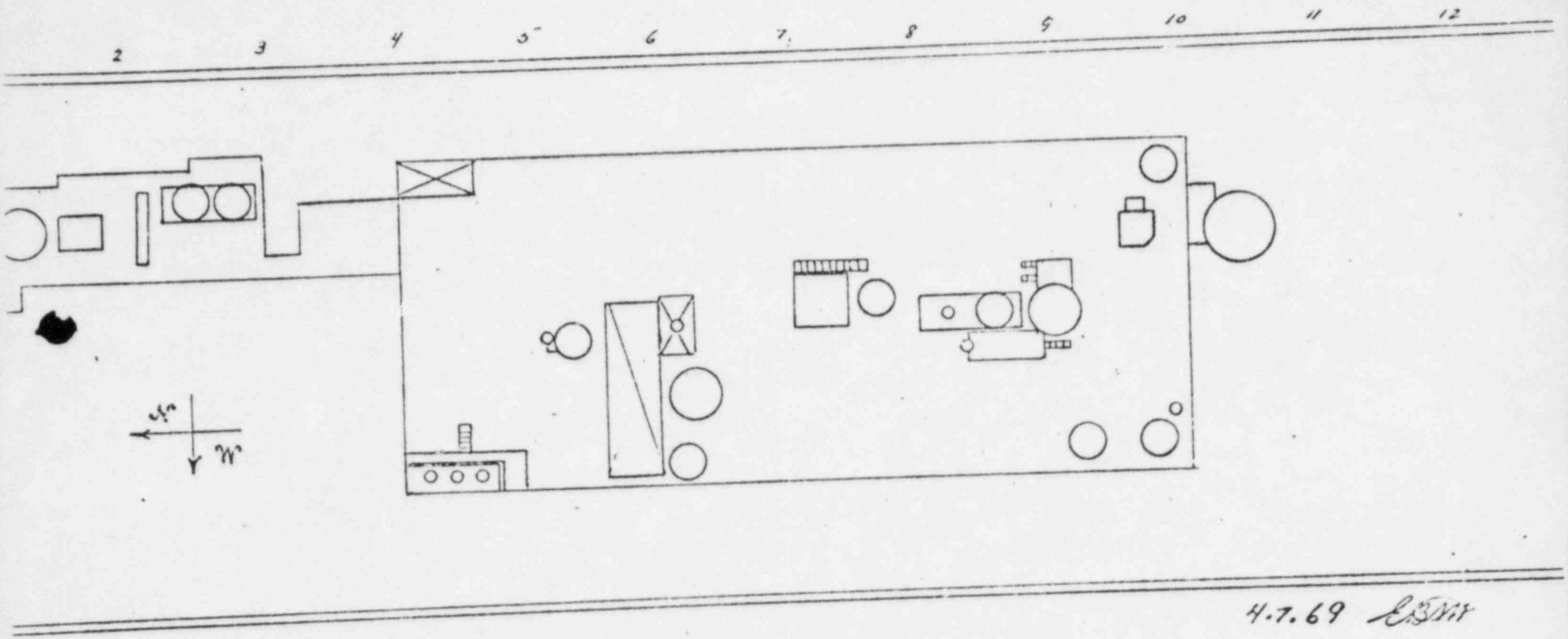
BLGD # 3 4.15.69 [signature]



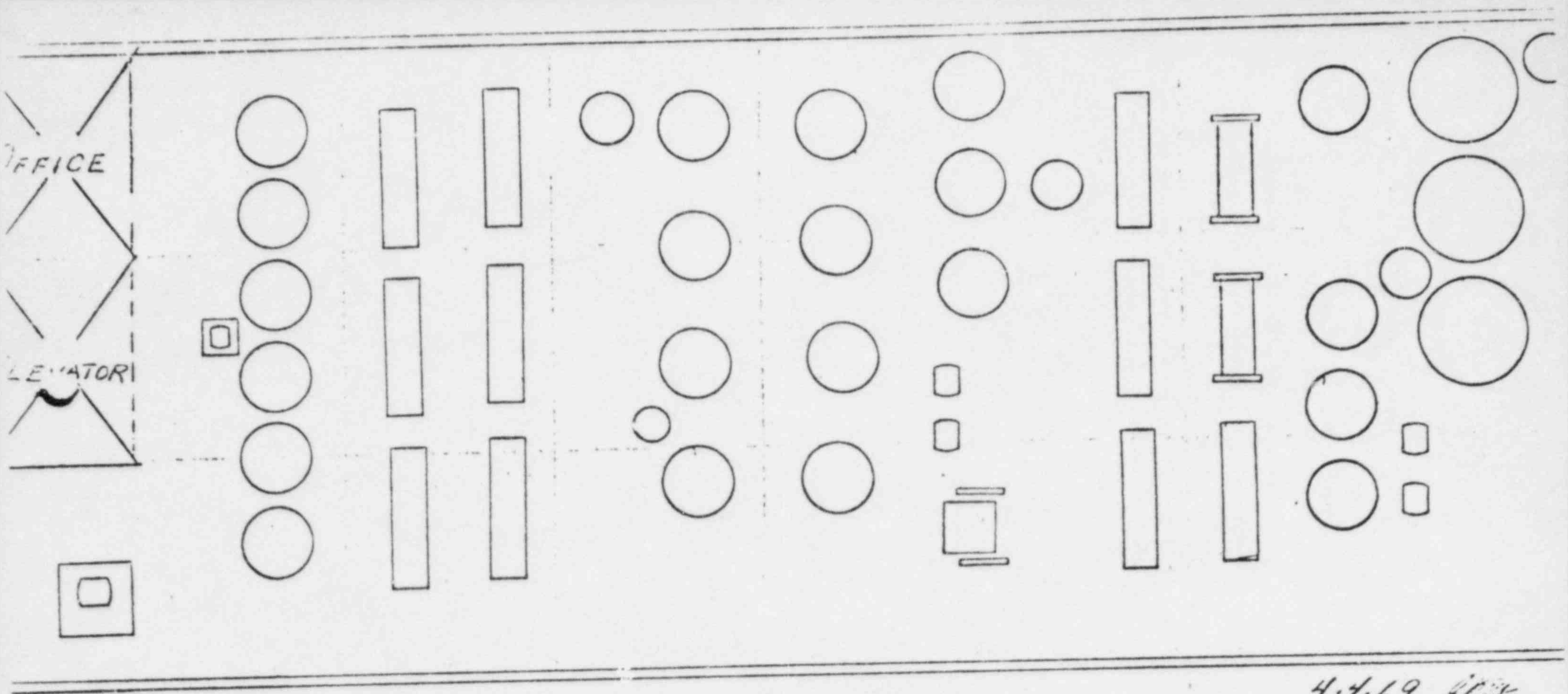


4.7.69 [signature]

BLDG #2 MAIN FLOOR EQUIPMENT LAYOUT

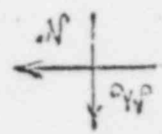


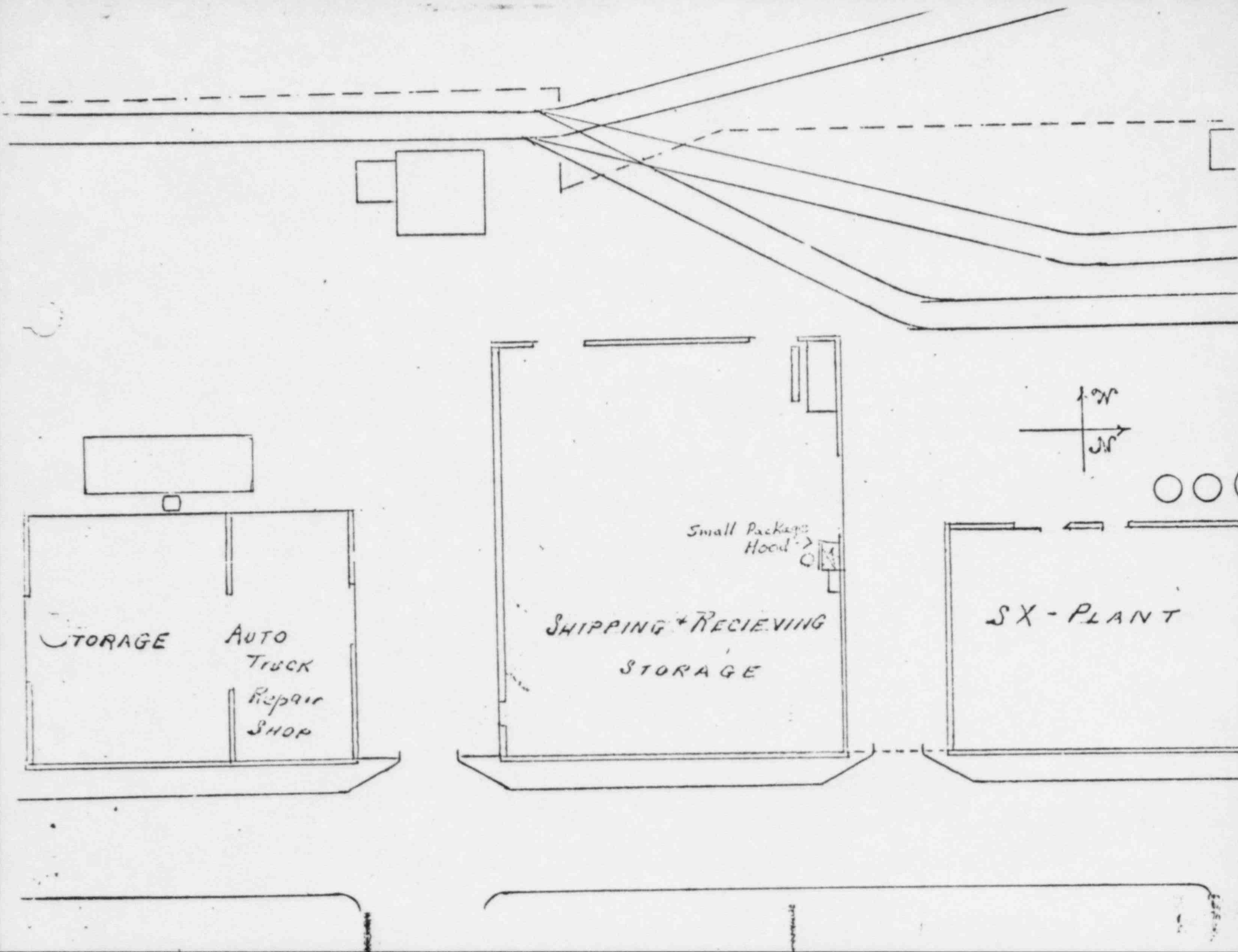
BLDG #2 BALCONY EQUIPMENT LAYOUT



4.4.69

Bldg# 9-3RD FLOOR EQUIPMENT LAYOUT

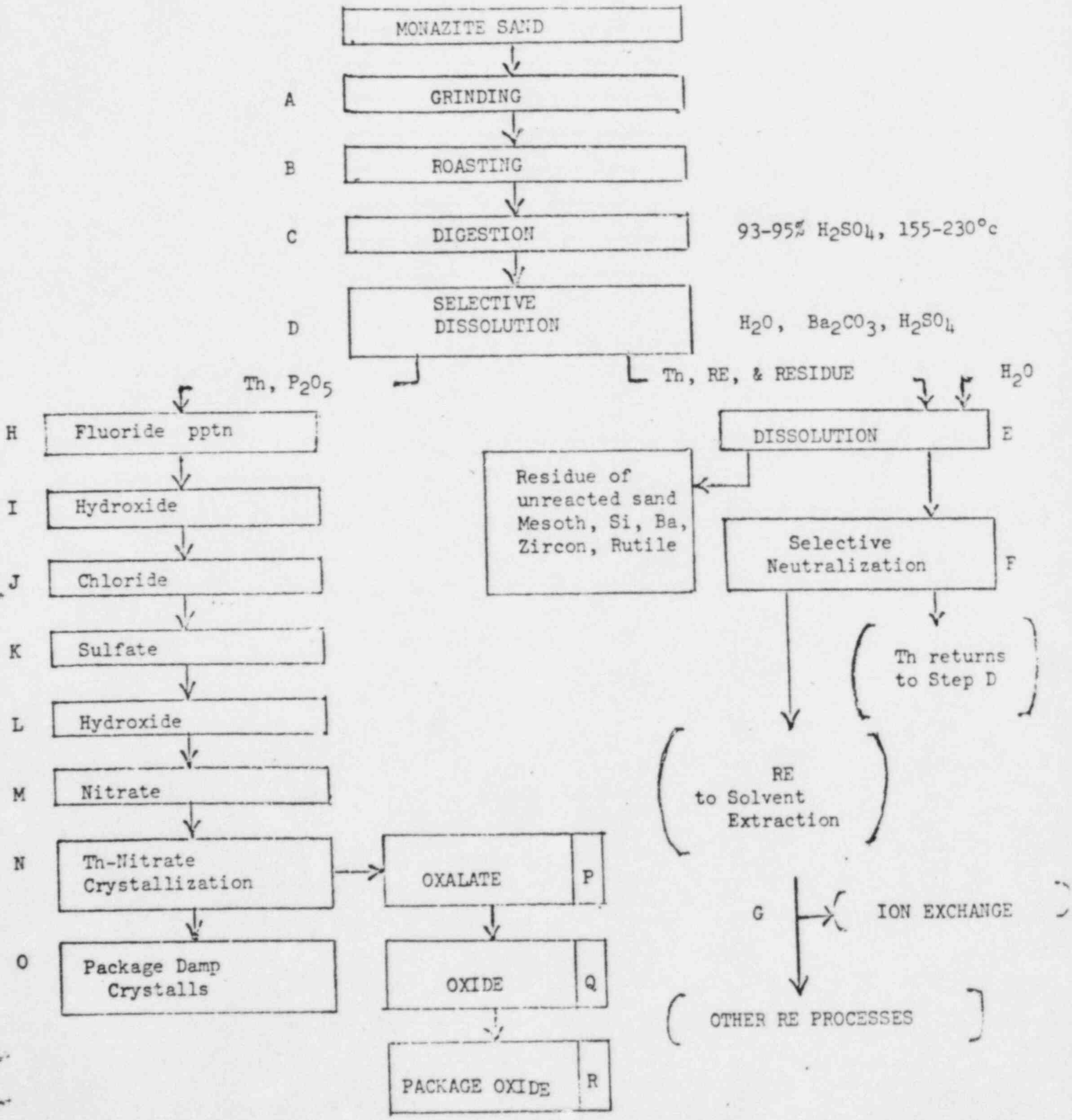




STORAGE
AUTO
TRUCK
Repair
SHOP
SHIPPING + RECIEVING
STORAGE
Small Package
Hood
SX - PLANT
N

8. (A flow diagram (the plant production operation, and a diagram of the plant layout, indicating areas and points in the process where dust is generated).

Our process is essentially the sulfuric acid method for extracting Thorium from Monazite ore.



9. (A description of dust collection and ventilation equipment that are utilized during plant operation, including type, capacity and location of such equipment, eg., ore transfer points, crushing, grinding, etc., and an analysis of the efficiency of the equipment as designed to control or prevent the release of airborne radioactivity to the environs.)

Dust collection equipment is indicated on the floor plans by a star (*). The star indicates the point of operation where airborne radioactivity is generated and thence collected.

A. At present we do not grind the ore, however we may at a future date. The grinding operation will be provided with veniliation control and dust collecting equipment which will prevent an airborne radioactivity exposure in excess of part 20 limits for the operator or operators who attend the operation and for unrestricted areas.

B. At present we do not roast the ore, although we do have equipment for doing this, and we may roast the ore in the future. (See floor plan titled "Sand Roasting Shed-Bldg. 4A". A Dracco 52 bag collector and a Schneible Multiwash Scrubber are located on the roof of Building 4A. Dust laden air is filtered through the bag collector. The filtered air then passes through the scrubber and the dust free air is then discharged to the atmosphere. The system loading is approximately 12,500 C.F.M. The air relocities at the various hoods (*) have a minimum of 125 F.P.M. Capture velocity is approximately 100 F.P.M. During past operations several hundred air samplings have been taken resulting in no overexposures for any of our personnel.

C-1 Roasted, or non-roasted ore is placed into a Monazite sand hopper (See floor plan titled "Bldg. 9 1st Floor Area"). The ore is lifted to the 4th floor by a bucket elevator. The sand hopper is hooded and ducted to a Dracco 3-compartment No. 40 bag collector which is located on the 4th floor roof.

The elevated ore is discharged into a surge bin. (See floor plan "Bldg. 9 Forth Floor Equipment Layout"). The surge bin discharges into charging buckets positioned on a weighing scale. This operation is enclosed in a hood ducted to the dust collector.

Air velocities at the face of the hoods are:

1. 1st Floor Sand Hopper Hood 135 F.P.M.
2. 4th Floor Weighing Station 110 F.P.M.

Capture velocity is approximately 75-100 F.P.M., and the system loading is approximately 8,000 C.F.M.

Hundreds of air samplings have shown no excessive exposures to airborne radioactivity for our personnel working at the sand hopper or weighing station.

C-2 The charging buckets are emptied into reaction pots containing sulfuric acid and this forms a wet paste. Acid vapors and gasses from the reaction are ventilated from the pots, scrubbed in Ducon type VW-3 centrifugal wet scrubbers and then passed through a water scrub shelf tower before being discharged to the atmosphere.

From this point through many process steps there is no significant airborne radioactivity problem.

K (Flow diagram Step K - Thorium Sulfate)

This part of the process is described here because we propose to install an additional scrubber in our system to eliminate a minor air-pollution problem.

Thorium sulfate is slowly crystalized from a Thorium Chloride solution using mild air agitation. Water vapor containing a small amount of hydrochloric acid is evolved. This vapor has been ventilated to the atmosphere through our general purpose process exhaust system which discharges 80 ft. above ground.

Once the scrubber is installed our general plant exhaust system discharge will be almost completely water vapor and air.

N. (Flow diagram Step N - Thorium Nitrate)

This part of the process is serviced by a scrubber. (See floor plan "Bldg. 9 2nd Floor Equipment Layout")

Thorium nitrate feed solution is evaporated in kettles to concentrate the solution. Upon cooling, crystals of thorium nitrate are formed. During the evaporation water vapor containing oxides of nitrogen are evolved. The kettles are completely enclosed in a hood which is ventilated to a packed tower scrubber with a caustic scrub to remove the small amount of nitrogen oxides. The scrubber discharges into our general process exhaust system.

The scrubber loading is 4300 C.F.M. and air velocities measured at the opened inspection door in the hood panel are greater than 200 F.P.M.

P,Q & R (Flow diagram Steps P, Q & R - Thorium Oxide)

(See floor plan "Thorium Oxide Rooms - Bldg. 3")

Damp thorium nitrate crystals are dissolved in water and oxalic acid added to precipitate thorium oxalate. This slurry is filtered and the damp cake is spred on trays and dried in a tray drier. The water vapor is vented directly to atmosphere.

The trays of dried oxalate are placed under a hood and the chemical is scooped into ceramic ignition saggers. The saggers are placed into a muffle furnace where the oxide is formed. A slot hood shroud is fixed around the furnace door to remove dust which may occur during loading and unloading the furnace.

After ignition and cooling the saggers are dumped into a blending drum. A slot hood removes dust generated when dumping. After blending, the blending drum outlet valve is alternately opened and closed to fill the final package. A dust vent removes dust during packaging.

The various hoods and vent used in these operations are ducted to a Brady Dust Filter Model 1375.

The air velocities at the face of the various hoods is as follows:

Dried Oxalate Hood	300 FPM
Furnace Slot Hood	300 FPM
Saggers Dumping Hood	130 FPM
Packaging Dust Vent	Above 300 FPM

System loading is approximately 6100 CFM.

The Brady dust filter collector is located 60 yards north of the Building 3 thorium oxide room. It is contained in a separate room as shown on the drawing titled "Bldg. #1 Floor Equipment Layout".

10 & 11 (A description of the survey program which is followed to determine concentrations of airborne radioactivity within the plant, including the make, model number and capacity of sampling devices, and your procedure for sample analysis. Include a description of :-

a. Each sampling location in respect to operating personnel.
b. Each sampling location in respect to process operation.
c. The frequency (for a & b)
d Surveys made during maintenance operations.)

Concentrations of airborne radioactivity within the plant are determined for the following:

A. Breathing zone of the operator while at the point of operation where dusty radioactive material is handled.(5 minute air sample)

B. Specific work area the operator occupies when not at the point of operation. (1 hour air sample)

C. General plant areas which the operator or others may occasionally or frequently occupy. (1 hour air sample)

D. During maintenance of thorium processing equipment containing dusty material.

Many of our operations are quite sporadic. Air samplings are not taken at the point of operation during down time. General air samples are obtained however, in each building and on each building floor which contains thorium operations, unless these areas are shut-down and only rarely occupied. A general air sampling is also made in a non-thorium operating area for "background" information. General air samples are taken monthly.

Breathing zone, point of operation air samples are indicated by solid circles on the attached floor plans. These samples are taken at one-half of the points shown every other week in such a manner that a sample is taken at each point once each four weeks, except at those points where no operations are conducted during the four week period.

A specific work area sample is taken whenever a breathing zone sample is found to contain more than 3 x 10-11 uc/ml natural Th, 7 x 10-10 uc/ml Ra224, 1 x 10-7 uc/ml Bi212, or 3 x 10-7 uc/ml Rn220. Under these circumstances we document the operators time in the various areas he occupies, and calculate his potential 40 hour exposure.

Upon learning that maintenance work is needed on equipment containing radioactive material an assessment is made of the particular job in question. If it is determined that a potential airborne contamination problem could exist then an air sampling program is established after all efforts are made to minimize the problem.

We have three air sampling devices which were designed and constructed by our personnel. Each sampler has a timer, an air pump, flow meter,

air flow adjustment, and a filter paper holder. The air flow meter is calibrated using a gas meter. The air sampler is set to draw 35 liters of air per minute through a Whatman No. 41 paper which is 1.25 inch in diameter.

We use a gas flow proportional alpha counter in the "windowless" position to analyze our air samples.

Alpha counting is done as follows:

I. In cases where daughter activity is more than negligible and at any new point of operation.

A. The sample is counted 1 hour after sampling.

Our standard formula for computing activity is:

$uc/ml \times 10^{-11} = C/M \times d/c \times 1.29/T \times 1/.7$

Where C/M = counts per minute from the sample.

d/c = disintegrations per count (from alpha standard source)

$1.29\ (x10^{-11}) = 1/22.2 \times 10^6\ d/m/uci \times 3.5 \times 10^4\ ml/min$

T = Sampling time (minutes)

1/.7 = Filter paper absorption factor

At this point in time the Rn^{220} has died off and most of the alpha count is due to Bi^{212}.

Using the standard formula compute the gross activity.

B. The sample is counted again 10.6 hours after sampling. This is a half-life of Pb 212 and half of the Bi212 is also gone both of which at this point are the result of 1/2 of the Rn220 originally present.

1. The standard formula times 2 = Rn220 activity

2. To obtain the Bi212 activity the standard formula calculation is multiplied by 0.9 and this product is subtracted from the gross activity found in A, and the difference is multiplied by 2.

C. The sample is counted again 106 hours after sampling.

This is 10 half-lives of Pb212 and all of the short lived daughters originally present are gone.

The standard formula is calculated and divided by 1.7=Ra224 activi[illegible]

D. The sample is counted again 465 hours after the sample was taken. At this point an apparent equilibrium has been established and we have nearly 6 alpha activity which is close to the amount at secular equilibrium.

$$\text{Th(nat)activity} = \frac{\text{Standard formula} - .1\ \text{Ra224 activity}}{5.9}$$

II. In cases where daughter activity is negligible counting is done 106 hours after the sample was taken.

The standard formula is divided by 6 to obtain the Th(nat)activity.

III. Each day the alpha standard is counted to assure that the counter is reliable.

Sample and background counts are properly taken to assure a 95% confidence level. We should detect a minimum of $9X10^{-11}$ uc/ml Rn220 and/or Bi212. For Th(nat) we should detect 2×10^{-12} uc/ml, and for Ra224 7×10^{-11} ux/ml. This applies to a 5 minute sample time. An hour sample would show at least 10 times greater sensitivity.

12. (A description of the procedure followed in determining the average daily and weekly exposures to airborne radioactivity for each employee who frequently or occasionally occupies areas where air contamination exceeds M.P.C. values specified in 10CFR 20)

We are not now using any operation which continuously causes an airborne concentration in excess of 3×10^{-11} uc/ml of natural thorium in a restricted area during a 40 hour work week outside of ventilation control equipment.

There are a few operations which may for short periods of time exceed 3×10^{-11} uc/ml of natural thorium in the air at the point of operation. Thus there is a possibility that on a 40 hour basis an airborne concentration greater than 1 M.P.C. might exist.

Whenever a 5 minute operators breathing zone sample shows greater than 3×10^{-11} uc/ml of natural Th the operators time at the point of operation is calculated. A 1 hour air sample is taken in the environs of the area where the operator spends most of his time. The time weighted exposure including the breathing zone sample and general air sample is calculated. If the calculations show that an average of 1 M.P.C. could be exceeded during a 40 hour work week then immediate steps are taken to correct the problem. If ventilation control equipment is found deficient it is repaired. If the operators handling methods are improper he is re-instructed. As a last resort employee rotation may be used.

It is extremely rare that a general area air sample exceeds 1 M.P.C. and these operating areas are occupied so little by personnel, other than the operator, that we do not propose to document the time of an occasional occupant.

13. (If treatment or disposal of licensed material by incineration is anticipated, an application should be made in accordance with 10CFR20 sec. 20.305).

In conformance with 10CFR20.305 we request that our license include a provision enabling us to incinerate Monazite ore bags and other combustable trash.

We are confident we will not exceed the airborne concentration limits for unrestricted areas for natural thorium when averaged over a year.

We will use a hand fed Model Co-200 multiple chamber incinerator equipped with a gas after burner which was built by the C.O. Hendrikson Company. The following data applies:

a. Trash burning capacity of incinerator - 200 lbs/hr.
b. Exhaust gas volume in stock corrected to 70°F - 300 C.F.M.
c. Stack height - 30 ft.
d. Particulate emission-0.17 grains per standard cubic foot.
e. Expected maximum operating time - 10 hrs/wk.
f. Micro curies (Th(nat) of exhaust gas within stack-$8x10^{-12}$ uc/ml (corrected to 70°F)
g. Expected yearly average concentration of Th(nat) within stack gas - 0.46 M.P.C. (Background neglected).
h. Ash & residue (Monazite sand) - 20% of trash weight.
i. Thorium content of ash & residue - 6% (1.2% of trash weight).

Before incineration the operator will clean out the ash from the previous days burning. This will assure that the ask is cold thereby minimizing airborne material. The ash & residue will be placed in boxes or drums and stored on our property for possible reclaiming of values.

The operator will then load and operate the incinerator.

X [An hour air sample will be taken in the general breathing zone area of the operator during the time he is cleaning the incinerator, packaging the ash, and operating the incinerator. We will monitor the exhaust discharge by isokinetic sampling within the stack and record the results.] X

In the beginning the air sampling will be done each time the incinerator is used. After sufficient data is obtained, the sampling frequency may be reduced. The reduced frequency will be adequate to assure compliance of the regulations.

14. (A description of plant discharge stacks including stack heights, types and concentrations of effluents discharged, method for controlling release of radioactive material, and methods for determining the concentration of radioactive material released to the environs.)

We have a total of 10 stacks which service our Thorium operations. These are:

1. Bldg. 9-General purpose process exhaust system, 3rd floor roof
This stack is 80 ft. from ground level. Many processing tanks are connected to the general exhaust system. These tanks are all part of the "wet" process. On an average, only trace amounts of SO_2, HF, NO_x, NH_3, H_2S are present. When the new scrubber is installed (as described in Section 9K) the minor air pollution problem with HCl and Cl_2 will be eliminated. The discharge from this stack will then be almost entirely air and water vapor..

2. Bldg.9-Dracco Dust Collector Stack, 4th floor roof
This stack is approximately 130 ft. high. This equipment is described in Section 9C-1 of this letter.

During operation, once every other week, hour long air samples are taken at the point of discharge and other areas on the roof. Most of the time the air sample results are well below 1 M.P.C. Th(nat) for unrestricted areas. On a rare occasion it will be discovered that the discharge shows higher radioactivity than usual and corrective maintenance is then done to correct the situation.

3. Bldg. 9-Water Scrub Shelf Tower, 4th floor roof
This equipment is described in Section 9C-2 of this letter: The discharge from this tower is 120 ft above ground level. A trace of SO_2 may be evolved from this tower.

4. Bldg. 3-Thorium Oxide Process Oxalate Precipitation
The kettles used to dissolve damp nitrate and precipitate the oxalate are enclosed in a hood which is vented by a stack 30 ft. high. The stack discharges water vapor. (See Section 9 P,Q,&R).

5. Bldg. 3-Thorium Oxalate Drier
The oxalate drier (See Section 9 P,Q,&R) stack vents water vapor and products of natural gas combustion at a height of 30 ft. from ground level.

6. Bldg. 3-Muffle Furnace
The furnace (See Section 9 P,Q,&R) exhaust stack discharges CO_2 and gas combustion products at a height of 30 ft.

7. Dust Collector for ThO_2 Process - Bldg. 3
The collector stack discharges at a height of 40 ft. above ground level. Air sampling similar to that described above (2) for the Dust Collector stack on the 4th floor roof is performed.

8. Ore Roasting - Bldg. 4A
As described in 9B, the ore roasting equipment is serviced by a dust collector and a wet scrubber. This combination very effectively removes dust before the ventilation air is discharged from the scrubber stack which is approximately 60 ft. in the air. Air samples are obtained on the roof of this building.

9. Incinerator
See Section 13 for details.

10. Shipping Warehouse Small Package Station
Occasionally we need to make small packages of Th nitrate or oxide. The radioactive material is handled within a dust collector hood with the operator outside. The collector is a Torit Model 124 bag collector. The clean air discharged 10 ft. above ground through a wall of the building. Loading is 2800 C.F.M.

As a double check on our dust collection effectiveness we take air samples around the periphery of our plant property. This is done four times a year and at least six air samples are taken. Also, on a weekly basis outside air samples are collected east and west of our plant at a distance of approximately one-half mile.

Roof top samples, fence line samples and remote samples over the past few years indicate we are not exceeding regulations covering airborne radioactivity in unrestricted areas.

15. (A description of the method for determining exposures of employees to external radiation. For film badge studies, indicate number and category of personnel involved in the program.)

A film badge program is used to determine the exposure of employees to external radiation.

All Chemical operators, laborers, maintenance men, and immediate supervisors of these employees are required to use film badges. Laboratory and other personnel who either work with or frequently visit areas where radioactive material is handled or stored also are required to use film badges. Persons whose duties are not likely to involve them with radioactive material handling, and who seldom visit operating or storage areas are not required to use film badges.

Chemical operators and laborers who are considered "thorium handlers" are on a weekly badge service to minimize the possibility of over-exposure. All other personnel in the film badge program are on a monthly badge service schedule.

(4/69) 23 weekly 105 monthly

We currently have 23 persons on weekly badge service and 105 on monthly service. These numbers will vary depending on production manpower requirements.

At a minimum, Gamma meter surveys are conducted during the time that monthly general air samples are obtained. Records of these surveys are made.

16. (A description of your methods for contamination control, including provisions for monitoring and the levels of contamination at which decontamination is performed.)

Our housekeeping program includes wet scrubbing of the floors daily in areas where thorium containing material is handled. In the case of a spill, the operator is instructed to clean it up as soon as practical. The level at which decontamination is necessary is that amount which is visible to the eye. A monitoring survey for surface contamination, therefore, is essentially a visual inspection. Survey meters are used to distinguish between radioactive and non-radioactive contamination.

Personal protective equipment provided for employee use when needed includes hard hats, safety glasses, chemical goggles, face shields, plastic jackets and pants, rubber safety shoes or boots, assorted glove types and styles, dust and fume respirators, and other miscellaneous equipment.

Shower and locker room facilities are available for all operating personnel. A clothes washer and dryer is also available. These people are instructed to bathe or wash thoroughly after their work shift. They are also instructed to promptly wash off any thorium material which may accidently spill on their skin.

17. (A copy of the written radiological safety operation instructions supplied to employees. These instructions should include provisions for personal hygiene, including washing prior to eating or leaving the plant, instructions for wearing personnel monitoring devices, and instructions for cleaning up dust and spills within the plant.

See enclosed "Radioactivity Statement" and Page 18 of booklet titled "General Safety Rules and Safe Procedures".

RADIOACTIVITY STATEMENT

General Instructions for Handl g Radioactive Materials in the st Chicago Plant

Employees of American Potash & Chemical Corp. are hereby informed of the occurrence of radioactive materials and radiation in the West Chicago Plant.

The Corporation is required by law to explain the safety problems associated with handling radioactive materials. In a sense there are no safety problems concerning radioactivity in th plant. That is, careful observations have failed to show any employee has ever been injured b radioactive material during the nearly sixty years this plant has operated. The reason for th is that radioactivity is present at levels very low compared to those known to be harmful. Th exact level at which radioactivity becomes harmful has not yet been determined. Scientists ar in universal agreement that exposure of normal persons to radioactive material produces no beneficial results. Consequently, the Atomic Energy Commission (AEC) has set very low levels of radiation and of airborne concentrations of radioactive material to which persons handling licensed material such as thorium may be exposed. The Corporation provides equipment such as hoo with forced draft ventilations, dust masks, gloves, etc., and follows good housekeeping procedures such as sweep-downs and wash-downs. No employee exercising common sense should ever receive radiation in excess of the limits permitted by the AEC, or be present in concentrations of airborne radioactivity in excess of permissible limits.

By observing some simple rules, an employee can keep his exposure well below even the very low limits allowed by the AEC. The basic principle is to avoid unnecessary contact with radioacti materials, such as monazite ore or thorium concentrates. Following are some of the ways of cutting down on exposure:

1. Most Important— Avoid any dust unnecessarily.
2. Wear a dust mask faithfully on the operations and at the times required. Your foreman wil instruct you as to when to wear, how to wear, and how to care for your mask.
3. Do not make unauthorized visits to dusty operations.
4. Do not rest on monazite bags or drums of thorium or even stay next to them unnecessarily.
5. If material is accidentally spilled, clean it up as soon as practical; or if you are in doubt as to proper procedure, tell your foreman. If the material can be recovered by sweeping it up, avoid raising dust. Spilled solutions are to be hosed down. If a thorium solution or powder is accidentally spilled on your skin, wash it off before doing anything els Other material should be washed off as soon as practical. Spilled thorium oxide powder is special case and is to be vacuumed up, unless the amount is so large as to make this imprac tical. For example, if a bottle of thorium oxide should break, it would be better to carefully shovel the bulk of it up while wearing a dust mask and gloves. After vacuuming, the area is to be wet-mopped with soap and water. Discharge the used water to the waste drain.
6. When you leave your work station, wash your hands thoroughly, especially before eating.
7. Your badge measures the radiation you receive from external sources. Wear your badge faithfully. Avoid splashing material on it.

Should you ever be exposed to more radioactivity in this plant than permitted by the AEC, you and the AEC will be so informed in writing by the Corporation as required by law. Such notice will not indicate that you have been injured in any manner. If there are any over-exposures in this plant, they will be slight. Also, the AEC has stated that considerably higher exposure limits than those permitted would not result in excessive hazards. The notifications serve as checks on the efficiency of our radiation protection program. It is good common sense for you to do your part to limit your exposure and that of your fellow worker to such low levels that we never have an over-exposure.

AMERICAN POTASH & CHEMICAL CORPORATION

I have read the above statement concerning radioactivity at the West Chicago Plant.

Date: ______________________ Signature: ______________________________

1. (A detailed description of your organization, including authority and responsibility of each level of management and/or supervision in regard to development, approval, and adherence of operating procedures.)

The authority and responsibility for developing our operating procedures is assigned to our Technical Services Department. Approvals are required by the Manager, Technical Services; Manager, Plant Engineering; Manager, Manufacturing; Safety Engineer; Manager, Production and General Manager. A safety committee review of the procedure is made prior to approvals.

The General Foremen and line supervisors have the responsibility of assuring adherence to the operating procedures. As an aid to the supervisor, safety inspections are conducted by committees and individuals. Processes are reviewed as required by the Technical Services Department.

2. (The qualifications and experience of the personnel in your organization assigned the responsibility for developing, conducting and administering the radiation safety program for the plant.)

The responsibility for developing, conducting and administering our radiation safety program is with our Radiation Safety Officer. This person is titled "Safety Engineer." He has a degree in chemistry and has several years experience in the inorganic chemical and chemical engineering fields. He has over 7 years experience in Safety Engineering. He has received formal training in the field of health physics from the U.S. Department of Health Education & Welfare by completing their courses titled "Basic Radiological Health" and "Occupational Radiation Protection".

Reporting to the Safety Engineer is a "Radiation Hygenist". This person has received formal training in health physics by completing courses in radiation detection and measurements and radioisotope chemistry at Aurora College, Aurora, Illinois.

We use the services of a consulting organization named "Health Physics Associates Ltd".

Our supervisors have a minimum of a high school education and report to chemists or chemical engineers. Supervisors receive Safety and Radiation Protection training.

3. (A description of the area in which the plant is located, including the size of nearby inhabited areas, location of wells, streams and rivers, flood stage levels of streams and rivers, and sources of water supply for the plant. A topographical map with the above identification is preferred.)

A composite USGS topographical map is attached as Exhibit I. The map is made up of portions of the West Chicago and Naperville, Illinois quadrangles in which the City of West Chicago and properties of the Rare Earth Division, American Potash & Chemical Corporation lie. The extent of the latter properties and the location of municipal and Division water supply wells are delineated on a transparent overlay positioned on the map.

The Division's physical plant is located on the southwest side of the City of West Chicago. Several private homes border the property on the north and east, and the Elgin, Joliet & Eastern RR borders it on the west. Other private homes are located to the west of the railroad property.

The elevation above sea level of the municipality ranges from 730 feet to 784 feet, the latter being the elevation at the West Chicago City Hall. The elevation of the Division's property is from 750 feet at the main plant location, on the north, to slightly under 730 feet in the disposal area, on the south.

The principal streams within a five mile radius of the plant are the Du Page River (west branch) on the east and Kress Creek on the west and south. The latter flows into the Du Page about two miles south of the plant. At their closest points, the Du Page River is one mile from the Division's disposal ponds and Kress Creek, one half mile. Both streams flow in a southerly direction.

The streams have no history of serious flooding. According to one authority (U.S. Corps of Engineers) the highest level or elevation on record for the Du Page River as measured at the gaging station at U. S. Highway 64, two miles north of the City, is 728.1 feet reached in June, 1967. There are no corresponding figures available for the Du Page at the sewage treatment plant, southeast of the City, or at its confluence with Kress Creek, but the same authority estimated that these would have been much lower.

4. (A description of the method for restricting both the plant and waste disposal area from unauthorized entry.)

Our plant and waste disposal areas are surrounded by cyclone type fencing. Gates in the fence are kept locked except when in use. Our employee and visitor entrance doors are open during business hours and a clerk-receptionist controls the entry of individuals. These doors are locked after business hours and only responsible persons can gain entry by using special keys issued for this purpose. Watchman tours are conducted during non-business hours. Watchclock key stations are located within the plant, out-of-doors, and in various out buildings. A record of the watchman tours is obtained from the watch-clock tape.

5. (A description of your waste disposal procedures. Where retention systems such as levees, dikes, ponds, etc., are used to prevent the release of liquid or solid waste containing radioactive material to offsite areas, describe the retention capability and integrity of the system, conditions that might lead to accidental release of the waste, the environmental effects of such a release and your program of inspection and maintenance to prevent such accidental occurences. This description should also include drawings showing the layout, heights, top width, side slopes, freeboard, seepage control, protection of embankment surfaces, foundation design, typical cross-sections, characteristics of fill material and a discussion of construction methods and specifications.)

Solid trash type waste which may be contaminated with Thorium material is kept separate from non-contaminated refuse. Monazite ore bags and a very small amount of other combustible material are burned in our incinerator. Non-contaminated refuse and scrap, and decontaminated scrap, are removed from our premisis by a scavenger service.

All scrap equipment which has been used in Thorium processing operations is surveyed and if needed, decontaminated to levels below the limits set forth in an A.E.C. document titled "Radioactivity Contamination Limits for Abandonment of Facilities and Equipment" as follows:

RADIOACTIVITY CONTAMINATION LIMITS FOR ABANDONMENT OF FACILITIES AND EQUIPMENT

1. The maximum amount of fixed alpha radioactivity in disintegrations per minute per 100 square centimeters on buildings or equipment should not exceed 25,000.

2. The average amount of fixed alpha radioactivity in disintegrations per minute per 100 square centimeters on buildings or equipment should not exceed 5,000.

3. The maximum amount of removable (capable of being removed by wiping the surface with a filter paper or soft absorbent paper) alpha radioactivity in disintegrations per minute per 100 square centimeters on buildings or equipment should not exceed 1,000.

4. (a) The maximum level at one centimeter from the most highly contaminated surface of a building or piece of equipment measured with an open-window beta-gamma survey meter through a tissue equivalent absorber of

not more than seven milligrams per square centimeter should not exceed one millirad per hour.

(b) The average radiation level at one centimeter from the contaminated surface of the building or equipment measured in the same manner should not exceed 0.2 millired per hour.

5. The contamination limits for abandonment of facilities involving U-233, or Plutonium should not exceed 1/10 of the limits in items 1, 2 and 3 above.

Solid chemical residue composed mainly of Silica, unreacted Monazite, Zercon, Rutile, Calcium and Barium sulfate, and other gangue is piled on the ground in our waste disposal area at the south west corner. This material is of a very sticky, pasty nature which dries to a hard cake. It does not have a tendency to dust or dry to a powder and is extremely insoluble. This pile does emanate some radiation. Survey meter readings taken at the fence line adjacent to the pile have never exceeded 2.5 mr per hour. The areas south and west of the fence are not inhabited. Parallel to, and about 25 ft. from the west fence is a railroad right-of-way. X

The radiation dosage to anyone on a passing train is negligible. Observations over a period of several years has shown that pedestrians very seldom use the railroad right-of-way. However, if it is assumed that a person makes four trips per day every day at three miles per hour along the 400 ft. of fence in question and that the dose rate is 2.5 mr/hr. The dose received would be less than 0.1 rem per year.

Pursuant to section 20.105 (a) we request allowance to produce a radiation level in the unrestricted area at the southwest boundary of our waste disposal area of not more than 2.5 mr per hour. X

Attached as Exhibits II and III are Drawings C-11083-2 and B-12016. These show the Division's property and plant in some detail, and graphically describe liquid waste disposal methods and procedures.

Inorganic liquid wastes generated in plant operations are discharged into surface trenches within the enclosed plant area. These discharge into an underground conduit which in turn discharges into a collecting basin or sump (Bldg. 14). Automatically operated pumps transfer the waste via underground and surface piping to a series of three settling and seepage ponds located approximately 750 feet south of the main plant area. X

Pond No. 1, the largest, is used primarily for settling entrained solids and post precipitates, and receives the pumped waste directly from Bldg. 14. Clarified waste is pumped to either or both Pond Nos. 2 and 3 for seepage and disposal. The level in Pond No. 1 is automatically maintained by the pump, and levels in the other ponds are controlled below the established free board point by manually valving off individual transfer lines.

Surface trenches within the enclosed plant area are constructed of concrete and lined with acid brick. Trenches are generally covered.

Underground conduit, in the most part, consists of 54 inch diameter reinforced concrete pipe lined with acid brick. In transition zones and a few other areas, the conduit is rectangular and again constructed of concrete lined with brick.

The collecting basin or sump is approximately 20 feet deep and has a holding capacity of 50,000 gallons. It is constructed of reinforced concret. and lined with acid brick.

The underground transfer line from the sump (Bldg. 14) to the disposal ponds is a 6 inch rubber-lined, steel pipe. It outcrops in the vicinity of Pond No. 2 and is connected to a 6 inch reinforced rubber hose laid above ground and discharging into Pond No. 1. Similar hoses run from the pumping station on Pond No. 1 to the other ponds.

Pond construction, holding capacity and other data are as shown in Exhibit III, Drawing B-12016.

All parts of the liquid waste disposal system are well inspected and maintained. Trenches, conduit and sump are cleaned and inspected annually, and repaired as indicated. Pumps and piping are checked daily, and transfer lines and ponds are inspected at least once every 8 hour work shift. Ponds are dredged annually to remove accumulated sludges.

6. (A description of the geological and hydrological characteristics which may affect the degree and mode by which liquid wastes may reach underground and/or surface waters. This should include estimates of local evaporation and seepage rates, depth of the local water table and premeability characteristics of underlying material.)

X As shown on the attached Exhibits II and III and described under "No. 5", inorganic liquid wastes are essentially all disposed of in seepage ponds. Some evaporation of the ponded waste takes place but because of climate and humidity conditions it is doubtful that the amount is significant. X

The ground in which the ponds are located consists of several strata of soils having varying degrees of permeability. The most permeable is the coarse sand and gravel stratum which forms the base or floor of the ponds. The uppermost or topsoil has fair to poor permeability, and the clay stratum underlying the gravel has very poor permeability. It is doubtful that much seepage takes place in either of these strata.

Seepage rates vary from 0.2 to 0.5 gal/sq.ft/hour. These appear to be low, considering the permeability of the gravel, but sludge settled in Pond No. 1 or small amounts that may be carried over into the other ponds impede outflow to some degree. Ground water levels also affect seepage. The current ground water elevation, as reported by the Illinois State Water Survey, averaged 726 feet in the West Chicago area. This will vary according to seasons and will be lowest in the fall and highest in the spring of the year.

7. (A description of the liquid effluent survey program[assuming plant effluents reach subterranean or surface water supplies], including the number, location and frequency of check samples and procedures for the sample analysis of natural Thorium and Radium-228.)

Liquid effluent samples are obtained daily. A one quart grab sample is obtained from the overflow hose which drains the settling pond (Pond #1). The sample is taken at the discharge end of the hose immediately before it enters the seepage pond (Pond #2). The seven samples per week are composited into a weekly sample.

The composite sample is allowed to stand until the very little amount of solids settle to the bottom of the jar. A 1 ml sample of the clear liquid is evaporated in a 1.25 inch stainless steel planchet for alpha counting. This sample contains the soluble radioactive material, if any.

The composite sample is then thoroughly stirred, suspending the solids. While stirring, a 1 ml sample is taken and dried in a planchet. This sample contains the soluble and insoluble radioactive material,-if any.

The samples are alpha counted (windowless) for 1 hour. A one hour background is counted immediately before each sample, and another background is counted after each sample. Assuming the before and after background counts are reasonably the same, the average background count is determined and deducted from the sample count. Should the before and after background counts not reasonably agree the counting is repeated.

The corrected counts of the sample "soluble only" is deducted from the corrected counts of the sample "soluble and insoluble" the difference being considered to be "insoluble only".

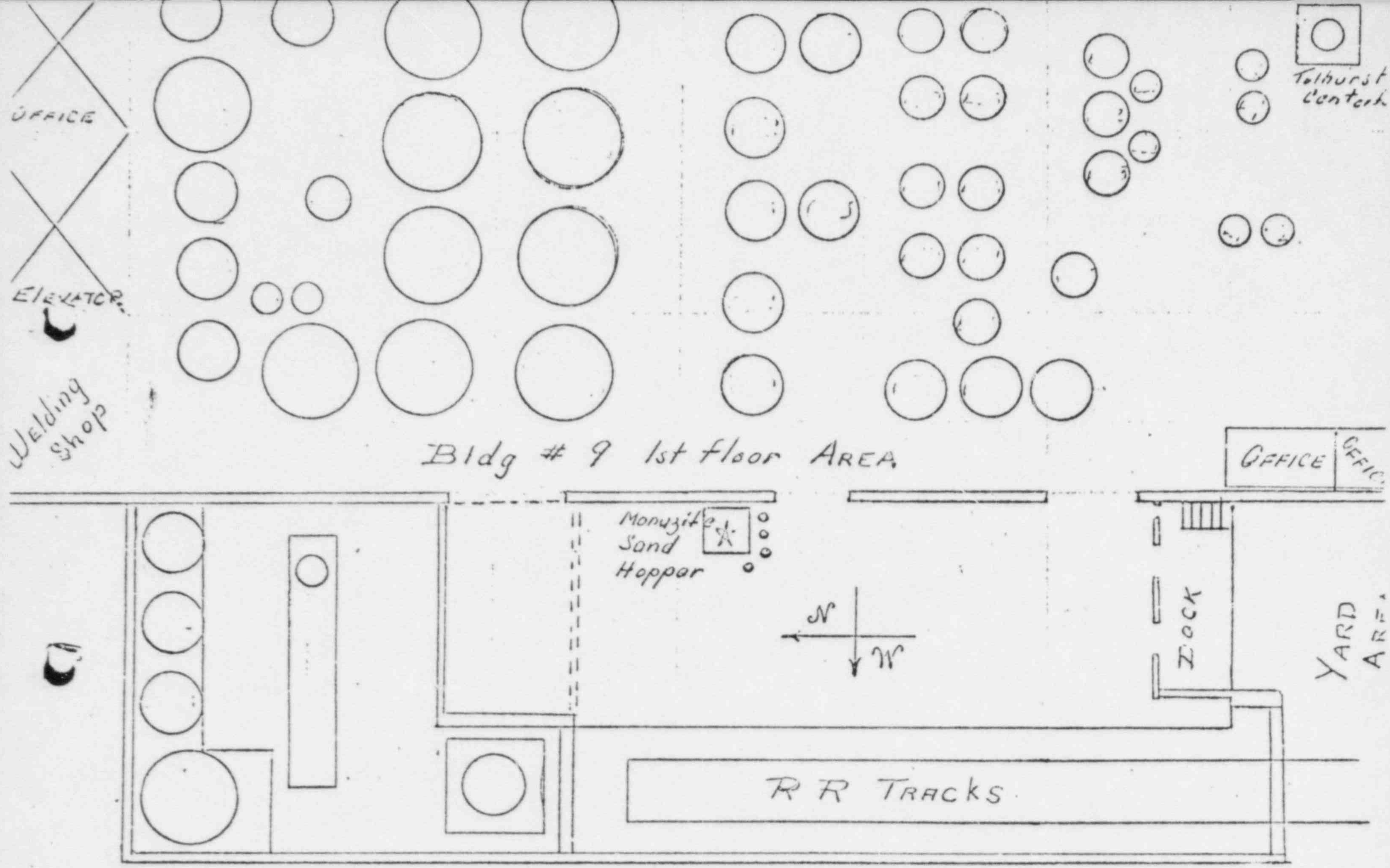
Aged thorium nitrate is dissolved in water to a concentration of 10^{-6}uci/ml. One ml of this solution is dried in a planchet. One hour before and after backgrounds are alpha counted with the thorium reference sample between.

The water sample counting data is corrected for background and divided by the corrected reference sample counts. Results are reported as uci/ml thorium (nat.).

Th nat.
Table II Col 2
Sol: 10^{-6}
Insol - 10^{-5}

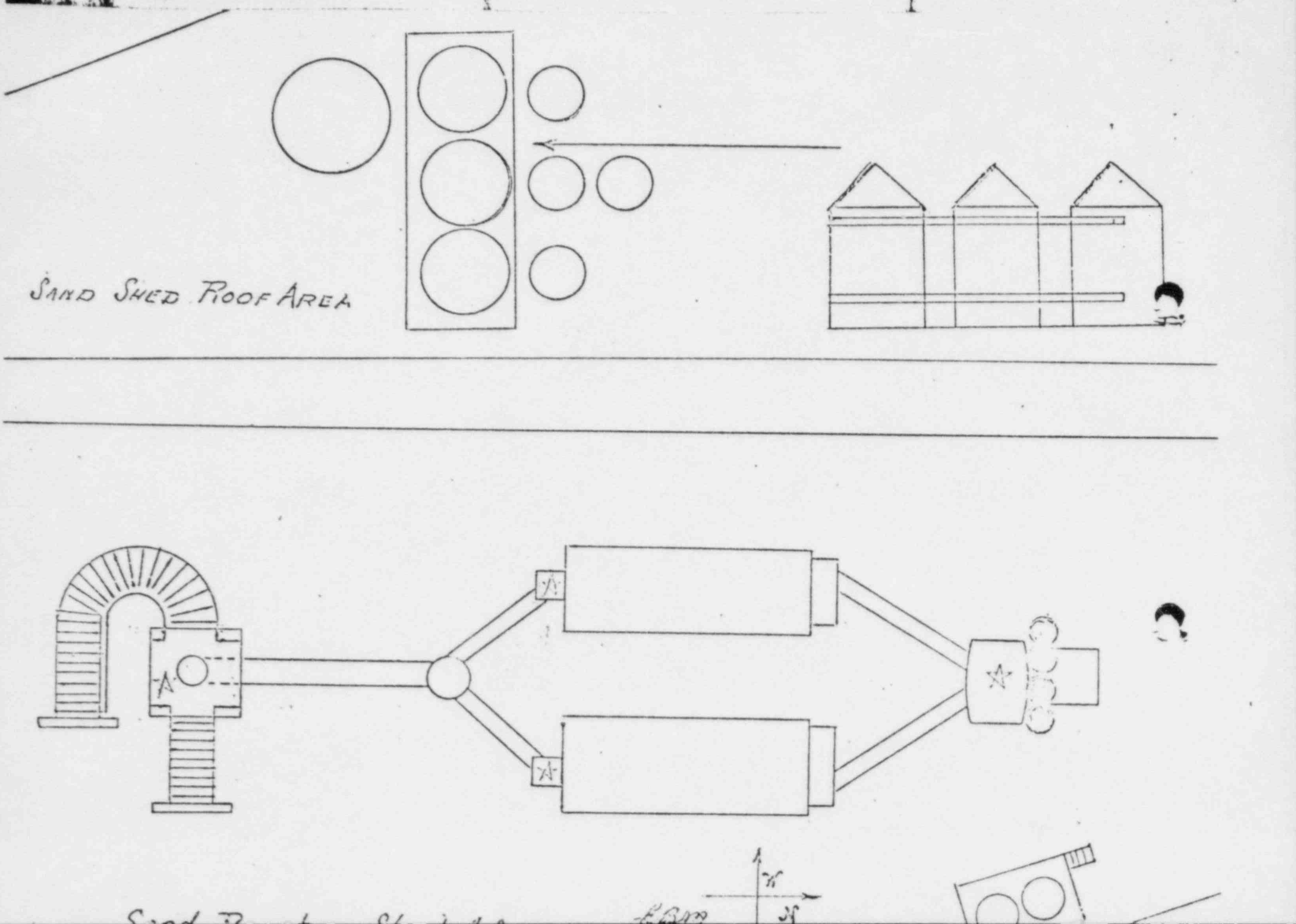
For a period of over a year during 1967 and 1968, waste effluent was radio assayed on a daily basis. Of 475 daily samples assayed for soluble radioactivity 306 were reported as N.D. and the average concentration was 0.12 x 10^{-6} u /ml. The insoluble portion was assayed as well. 285 of the samples for insoluble radiation were N.D. and the average concentration was 0.36 x 10^{-6} uci/ml.

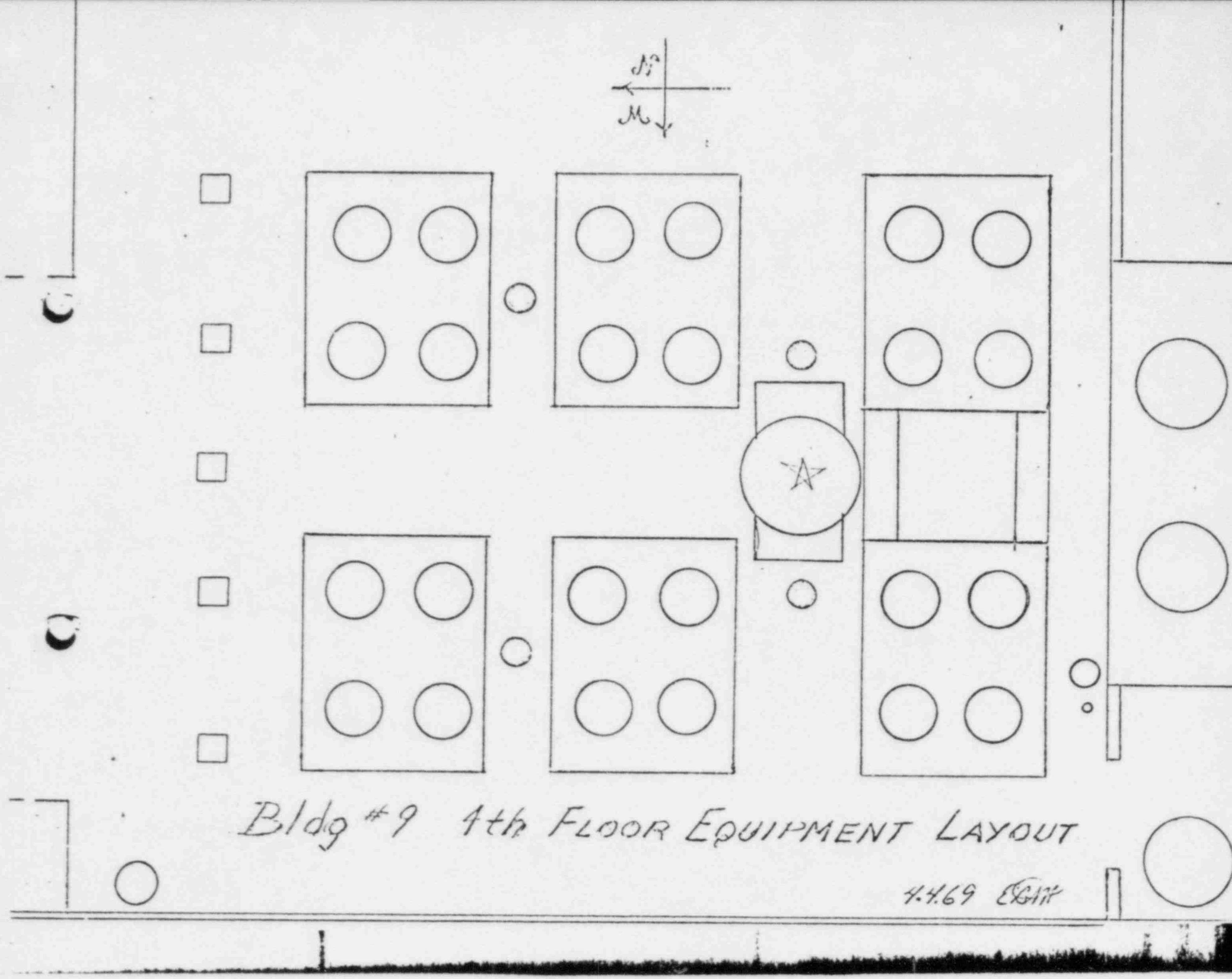
Most N.D. results reported are equal or very nearly equal to background. Results less than 10^{-7} uc/ml are also reported as N.D.

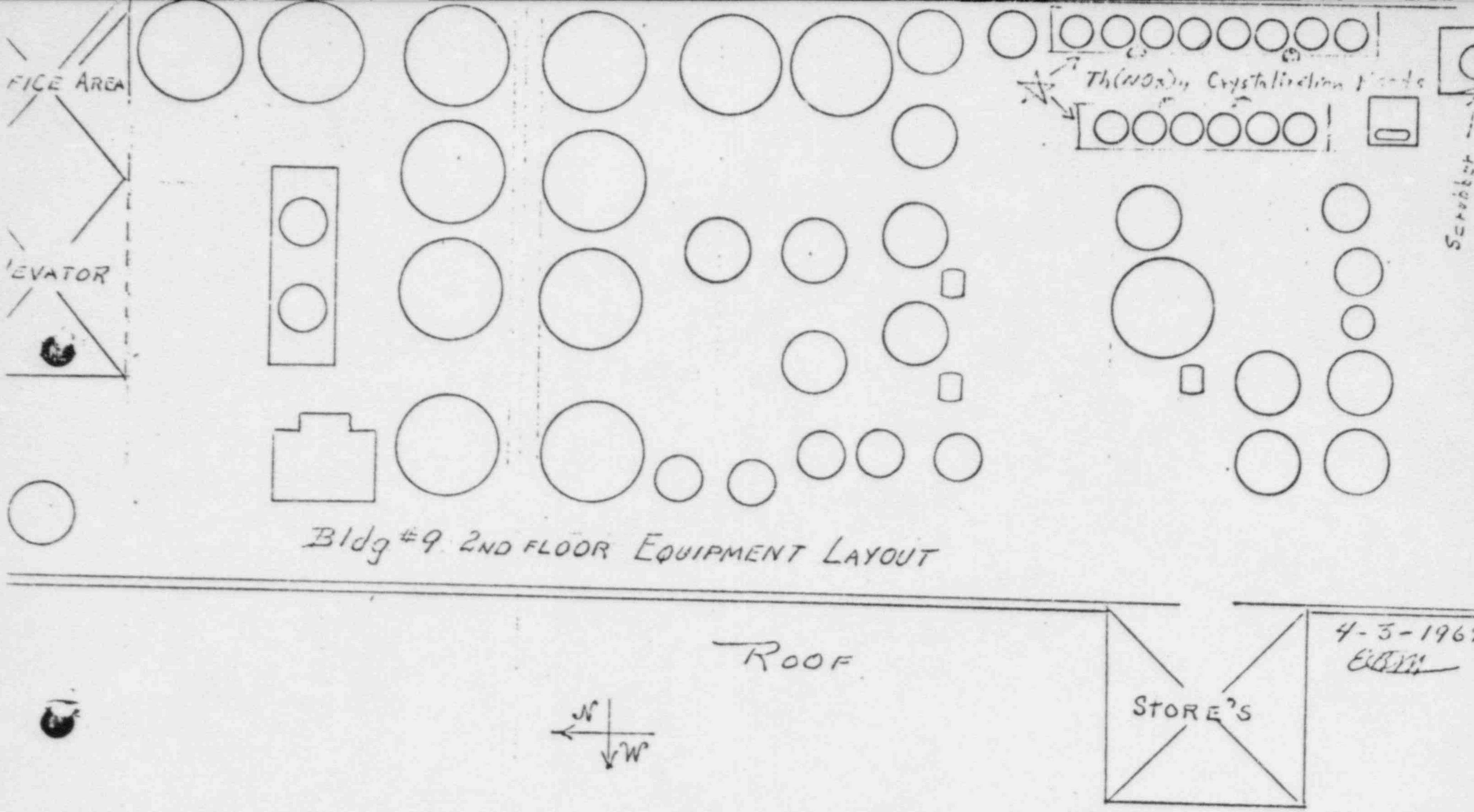


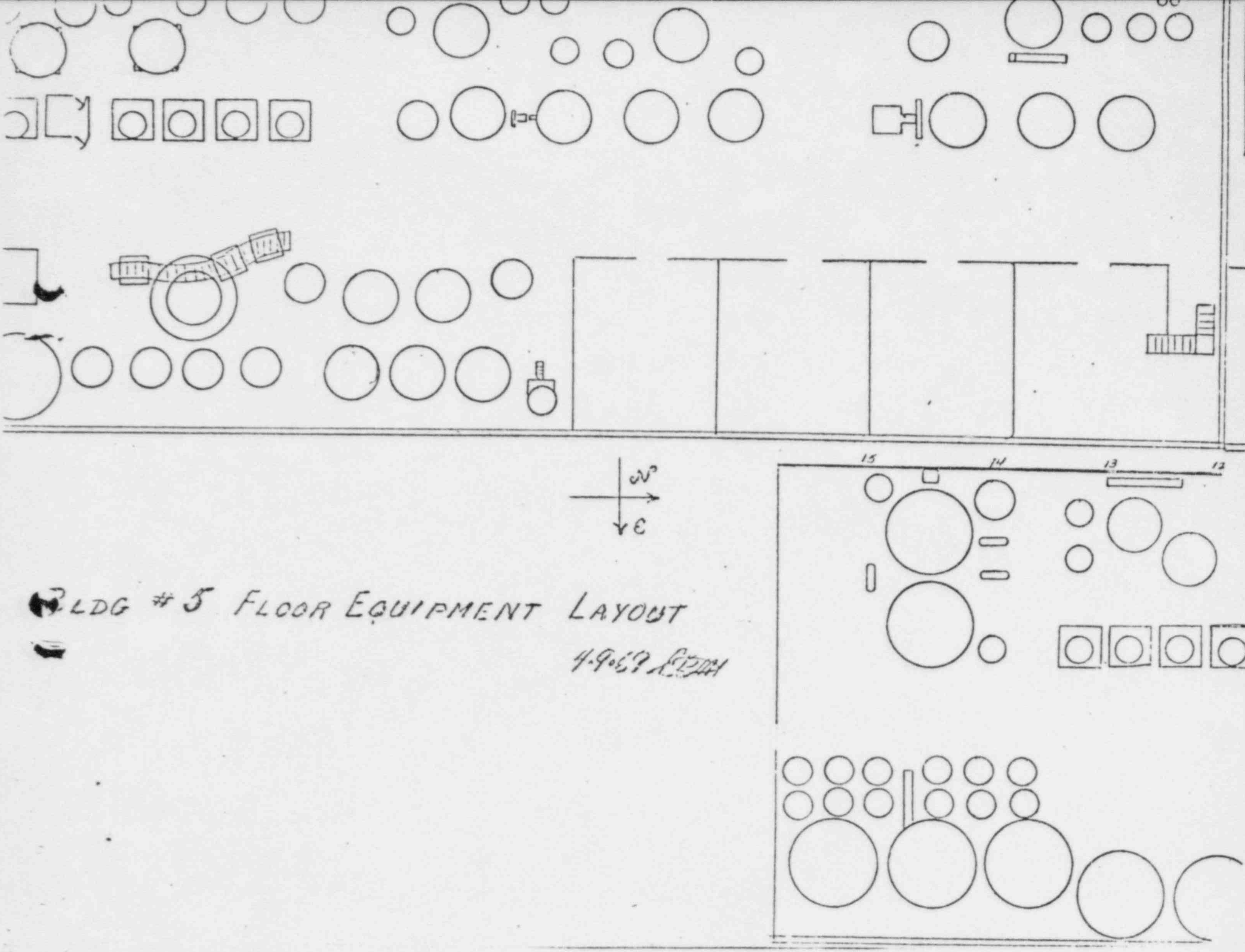
OFFICE
ELEVATOR
Welding Shop
Tolhurst Contork
Bldg # 9 1st floor AREA
OFFICE
OFFIC
Monazite Sand Hopper
N
W
DOCK
YARD AREA
R R TRACKS

4·3·69 E.B.M

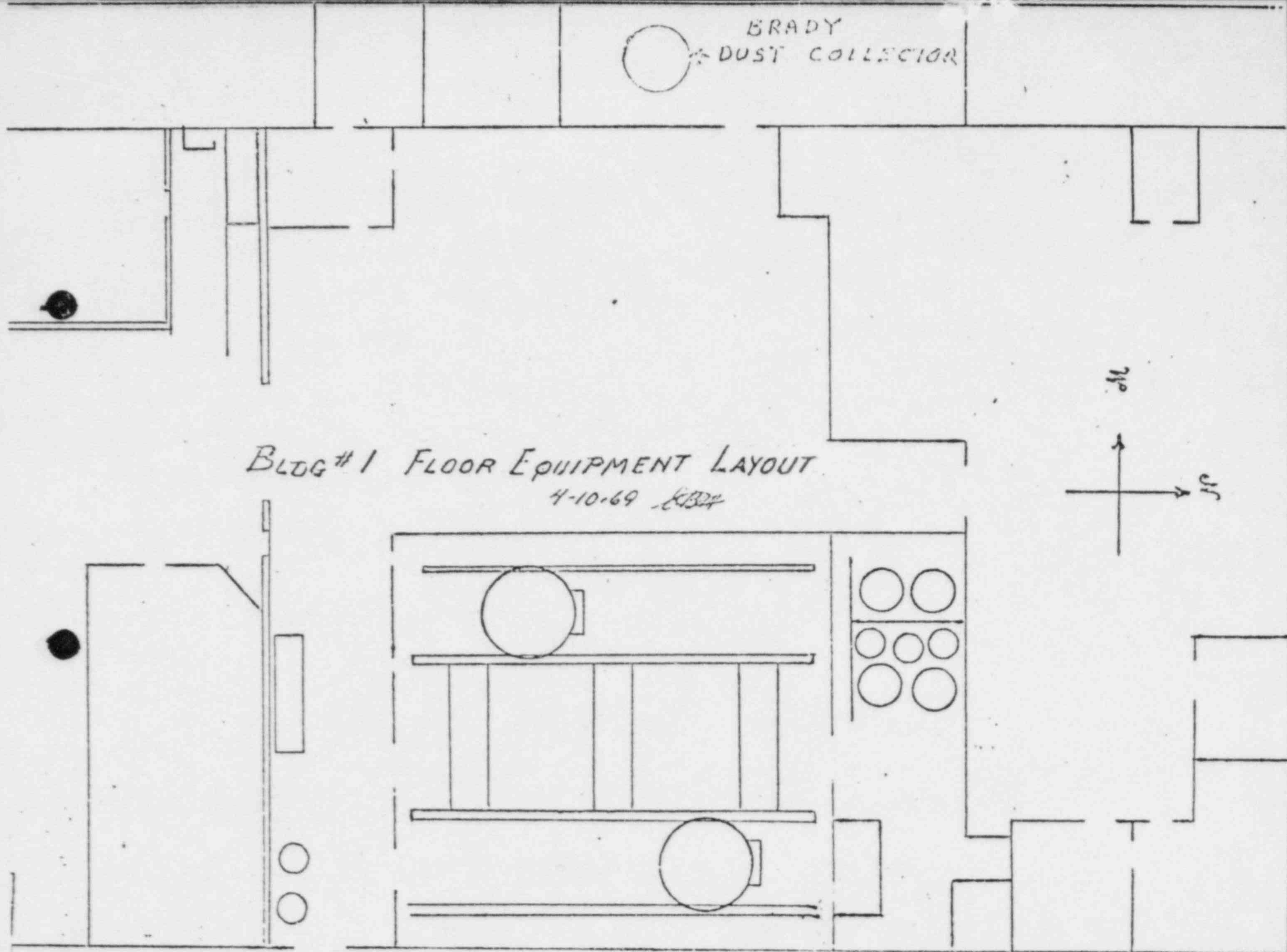

SAND SHED ROOF AREA

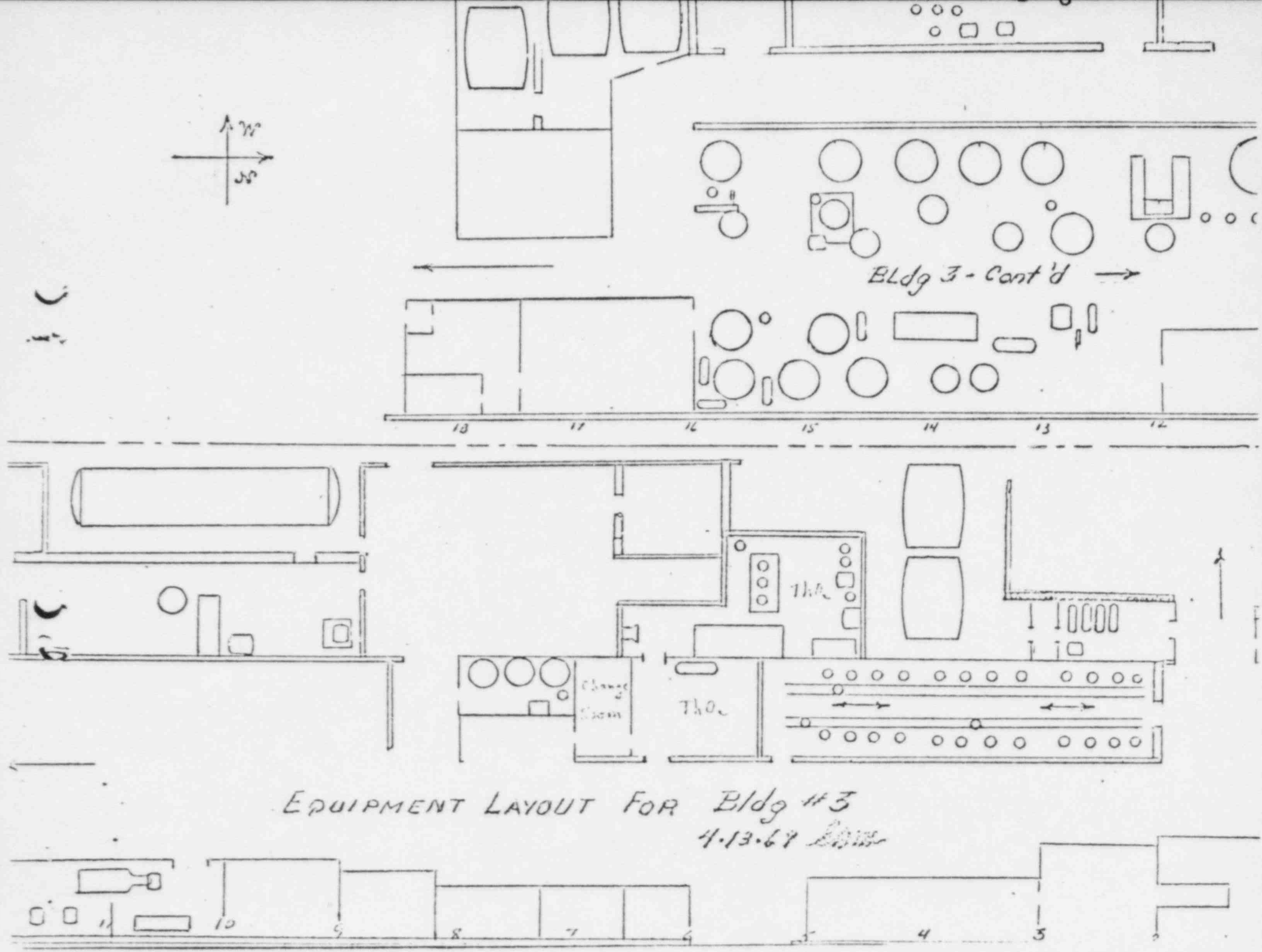

N
M
Bldg #9 4th Floor Equipment Layout
4.4.69


FICE AREA
EVATOR
Th(NO3)4 Crystallization Pots
Scrubber
Bldg #9 2ND FLOOR EQUIPMENT LAYOUT
ROOF
N
W
STORE'S
4-3-1969



BLDG # 5 FLOOR EQUIPMENT LAYOUT

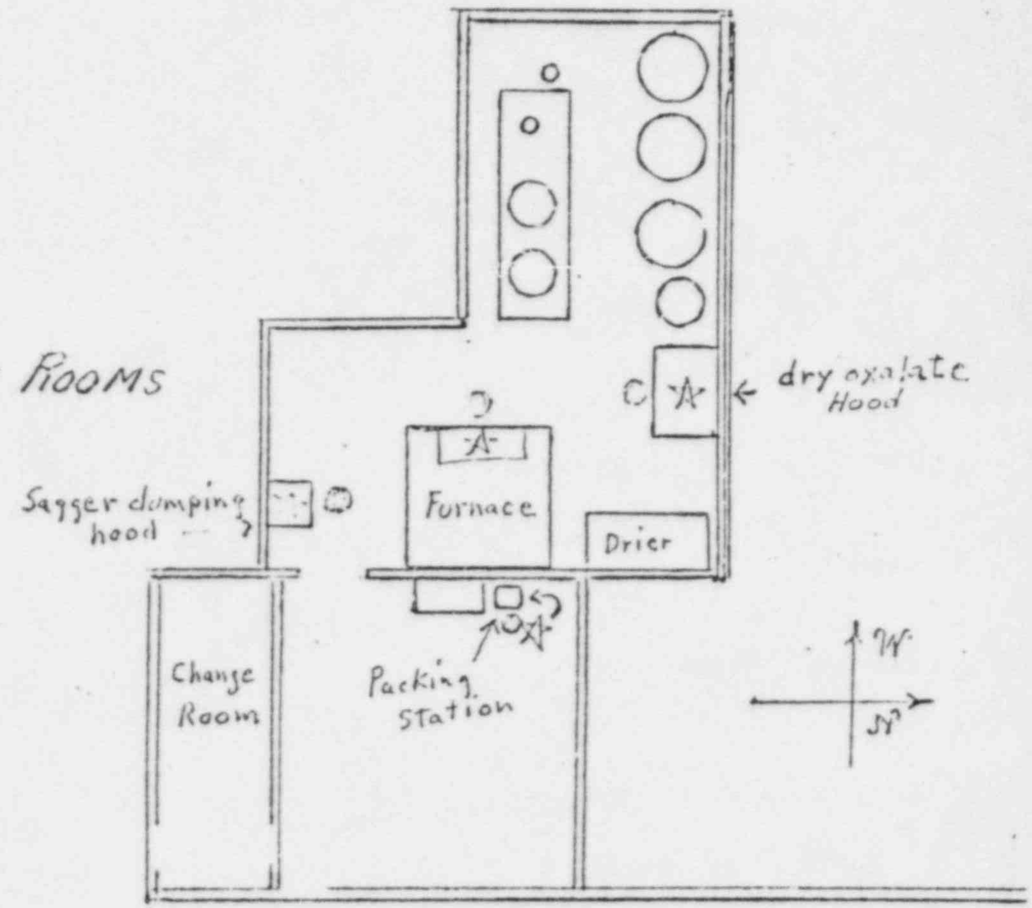

BRADY
DUST COLLECTOR
BLDG #1 FLOOR EQUIPMENT LAYOUT
4-10-69
N
W

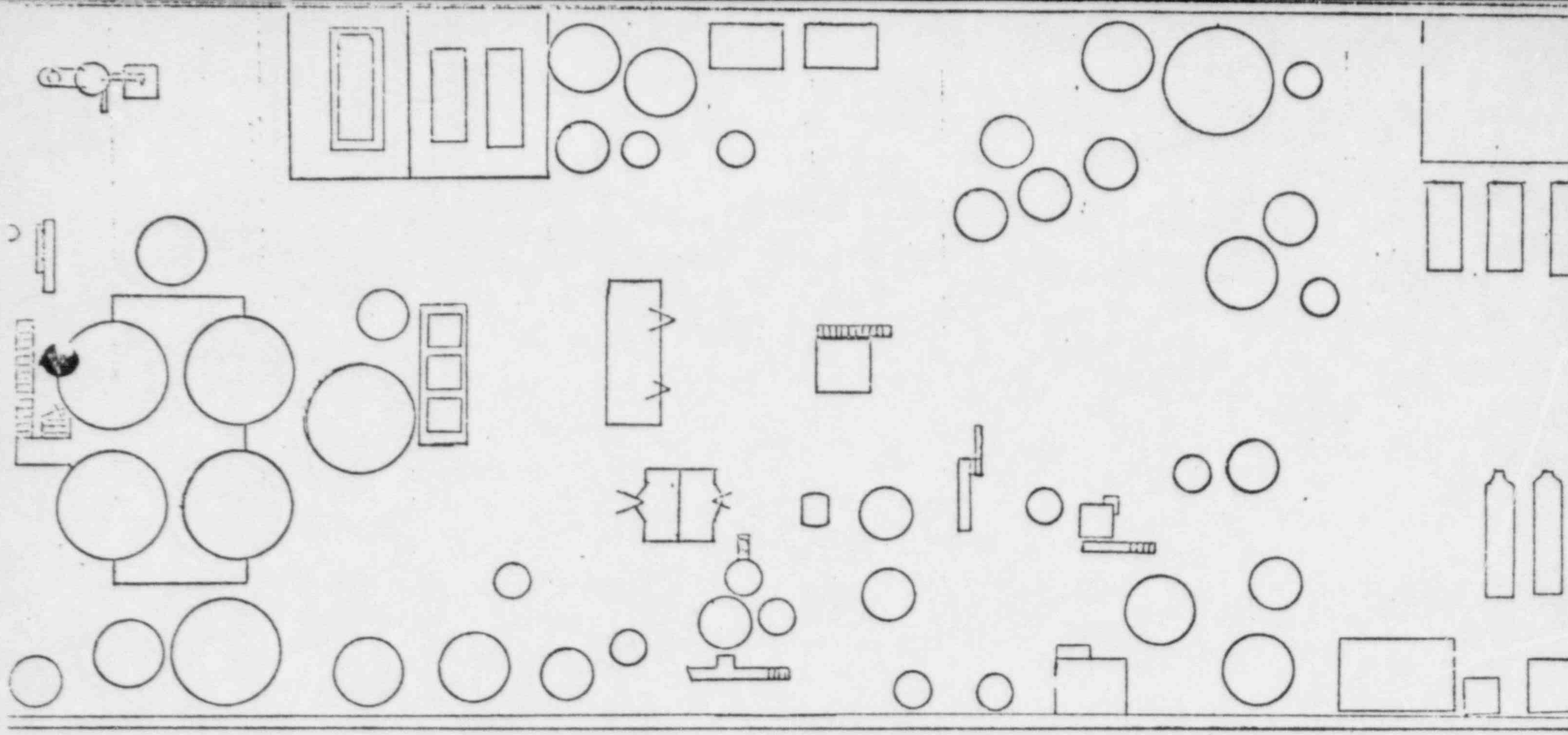


EQUIPMENT LAYOUT FOR Bldg #3
4-13-67

EQUIPMENT LAYOUT OF THORIUM OXIDE ROOMS

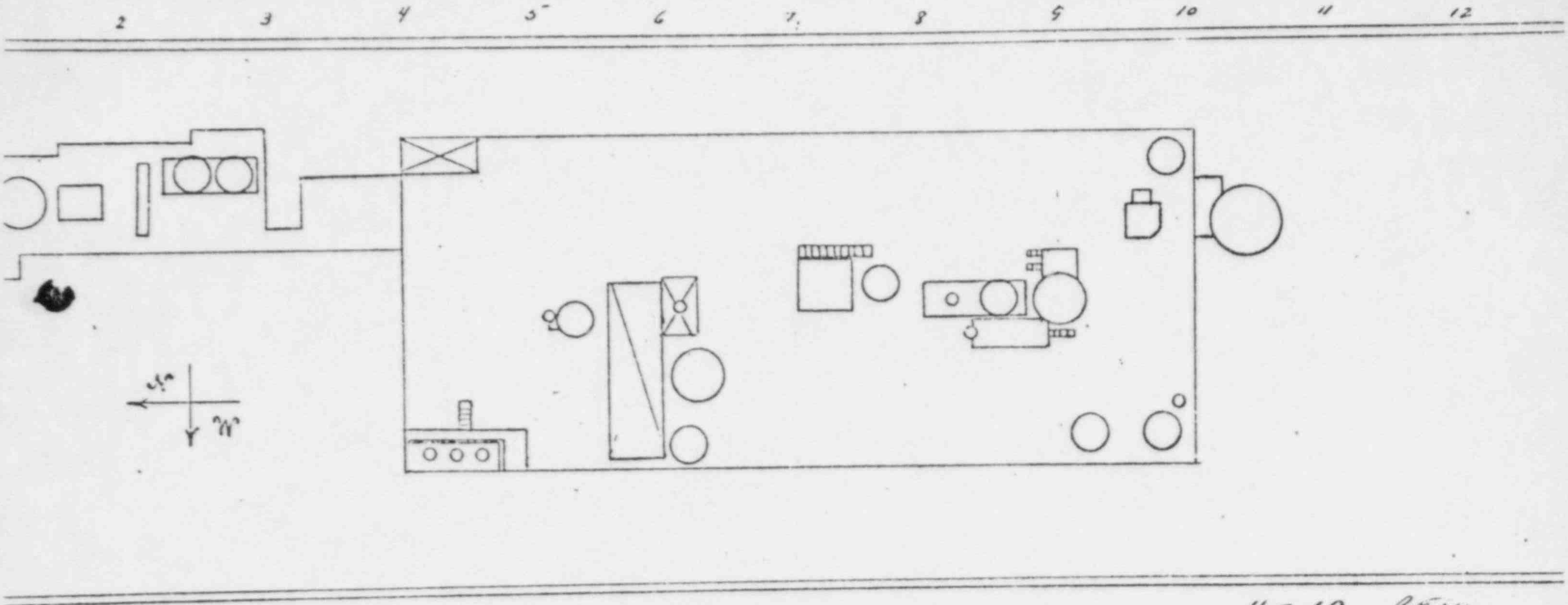
BLGD # 3 4-15-69 [illegible]





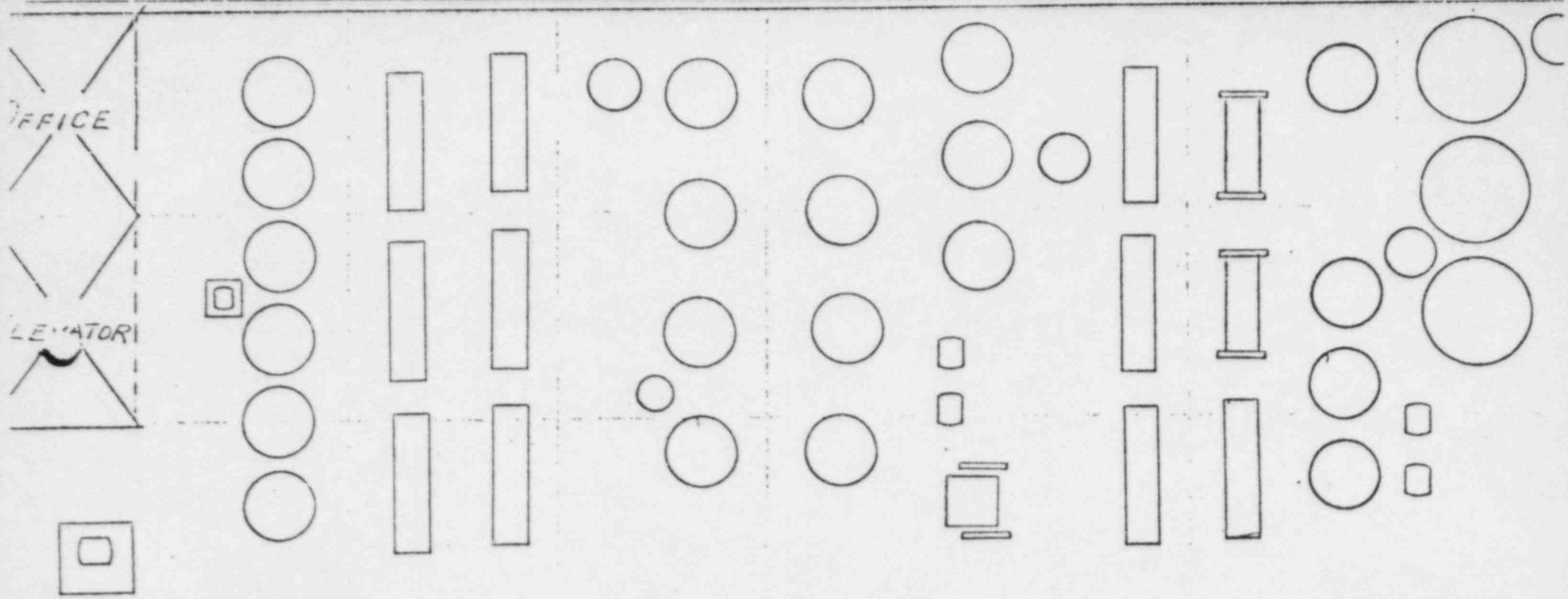
4.7.69 [signature]

BLDG #2 MAIN FLOOR EQUIPMENT LAYOUT



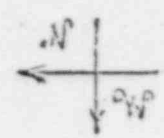
4.7.69 [signature]

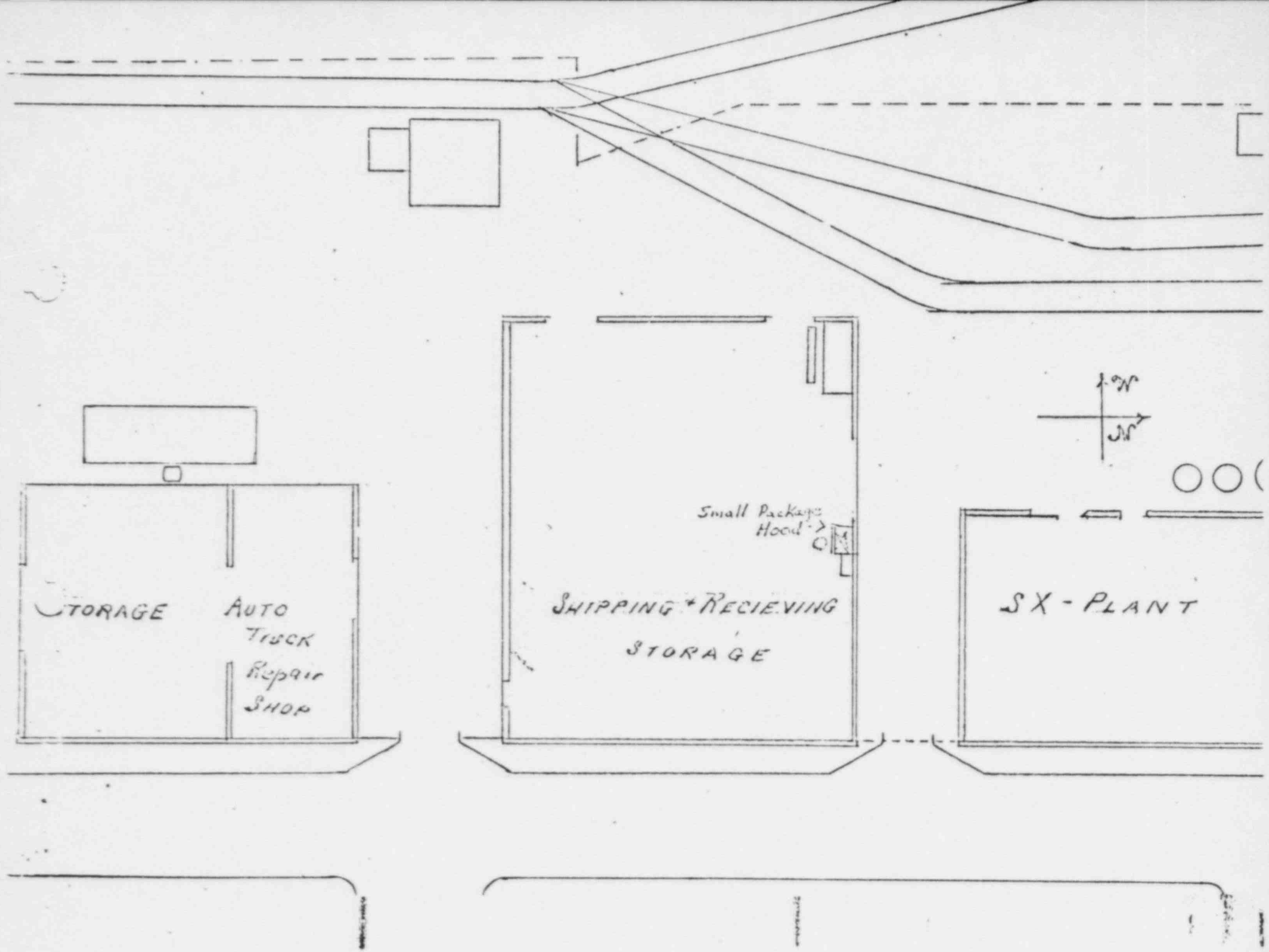
BLDG #2 BALCONY EQUIPMENT LAYOUT



4.4.69 [illegible]

Bldg# 9-3RD FLOOR EQUIPMENT LAYOUT

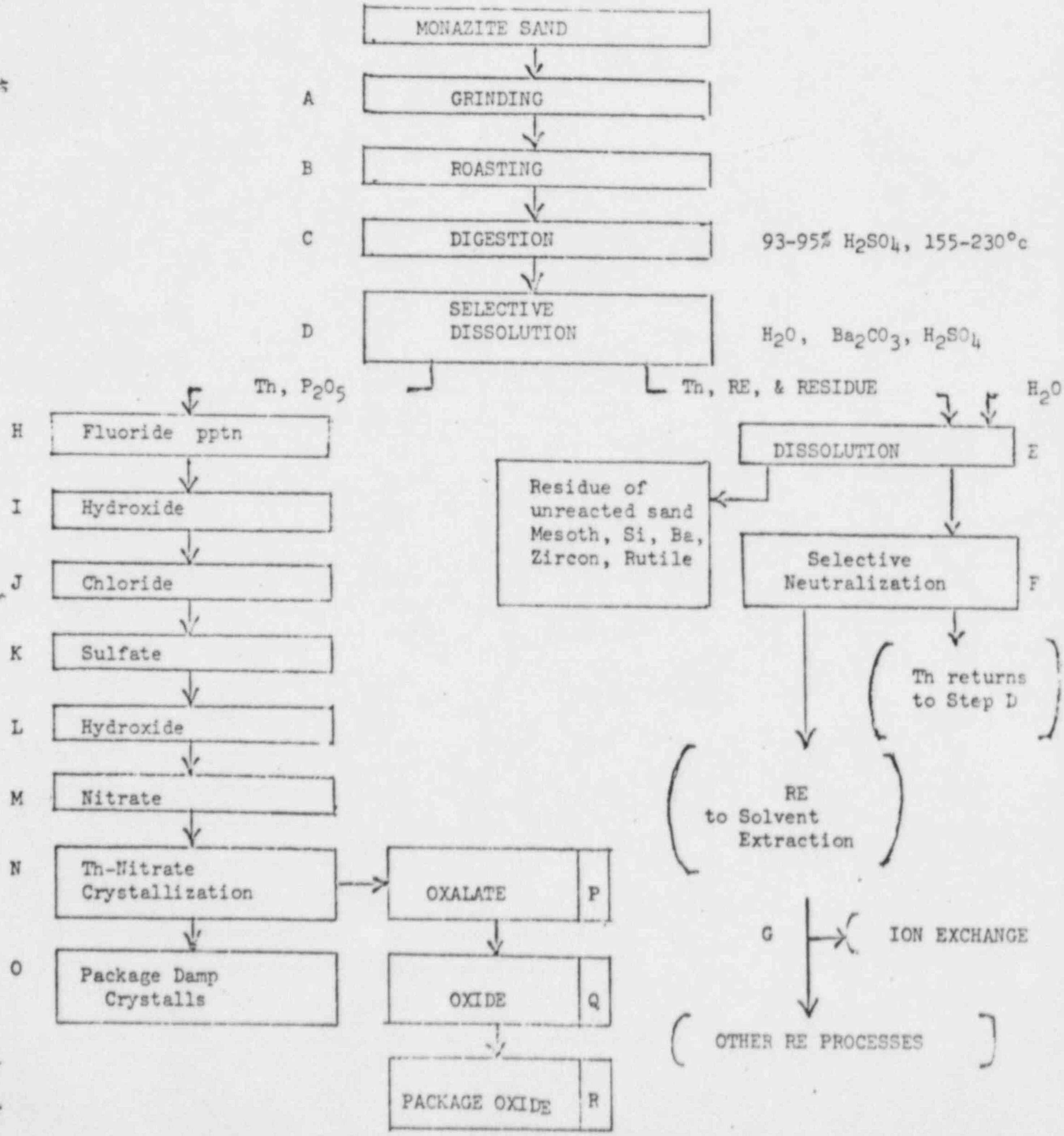




N
N
Small Package Hood
SHIPPING + RECIEVING STORAGE
SX - PLANT
STORAGE
AUTO Track Repair SHOP

8. (A flow diagram (the plant production operation, and a diagram of the plant layout, indicating areas and points in the process where dust is generated).

Our process is essentially the sulfuric acid method for extracting Thorium from Monazite ore.



9. (A description of dust collection and ventilation equipment that are utilized during plant operation, including type, capacity and location of such equipment, eg., ore transfer points, crushing, grinding, etc., and an analysis of the efficiency of the equipment as designed to control or prevent the release of airborne radioactivity to the environs.)

Dust collection equipment is indicated on the floor plans by a star (*). The star indicates the point of operation where airborne radioactivity is generated and thence collected.

A. At present we do not grind the ore, however we may at a future date. The grinding operation will be provided with veniliation control and dust collecting equipment which will prevent an airborne radioactivity exposure in excess of part 20 limits for the operator or operators who attend the operation and for unrestricted areas.

B. At present we do not roast the ore, although we do have equipment for doing this, and we may roast the ore in the future. (See floor plan titled "Sand Roasting Shed-Bldg. 4A". A Dracco 52 bag collector and a Schneible Multiwash Scrubber are located on the roof of Building 4A. Dust laden air is filtered through the bag collector. The filtered air then passes through the scrubber and the dust free air is then discharged to the atmosphere. The system loading is approximately 12,500 C.F.M. The air relocities at the various hoods (*) have a minimum of 125 F.P.M. Capture velocity is approximately 100 F.P.M. During past operations several hundred air samplings have been taken resulting in no overexposures for any of our personnel.

C-1 Roasted, or non-roasted ore is placed into a Monazite sand hopper (See floor plan titled "Bldg. 9 1st Floor Area"). The ore is lifted to the 4th floor by a bucket elevator. The sand hopper is hooded and ducted to a Dracco 3-compartment No. 40 bag collector which is located on the 4th floor roof.

The elevated ore is discharged into a surge bin. (See floor plan "Bldg. 9 Forth Floor Equipment Layout"). The surge bin discharges into charging buckets positioned on a weighing scale. This operation is enclosed in a hood ducted to the dust collector.

Air velocities at the face of the hoods are:

1. 1st Floor Sand Hopper Hood 135 F.P.M. ✓
2. 4th Floor Weighing Station 110 F.P.M. ✓

Capture velocity is approximately 75-100 F.P.M., and the system loading is approximately 8,000 C.F.M.

Hundreds of air samplings have shown no excessive exposures to airborne radioactivity for our personnel working at the sand hopper or weighing station.

C-2 The charging buckets are emptied into reaction pots containing sulfuric acid and this forms a wet paste. Acid vapors and gasses from the reaction are ventilated from the pots, scrubbed in Ducon type VW-3 centrifugal wet scrubbers and then passed through a water scrub shelf tower before being discharged to the atmosphere.

From this point through many process steps there is no significant airborne radioactivity problem.

K (Flow diagram Step K - Thorium Sulfate)

This part of the process is described here because we propose to install an additional scrubber in our system to eliminate a minor air-pollution problem.

Thorium sulfate is slowly crystalized from a Thorium Chloride solution using mild air agitation. Water vapor containing a small amount of hydrochloric acid is evolved. This vapor has been ventilated to the atmosphere through our general purpose process exhaust system which discharges 80 ft. above ground.

Once the scrubber is installed our general plant exhaust system discharge will be almost completely water vapor and air.

N. (Flow diagram Step N - Thorium Nitrate)

This part of the process is serviced by a scrubber. (See floor plan "Bldg. 9 2nd Floor Equipment Layout")

Thorium nitrate feed solution is evaporated in kettles to concentrate the solution. Upon cooling, crystals of thorium nitrate are formed. During the evaporation water vapor containing oxides of nitrogen are evolved. The kettles are completely enclosed in a hood which is ventilated to a packed tower scrubber with a caustic scrub to remove the small amount of nitrogen oxides. The scrubber discharges into our general process exhaust system.

The scrubber loading is 4300 C.F.M. and air velocities measured at the opened inspection door in the hood panel are greater than 200 F.P.M.

P,Q & R (Flow diagram Steps P, Q & R - Thorium Oxide)

(See floor plan "Thorium Oxide Rooms - Bldg. 3")

Damp thorium nitrate crystals are dissolved in water and oxalic acid added to precipitate thorium oxalate. This slurry is filtered and the damp cake is spred on trays and dried in a tray drier. The water vapor is vented directly to atmosphere.

The trays of dried oxalate are placed under a hood and the chemical is scooped into ceramic ignition saggers. The saggers are placed into a muffle furnace where the oxide is formed. A slot hood shroud is fixed around the furnace door to remove dust which may occur during loading and unloading the furnace.

After ignition and cooling the saggers are dumped into a blending drum. A slot hood removes dust generated when dumping. After blending, the blending drum outlet valve is alternately opened and closed to fill the final package. A dust vent removes dust during packaging.

The various hoods and vent used in these operations are ducted to a Brady Dust Filter Model 1375.

The air velocities at the face of the various hoods is as follows:

Dried Oxalate Hood	300 FPM
Furnace Slot Hood	300 FPM
Saggers Dumping Hood	130 FPM
Packaging Dust Vent	Above 300 FPM

System loading is approximately 6100 CFM.

The Brady dust filter collector is located 60 yards north of the Building 3 thorium oxide room. It is contained in a separate room as shown on the drawing titled "Bldg. #1 Floor Equipment Layout".

10 & 11 (A description of the survey program which is followed to determine concentrations of airborne radioactivity within the plant, including the make, model number and capacity of sampling devices, and your procedure for sample analysis. Include a description of :-

a. Each sampling location in respect to operating personnel.
b. Each sampling location in respect to process operation.
c. The frequency (for a & b)
d Surveys made during maintenance operations.)

Concentrations of airborne radioactivity within the plant are determined for the following:

A. Breathing zone of the operator while at the point of operation where dusty radioactive material is handled.(5 minute air sample)

B. Specific work area the operator occupies when not at the point of operation. (1 hour air sample)

C. General plant areas which the operator or others may occasionally or frequently occupy. (1 hour air sample)

D. During maintenance of thorium processing equipment containing dusty material.

Many of our operations are quite sporadic. Air samplings are not taken at the point of operation during down time. General air samples are obtained however, in each building and on each building floor which contains thorium operations, unless these areas are shut-down and only rarely occupied. A general air sampling is also made in a non-thorium operating area for "background" information. General air samples are taken monthly.

Breathing zone, point of operation air samples are indicated by solid circles on the attached floor plans. These samples are taken at one-half of the points shown every other week in such a manner that a sample is taken at each point once each four weeks, except at those points where no operations are conducted during the four week period.

A specific work area sample is taken whenever a breathing zone sample is found to contain more than 3 x 10-11 uc/ml natural Th, 7 x 10-10 uc/ml Ra224, 1 x 10-7 uc/ml Bi212, or 3 x 10-7 uc/ml Rn220. Under these circumstances we document the operators time in the various areas he occupies, and calculate his potential 40 hour exposure.

Upon learning that maintenance work is needed on equipment containing radioactive material an assessment is made of the particular job in question. If it is determined that a potential airborne contamination problem could exist then an air sampling program is established after all efforts are made to minimize the problem.

We have three air sampling devices which were designed and constructed by our personnel. Each sampler has a timer, an air pump, flow meter,

air flow adjustment, and a filter paper holder. The air flow meter is calibrated using a gas meter. The air sampler is set to draw 35 liters of air per minute through a Whatman No. 41 paper which is 1.25 inch in diameter.

We use a gas flow proportional alpha counter in the "windowless" position to analyze our air samples.

Alpha counting is done as follows:

I. In cases where daughter activity is more than negligible and at any new point of operation.

A. The sample is counted 1 hour after sampling.

Our standard formula for computing activity is:

$uc/ml \times 10^{-11} = C/M \times d/c \times 1.29/T \times 1/.7$

Where C/M = counts per minute from the sample.

d/c = disintegrations per count (from alpha standard source)

$1.29\ (x10^{-11}) = 1/22.2 \times 10^{6}\ d/m/uci \times 3.5 \times 10^{4}\ ml/min$

T = Sampling time (minutes)

1/.7 = Filter paper absorption factor

At this point in time the Rn^{220} has died off and most of the alpha count is due to Bi^{212}.

Using the standard formula compute the gross activity.

B. The sample is counted again 10.6 hours after sampling. This is a half-life of Pb 212 and half of the Bi212 is also gone both of which at this point are the result of 1/2 of the Rn220 originally present.

1. The standard formula times 2 = Rn220 activity

2. To obtain the Bi212 activity the standard formula calculation is multiplied by 0.9 and this product is subtracted from the gross activity found in A, and the difference is multiplied by 2.

C. The sample is counted again 106 hours after sampling.

This is 10 half-lives of Pb212 and all of the short lived daughters originally present are gone.

The standard formula is calculated and divided by 1.7=Ra224 activi

D. The sample is counted again 465 hours after the sample was taken. At this point an apparent equilibrium has been established and we have nearly 6 alpha activity which is close to the amount at secular equilibrium.

$$\text{Th(nat)activity} = \frac{\text{Standard formula} - .1\ \text{Ra224 activity}}{5.9}$$

II. In cases where daughter activity is negligible counting is done 106 hours after the sample was taken.

The standard formula is divided by 6 to obtain the Th(nat)activity.

III. Each day the alpha standard is counted to assure that the counter is reliable.

Sample and background counts are properly taken to assure a 95% confidence level. We should detect a minimum of $9X10^{-11}$ uc/ml Rn220 and/or Bi212. For Th(nat) we should detect 2×10^{-12} uc/ml, and for Ra224 7×10^{-11} ux/ml. This applies to a 5 minute sample time. An hour sample would show at least 10 times greater sensitivity.

12. (A description of the procedure followed in determining the average daily and weekly exposures to airborne radioactivity for each employee who frequently or occasionally occupies areas where air contamination exceeds M.P.C. values specified in 10CFR 20)

We are not now using any operation which continuously causes an airborne concentration in excess of 3×10^{-11} uc/ml of natural thorium in a restricted area during a 40 hour work week outside of ventilation control equipment.

There are a few operations which may for short periods of time exceed 3×10^{-11} uc/ml of natural thorium in the air at the point of operation. Thus there is a possibility that on a 40 hour basis an airborne concentration greater than 1 M.P.C. might exist.

Whenever a 5 minute operators breathing zone sample shows greater than 3×10^{-11} uc/ml of natural Th the operators time at the point of operation is calculated. A 1 hour air sample is taken in the environs of the area where the operator spends most of his time. The time weighted exposure including the breathing zone sample and general air sample is calculated. If the calculations show that an average of 1 M.P.C. could be exceeded during a 40 hour work week then immediate steps are taken to correct the problem. If ventilation control equipment is found deficient it is repaired. If the operators handling methods are improper he is re-instructed. As a last resort employee rotation may be used.

It is extremely rare that a general area air sample exceeds 1 M.P.C. and these operating areas are occupied so little by personnel, other than the operator, that we do not propose to document the time of an occasional occupant.

13. (If treatment or disposal of licensed material by incineration is anticipated, an application should be made in accordance with 10CFR20 sec. 20.305).

In conformance with 10CFR20.305 we request that our license include a provision enabling us to incinerate Monazite ore bags and other combustable trash.

We are confident we will not exceed the airborne concentration limits for unrestricted areas for natural thorium when averaged over a year.

We will use a hand fed Model Co-200 multiple chamber incinerator equipped with a gas after burner which was built by the C.O. Hendrikson Company. The following data applies:

a. Trash burning capacity of incinerator - 200 lbs/hr.
b. Exhaust gas volume in stock corrected to 70°F - 300 C.F.M.
c. Stack height - 30 ft.
d. Particulate emission-0.17 grains per standard cubic foot.
e. Expected maximum operating time - 10 hrs/wk.
f. Micro curies (Th(nat) of exhaust gas within stack-$8x10^{-12}$ uc/ml (corrected to 70°F)
g. Expected yearly average concentration of Th(nat) within stack gas - 0.46 M.P.C. (Background neglected).
h. Ash & residue (Monazite sand) - 20% of trash weight.
i. Thorium content of ash & residue - 6% (1.2% of trash weight).

Before incineration the operator will clean out the ash from the previous days burning. This will assure that the ask is cold thereby minimizing airborne material. The ash & residue will be placed in boxes or drums and stored on our property for possible reclaiming of values.

The operator will then load and operate the incinerator.

X [An hour air sample will be taken in the general breathing zone area of the operator during the time he is cleaning the incinerator, packaging the ash, and operating the incinerator. We will monitor the exhaust discharge by isokinetic sampling within the stack and record the results.] X

In the beginning the air sampling will be done each time the incinerator is used. After sufficient data is obtained, the sampling frequency may be reduced. The reduced frequency will be adequate to assure compliance of the regulations.

14. (A description of plant discharge stacks including stack heights, types and concentrations of effluents discharged, method for controlling release of radioactive material, and methods for determining the concentration of radioactive material released to the environs.)

We have a total of 10 stacks which service our Thorium operations. These are:

1. Bldg. 9-General purpose process exhaust system, 3rd floor roof
This stack is 80 ft. from ground level. Many processing tanks are connected to the general exhaust system. These tanks are all part of the "wet" process. On an average, only trace amounts of SO_2, HF, NO_x, NH_3, H_2S are present. When the new scrubber is installed (as described in Section 9K) the minor air pollution problem with HCl and Cl_2 will be eliminated. The discharge from this stack will then be almost entirely air and water vapor..

2. Bldg.9-Dracco Dust Collector Stack, 4th floor roof
This stack is approximately 130 ft. high. This equipment is described in Section 9C-1 of this letter.

   During operation, once every other week, hour long air samples are taken at the point of discharge and other areas on the roof. Most of the time the air sample results are well below 1 M.P.C. Th(nat) for unrestricted areas. On a rare occasion it will be discovered that the discharge shows higher radioactivity than usual and corrective maintenance is then done to correct the situation.

3. Bldg. 9-Water Scrub Shelf Tower, 4th floor roof
This equipment is described in Section 9C-2 of this letter. The discharge from this tower is 120 ft above ground level. A trace of SO_2 may be evolved from this tower.

4. Bldg. 3-Thorium Oxide Process Oxalate Precipitation
The kettles used to dissolve damp nitrate and precipitate the oxalate are enclosed in a hood which is vented by a stack 30 ft. high. The stack discharges water vapor. (See Section 9 P,Q,&R).

5. Bldg. 3-Thorium Oxalate Drier
The oxalate drier (See Section 9 P,Q,&R) stack vents water vapor and products of natural gas combustion at a height of 30 ft. from ground level.

6. Bldg. 3-Muffle Furnace
The furnace (See Section 9 P,Q,&R) exhaust stack discharges CO_2 and gas combustion products at a height of 30 ft.

7. Dust Collector for ThO_2 Process - Bldg. 3
The collector stack discharges at a height of 40 ft. above ground level. Air sampling similar to that described above (2) for the Dust Collector stack on the 4th floor roof is performed.

8. Ore Roasting - Bldg. 4A
As described in 9B, the ore roasting equipment is serviced by a dust collector and a wet scrubber. This combination very effectively removes dust before the ventilation air is discharged from the scrubber stack which is approximately 60 ft. in the air. Air samples are obtained on the roof of this building.

9. Incinerator
See Section 13 for details.

10. Shipping Warehouse Small Package Station
Occasionally we need to make small packages of Th nitrate or oxide. The radioactive material is handled within a dust collector hood with the operator outside. The collector is a Torit Model 124 bag collector. The clean air discharged 10 ft. above ground through a wall of the building. Loading is 2800 C.F.M.

As a double check on our dust collection effectiveness we take air samples around the periphery of our plant property. This is done four times a year and at least six air samples are taken. Also, on a weekly basis outside air samples are collected east and west of our plant at a distance of approximately one-half mile.

Roof top samples, fence line samples and remote samples over the past few years indicate we are not exceeding regulations covering airborne radioactivity in unrestricted areas.

15. (A description of the method for determining exposures of employees to external radiation. For film badge studies, indicate number and category of personnel involved in the program.)

A film badge program is used to determine the exposure of employees to external radiation.

All Chemical operators, laborers, maintenance men, and immediate supervisors of these employees are required to use film badges. Laboratory and other personnel who either work with or frequently visit areas where radioactive material is handled or stored also are required to use film badges. Persons whose duties are not likely to involve them with radioactive material handling, and who seldom visit operating or storage areas are not required to use film badges.

Chemical operators and laborers who are considered "thorium handlers" are on a weekly badge service to minimize the possibility of over-exposure. All other personnel in the film badge program are on a monthly badge service schedule.

(4/69)
23 weekly
105 monthly

We currently have 23 persons on weekly badge service and 105 on monthly service. These numbers will vary depending on production manpower requirements.

At a minimum, Gamma meter surveys are conducted during the time that monthly general air samples are obtained. Records of these surveys are made.

16. (A description of your methods for contamination control, including provisions for monitoring and the levels of contamination at which decontamination is performed.)

Our housekeeping program includes wet scrubbing of the floors daily in areas where thorium containing material is handled. In the case of a spill, the operator is instructed to clean it up as soon as practical. The level at which decontamination is necessary is that amount which is visible to the eye. A monitoring survey for surface contamination, therefore, is essentially a visual inspection. Survey meters are used to distinguish between radioactive and non-radioactive contamination.

Personal protective equipment provided for employee use when needed includes hard hats, safety glasses, chemical goggles, face shields, plastic jackets and pants, rubber safety shoes or boots, assorted glove types and styles, dust and fume respirators, and other miscellaneous equipment.

Shower and locker room facilities are available for all operating personnel. A clothes washer and dryer is also available. These people are instructed to bathe or wash thoroughly after their work shift. They are also instructed to promptly wash off any thorium material which may accidently spill on their skin.

17. (A copy of the written radiological safety operation instructions supplied to employees. These instructions should include provisions for personal hygiene, including washing prior to eating or leaving the plant, instructions for wearing personnel monitoring devices, and instructions for cleaning up dust and spills within the plant.

See enclosed "Radioactivity Statement" and Page 18 of booklet titled "General Safety Rules and Safe Procedures".

RADIOACTIVITY STATEMENT

General Instructions for Handling Radioactive Materials in the West Chicago Plant

Employees of American Potash & Chemical Corp. are hereby informed of the occurrence of radioactive materials and radiation in the West Chicago Plant.

The Corporation is required by law to explain the safety problems associated with handling radioactive materials. In a sense there are no safety problems concerning radioactivity in th plant. That is, careful observations have failed to show any employee has ever been injured b radioactive material during the nearly sixty years this plant has operated. The reason for th is that radioactivity is present at levels very low compared to those known to be harmful. Th exact level at which radioactivity becomes harmful has not yet been determined. Scientists ar in universal agreement that exposure of normal persons to radioactive material produces no ben ficial results. Consequently, the Atomic Energy Commission (AEC) has set very low levels of radiation and of airborne concentrations of radioactive material to which persons handling licensed material such as thorium may be exposed. The Corporation provides equipment such as ho with forced draft ventilations, dust masks, gloves, etc., and follows good housekeeping procedures such as sweep-downs and wash-downs. No employee exercising common sense should ever receive radiation in excess of the limits permitted by the AEC, or be present in concentrations of airborne radioactivity in excess of permissible limits.

By observing some simple rules, an employee can keep his exposure well below even the very low limits allowed by the AEC. The basic principle is to avoid unnecessary contact with radioacti materials, such as monazite ore or thorium concentrates. Following are some of the ways of cutting down on exposure:

1. Most Important— Avoid any dust unnecessarily.
2. Wear a dust mask faithfully on the operations and at the times required. Your foreman wil instruct you as to when to wear, how to wear, and how to care for your mask.
3. Do not make unauthorized visits to dusty operations.
4. Do not rest on monazite bags or drums of thorium or even stay next to them unnecessarily.
5. If material is accidentally spilled, clean it up as soon as practical; or if you are in doubt as to proper procedure, tell your foreman. If the material can be recovered by sweep ing it up, avoid raising dust. Spilled solutions are to be hosed down. If a thorium solution or powder is accidentally spilled on your skin, wash it off before doing anything els Other material should be washed off as soon as practical. Spilled thorium oxide powder is special case and is to be vacuumed up, unless the amount is so large as to make this imprac tical. For example, if a bottle of thorium oxide should break, it would be better to carefully shovel the bulk of it up while wearing a dust mask and gloves. After vacuuming, the area is to be wet-mopped with soap and water. Discharge the used water to the waste drain.
6. When you leave your work station, wash your hands thoroughly, especially before eating.
7. Your badge measures the radiation you receive from external sources. Wear your badge faithfully. Avoid splashing material on it.

Should you ever be exposed to more radioactivity in this plant than permitted by the AEC, you and the AEC will be so informed in writing by the Corporation as required by law. Such notice will not indicate that you have been injured in any manner. If there are any over-exposures in this plant, they will be slight. Also, the AEC has stated that considerably higher exposure limits than those permitted would not result in excessive hazards. The notifications serve as checks on the efficiency of our radiation protection program. It is good common sense for you to do your part to limit your exposure and that of your fellow worker to such low levels that we never have an over-exposure.

AMERICAN POTASH & CHEMICAL CORPORATION

I have read the above statement concerning radioactivity at the West Chicago Plant.

Date:______________________ Signature:______________________________