23 pgs

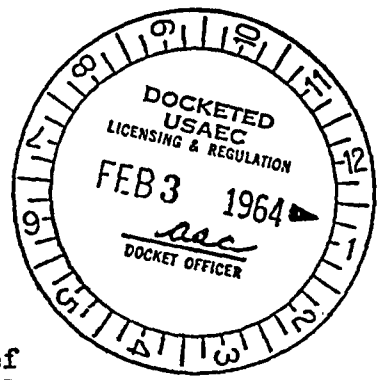
DOCKET NO. 70-820

UNITED NUCLEAR
CORPORATION
CHEMICALS DIVISION

L&R File Copy

January 31, 1964

ROUTE 21-A
HEMATITE, MISSOURI



Mr. Eber R. Price
Assistant Director
Division of Licensing and Regulation
U. S. Atomic Energy Commission
Washington 25, D.C.

ATTENTION: Mr. Robert L. Layfield, Acting Chief
Source & Special Nuclear Materials Branch
Division of Licensing & Regulation

SUBJECT: APPLICATION FOR SOURCE AND SPECIAL NUCLEAR MATERIAL LICENSES FOR UNITED NUCLEAR CORPORATION'S SCRAP PLANT FACILITIES AT WOOD RIVER JUNCTION, RHODE ISLAND

Gentlemen:

Reference is made to your letter of January 22, 1964, in which you identify area for clarification or where additional information is required. Reference is also made to our conversation of January 23, at the plant site in Rhode Island.

Regarding the matter on proprietary information, we request that the drawings (entitled Sheets) and detail calculation listed below be withheld from the public document room on the basis that they reveal capacity and technological information in such detail that their release would place us at a disadvantage with our competition. Drawings and detail calculations which we request be withheld are:

General Information and Procedures

A-902	Head Ends Flow Sheet
A-904	Extraction and Precipitation
A-905	Filtration and Finishing
A-602	Equipment Layout Plant - Sheet 2 (including its use in Appendix 1A)
A-603	Equipment Layout - Sections and Elevations

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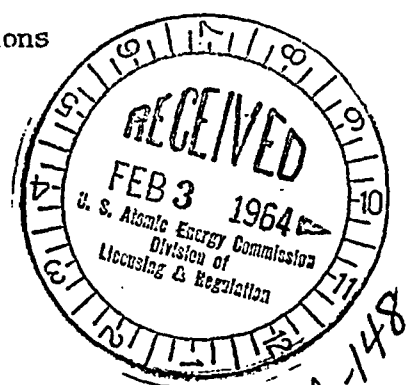

B-148

ADVANCE COPY

All of "Section I, Nuclear Safety Solid Angle and Related Calculations" of "Nuclear Safety Calculations and Reference Sheets".

Nuclear Safety Calculations

A-701	Dissolvers - Assembly and Details
A-707	Lined Dissolver - Assembly (1-J-1)
A-705	Hood Details - Sheet No. 1
A-709	Hood Details - Sheet No. 2
A-710	Hood Details - Sheet No. 3

General Information Manual

1. See revised page attached (page marked No. 1).

2. See revised page attached (page marked No. 3).

3. In accordance with our discussion of January 23, 1964, we have forwarded an evaluation report covering the Hematite Plant; if this report suffices, a similar report on the Rhode Island Facility will be submitted.

Health Physics Manual

5. See revised page attached (page marked No. 4)

6a. Air samples will be collected in the general breathing zone associated with the job. If concentration in excess of MPC are found the equipment will either be modified to reduce the concentrations below MPC or concentrations will be "time weighted" for the job or suitable respirators will be provided as approved by the AEC.

weekly & monthly smears

6b. Air volumes sampled are measured either by rotameters or orifices. The manufacturer's calibration of these are used.

no

6c. See revised pages attached (pages marked No. 5)

7. Air-borne Concentrations in Unrestricted Areas. Reference is made to ORO-545, using a stack height of 10 meters and average wind velocity of 6 miles per hour. We calculate that maximum concentration of materials discharged from process stacks occurs at a distance of 170 meters from the center of the plant. Concentrations will be determined at this distance downwind from the plant at least once per week. This concentration to be controlled to less than 10-CFR-20 limits.

Justification calculations are in separate pages attached (pages marked No. 6)

Respirators G.A.

8. No comment needed.

9. The absolute filters are not fire resistant.

10. No process streams are connected into the septic tank and leach bed system.

11. The lagoon is lined with overlapping polyethylene sheets which have been joined with a heat-weld seam. When the lagoon has filled sufficiently to require removal of solids, a new liner will be laid down. Although we do not anticipate any significant contamination of the subterranean waters, samples of this water will be taken (of the plant drinking water) once a month and checked for increase of alpha and beta activity, fluoride, nitrate, and elements present in the waste effluent such as Zr, Al, etc.

How deep is water table at LLC?

Emergency Control Plan

12. Reply to this item is in preparation and will be sent to you shortly. It will be identified as "pages marked No. 7" and will be a new section -- Section XV -- to the Emergency Control Plan.

13. See revised pages attached (pages marked No. 8).

14. "Limited Safe" means that the unit is safe by limits on one or more of the following: enrichment, volume, geometry, mass, concentration.

15. See revised page attached (page marked No. 9).

16. See revised page attached (page marked No. 10).

17. The separator will be filled with Raschig Rings; a screen will be installed over the bottom pipe outlet to prevent loss of rings.

18. See revised page attached (page marked No. 11).

19. See revised page attached (page marked No. 11) which provides a combination of design and administrative procedures to insure protection against criticality in case of tube bundle failure.

20. Condenser 1-E-1 is 4.987 inch inside diameter and thus geometrically safe. "Vessel" at F-1.5 is less than 5 inch diameter. Unvalved vent line ($\frac{1}{2}$" VC) from top of 2 inch pyrex pipe leg prevents an inadvertent pressure build up.

21. See revised page attached (page marked No. 11).

22. & 23. See revised page attached (page marked No. 12).

24. Per our discussion of January 23, 1964, Figure 1, TID-7016 Revision 1 shows 10 kg of uranium limited safe at H/U $\leq$ 4.

25. Reply to this item is in preparation and will be sent to you shortly.

Yours truly,

L J Swallow
RJOS

L. J. Swallow

LJS:cn
Encls.

207.2.2 Organization

Each person handling enriched uranium has the responsibility of nuclear safety in that he is responsible for following approved procedures.

When a new piece of equipment or modification of existing equipment is planned, the person responsible for the installation and operation contacts the Nuclear Safety Supervisor. At this time the nuclear safety problems are discussed. The design then progresses taking into account the recommendations of the Nuclear Safety Supervisor. When the design and basic operating procedures have been finalized, the Nuclear Safety Supervisor prepares the license application and/or feasibility report outlining the method of operation and basis for nuclear safety. The Scrap Plant Superintendent prepares detailed operating procedures which include any special nuclear safety requirements such as batch size, equipment spacing, work area, handling procedures specified in the license application or feasibility report. These procedures are carefully explained to the Foreman and by the Foreman to the operator.

In cases where the process and equipment is new and unique to the plant, the Foreman and/or Technician may start it up with natural, enriched or depleted uranium to gain operating experience ~~before introducing enriched uranium and~~ before operators are assigned.

Plant audits are made by the Nuclear Safety Supervisor as a continuing followup to see that approved procedures remain in effect. Any deviations noted are called to the attention of the Foreman for corrective action.

207.2.3 Basic Plant Design

The general arrangement of the plant is shown on Drawings A-601, A-602, A-603 and Y-601.

The plant consists of a single principal building with office, locker-room, general utilities and maintenance facilities to the front (West End) and storage and processing facilities at the back (East End). A small laboratory is located at the second level above the locker-room area.

A paved yard will be used for outside storage. A lagoon with waste discharge control facilities is located within the fenced area and just north of the building.

207.3 Special Nuclear Material Quantities

The estimated annual throughput is expected to be approximately: 650 kilograms of fully enriched uranium the first year and approximately 1200 kilograms of fully enriched uranium the second year.

The maximum quantity of special nuclear material on hand at any one time will be 2,000 kg.

The types of scraps for which these facilities have been designed include:

U-Zr alloys as chips (6-10% U content); pickle liquors of U-Zr (less than 5 grams/liter)

U-Al alloys (5 to 60% U content)

UO_2-ZrO_2 (70 to 80% U content)

UO_2-ZrO_2 - coated (50 - 60% U content)

Combustibles as carbonaceous materials

SUBJECT:

Emergency Alarm System

The GA-2A detector does not keep up with an almost instantaneous rise in radiation, but lags to the extent that only 63% of a sudden change is read two seconds after the change has occurred. Thus, if the change is to a point only slightly above 20 mr/hour, the detector will probably not set off an alarm until some three or even four seconds after the change has occurred. On the other hand, should the change be to the region of, let us say, 1000 mr/hour, the detector will trip in a very small fraction of a second after the advent of the radiation. This means that the response is practically instantaneous in the case of any severe outburst of radiation, although it is slightly delayed in the minimum cases.

Our instruments are so constructed that while some electrical failures will cause the general alarm to sound, others will merely actuate signal lights. In this way, supported by our own close routine inspection of the system, we hope to avoid false alarms and the confusion and anxiety they would cause, while still being immediately aware of any irregularity in the system.

The instruments are set to operate normally at a very low range of gamma radiation, most of which is provided by a tiny radiation source within each instrument case. A high level electrical contact is actuated if the range being measured by one of the detectors rises to 20 mr/hour, and a low level contact is actuated if the range falls to the neighborhood of approximately 0.1 mr/hour. If the high level contact is actuated, the alarm sounds for evacuation of the work area and office. If the low level contact is actuated a light on the main panel of the alarm system comes on, indicating which detector sent in the signal. In addition, an amber light shows in the panel of the detector itself.

The placement of the detectors is such that the maximum distance to any stored or in-process fissionable material inside the building is <70'. Outside storage is <100' maximum from the storage yard detector.

The sirens which given the evacuation signal in event of a reading in excess of 20 mr/hours are Edwards #315, rated at 108 decibels. Two inside and one outside will provide an unmistakeable warning.

Power supply for the radiation monitors is designed to keep them operable despite general plant power failure. A 4.5 kv Empire Model 4-5DFA8 diesel generator provides auxiliary power for the radiation alarm circuits (emergency power to this circuit is automatic upon power failure), as well as for emergency perimeter lighting and the fire alarm system. The emergency power system will be checked at least once a month by manually actuating the automatic trip system and osbserving the performance of the diesel unit.

5. Skin After Washing

   a) Total: 1,000 dpm/100 cm^2.

   b) Removable: None detectable.

6. Work Clothes After Plant Wash

   a) Total: 2,000 dpm/100 cm^2.

IX. MONITORING SURVEYS

Surveys will be conducted on a regularly scheduled basis consistent with plant operation and survey results.

A. Air Sampling

Sampling is done with Whatman No. 41 filter paper. At least one cubic meter of air is filtered at a minimum rate of 0.5 cfm.

The schedule of routine sampling is included in the appendix. Additional sampling will be done as the need is indicated by the results of the routine sampling or as requested by line supervision.

The samples are counted for alpha in a gas proportional counter. Counting time is a function of sample activity, but in general is not less than ten (10) minutes.

B. Surface Contamination

Total alpha contamination is measured with a portable gas proportional counter. Smear samples are taken with Whatman No. 41 filter paper or equivalent smearing an area of approximately 100 cm^2. The smear samples are counted by a gas proportional counter.

The schedule of routine sampling is included in the appendix. Additional samples will be collected based on results of routine sampling or as requested by line supervision.

C. Water Samples

1. Plant Waste Effluent

The contamination level of the plant waste effluent is measured at the lagoon discharge. A sample of the overflow is collected continuously. The sample is analyzed for alpha and beta activity and pH on a weekly or montly shcedule. In the case of a monthly schedule the sample will be a composite of the weekly samples. The effluent sampling system is shown on Sheet No. Y-403 and consists of a meter to provide a record of total discharge and a sample tap from which a proportionate amount of the total discharge flow will be diverted into a bucket sized container. These samples will be collected and analyzed initially at a frequency of at least once per week. Backup information on waste discharges are obtainable from operational samples.

2. Pawcatuck River

One grab sample per month from above and below the plant outfall is analyzed for alpha and beta activity and pH.

3. Special Samples

Depending on the work in progress, special samples and tests are made on an as-needed basis.

D. Air Exhaust Systems

1. Process Exhaust

Exhaust stacks are sampled only as requested by the Operating Department or when the routine air sampling program indicates excessive levels in the plant supply air systems or public area.

2. Exhaust System Efficiency

A weekly inspection of all process exhaust systems will be made. This will include intake velocity measurements and inspection of the degree of filter loading. Velocity measurements are made with a velometer; filter loading is determined by pressure drop readings.

January 30, 1964

Atmospheric Dispersion Estimation
Location of Maximum Concentration
UNC Rhode Island Facility

An estimation was made to determine the location of the maximum airborne concentration in unrestricted areas resulting from exhaust stack effluents from the Rhode Island facility of United Nuclear Corporation.

According to ORO-545, Graphs for Estimating Atmospheric Dispersion, Hilsmeier and Gifford derived a family of curves based on Giffords formula (1961) (derived from Suttons diffusion formula) which is

$$X = \frac{Q}{\pi \sigma_y \sigma_z \bar{u}} \exp\left[-1/2\left(\frac{y^2}{\sigma_y^2} + \frac{h^2}{\sigma_z^2}\right)\right]$$

where X = ground level air concentration values in curies per cubic meter.

Q = source strength in grams or curies per second.

$\bar{u}$ = average wind speed in meters per second.

h = height of source above ground in meters.

y = lateral (crosswind) distance from the plume axis in meters.

This was modified to express the dispersion coefficients in the y and z directions as standard deviations of the plume distribution, σ_y and σ_z m. Pasquill proposed families of curves of dispersion coefficients versus distance from the source. Using the above equation and these values, graphs of downwind ground concentrations were derived for various source heights and published in ORO-545.

For the physical layout of the Rhode Island plant, the values in the graph for h = 10 meter was used. These stack outlets

are approximately thirty feet above ground level. Prevailing weather conditions indicate that we use the value of curve D which gives

$$\bar{u}\left(\frac{X}{Q}\right)_{max} = 1.3 \times 10^{-3}$$

which occurs at 170 yards.

Therefore the maximum air concentration from plant exhaust stack effluent would occur at approximately 170 yards from the center of the stacks.

Information contained in the Handbook of Air Conditioning, Heating and Ventilation edited by Clifford Stroke indicates the following weather conditions for the portion of Rhode Island around Providence and points south:

Average Wind Velocity

	Providence	Block Island
January	11.8 mph	19.8 mph
July	9.1 mph	12.7 mph

This area experiences 120 clear days per year with an average of 9½ hours of clear conditions per day.

Attached find copies of the data and graphs from which these estimates were made.

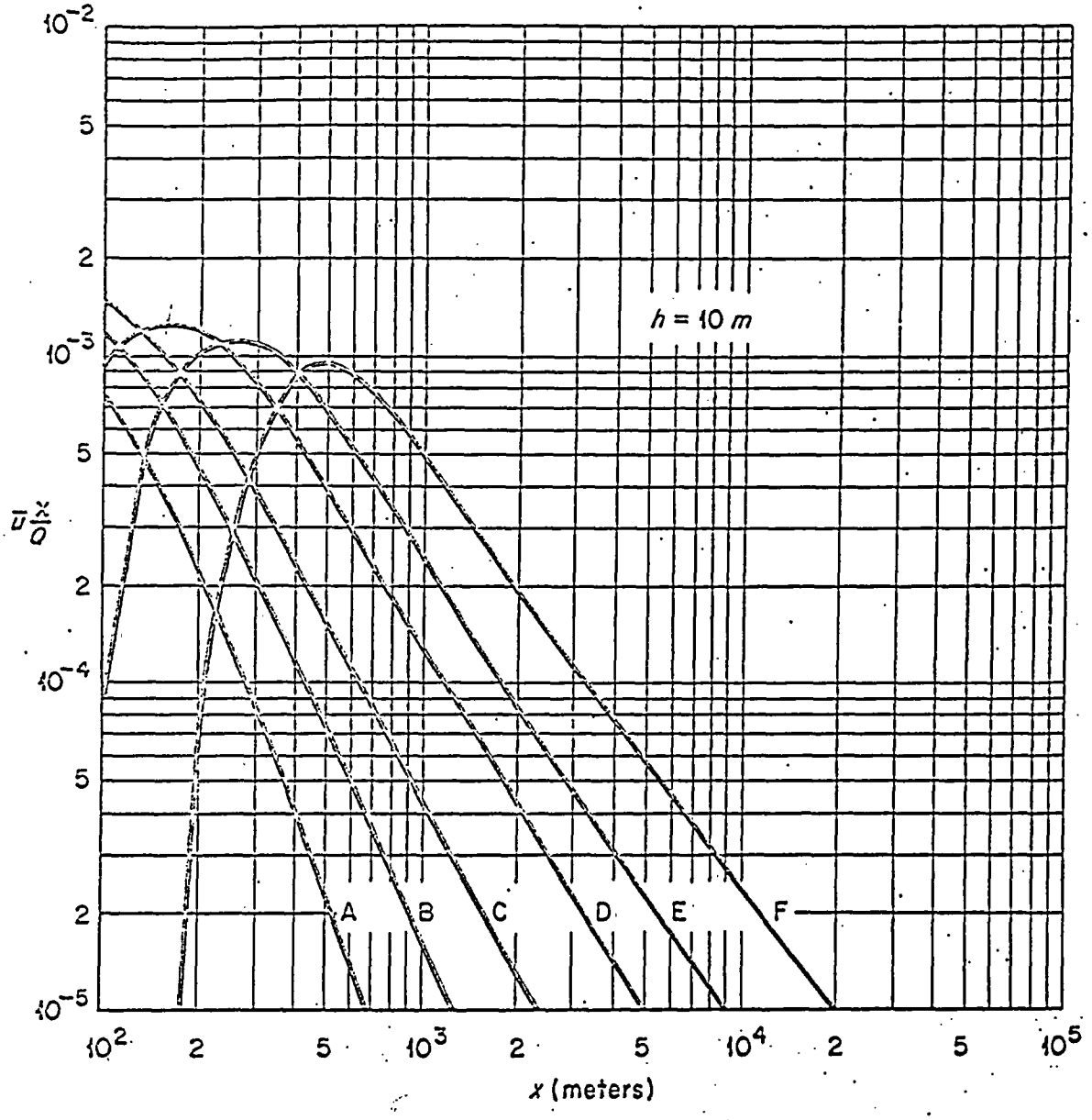

Fig. 4—Values of $\bar{u}\chi/Q$ as a function of downwind distance, x; m, for various weather types; source at surface. h = 10, 30, and 100 m, respectively.

types; source at surface.

Table I - METEOROLOGICAL CATEGORIES

A: Extremely unstable conditions
B: Moderately unstable conditions
C: Slightly unstable conditions
D: Neutral conditions*
E: Slightly stable conditions
F: Moderately stable conditions

Surface wind speed, m/sec	Daytime insolation			Thin overcast or ≥ 4/8 cloudiness†	≤ 3/8 cloudiness
	Strong	Moderate	Slight		
< 2	A	A-B	B		
2	A-B	B	C	E	F
4	B	B-C	C	D	E
6	C	C-D	D	D	D
> 6	C	D	D	D	D

* Applicable to heavy overcast, day or night.

† The degree of cloudiness is defined as that fraction of the sky above the local apparent horizon which is covered by clouds. [Manual of Surface Observations (WBAN), Circular N(7th ed.), paragraph 1210, U. S. Government Printing Office, Washington, July 1960.]

Security Operations Officer
Committee Member — Plant Phone 286-448 New Haven

Superintendent of Mat'l. Control
Committee Member — Plant Phone 301 New Haven

Criticality Engineer

XIV. EVACUATION PLAN

1. Non-Nuclear Alarm

Alarm -- Loud, intermittent alarm by horn

Action-- All operators not urgently required will report to assembly area with fire extinguishers.

Operators engaged in hydrolysis, extraction, or other work requiring constant attention will remain at their posts, unless, of course, that is the emergency area.

One operator will remain in each unaffected production area in any case.

Assembly Point -- Driveway at main truck gate entrance

Emergency Coordinator will be that person present who is highest on list:

Plant Superintendent
Acting Plant Supervisor
Foreman

The Emergency Coordinator will determine source of alarm from the guard and will report to Assembly Point where he will take charge of the assembled group.

The Emergency Coordinator will determine as soon as possible if additional help is required.

The Emergency Coordinator will be in full charge and will take such action to reduce the emergency as required.

2. Nuclear Alarm

Nuclear Alarm -- Loud, continuous alarm by siren

Action -- Plant will be evacuated immediately; personnel will leave by nearest exit by running until at least 500 ft. away from plant. Employees working in the northern and eastern portions of the building at the time of an incident, will exit on the north side of the structure, proceeding to the personnel gate located at the northwest corner of the building, using both the personnel gate and the door to the security police post as methods of egress. Guards or supervisory personnel will unlock any locked exit.

Employees in the western position of the plant or the administrative area, are to leave by the closest door available (either through the cafeteria, the main lobby or the security police post).

Employees in the southern or central portion of the plant when the incident occurs will proceed through the door in the southern side of the building and, proceed out of the security area through the security/emergency turnstile located at the southwest corner of the area.

If necessary employees are to be carried from the plant. All personnel will proceed to assembly point which will be a pre-fab type building shelter to be located more than 500 ft from the fence and to the southwest.

As quickly as possible the following actions will be carried out:

1.) Account for all personnel and visitors and post a guard to prevent anyone entering area.

2.) Determine if a criticality incident has occurred or if the alarm was false; care for the injured.

3.) Notify proper personnel -- hospital, UNC Headquarters, etc.

4.) If necessary segregate contaminated personnel and decontaminate.

5.) Continue with procedures outlined in plans available at the assembly site (See attached plans A and B covering actual and false alarms).

Effective Feb. 1, 1964
Issued Jan. 31, 1964

EMERGENCY PROCEDURE

NUCLEAR ALARM

PLAN "A"

(Nuclear Incident)

EMERGENCY COORDINATOR'S INSTRUCTIONS

If it appears that a nuclear incident has occurred, call the following persons in order listed:

	HOME	OFFICE
R. A. Holtheus		
G. N. Briggs		
R. C. Johnson		
J. A. Lindberg		

Relate the occurrence to the first person contacted -- what happened, radiation detector readings, visual evidence, etc. If the person contacted agrees that an incident has occurred, or if none of the above can be reached, take the following steps:

(1) Collect all film badges. Remove film from holder and store separate from holders. Read the indium foil on the badge with the LOW level radiation detector set on XI scale. Be sure detector is properly adjusted. Record, in duplicate, the readings obtained.

Have all personnel complete the form describing their location at time of alarm, observation, etc. Forms are in desk at assembly point.

Anyone whose indium foil shows detectable radiation is to be dispatched to _____ Hospital, Emergency Entrance, on _____. Send the original of the sheet of badge readings to the hospital with the personnel. Dispatch such personnel in group insofar as possible. Appoint one man to be in charge of group.

Indium T½

(2) Notify the following doctors that a nuclear incident has occurred and that _____ persons are on the way to _____ Hospital, Emergency Entrance:

Dispatch Immediate Courtesy

Dr.

Revised January 31, 1964

Dr.

Dr.

(3) Call for additional manpower by notifying the Fuels Division, New Haven.

Ask the first person notified to dispatch both mechanics, two capable operators and a guard to the plant (report to assembly point) immediately.

(4) Notify R. A. Holthaus

The first person contacted will call the USAEC, Oak Ridge Field Office, Oak Ridge, Tenn., Area Code 615, telephone number 483-7486 and inform them of the occurrence. Then see that all persons on the following list have been notified:

	Home	Office
R. A. Holthaus		
G. N. Briggs		
J. A. Lindberg		

(5) When the off duty guard arrives, dispatch guard who was on duty at the time of the occurrence to_____Hospital, if his badge shows detectable radiation.

When Emergency Coordinator is properly relieved, he will report to_____Hospital if his badge shows detectable radiation.

MISCELLANEOUS INSTRUCTIONS

Do not give information concerning the occurrence to anyone. If asked for information, state that none is available at the present time, but that a statement will be made later, please leave name and phone number.

EMERGENCY PROCEDURE

NUCLEAR ALARM

Plan "B"

(Suspected Malfunction in Nuclear Alarm System)

In the absence of any indication of a nuclear incident, it may be possible that a failure in the system caused the alarm.

Under these circumstances, obtain the high level and the low level monitoring devices. Adjust them for proper operation on the lowest scale.

Approach the plant cautiously, noting the readings on the meters. Do not approach any area which gives a reading of 50 mr/hr.

NOTE:-- If readings of this magnitude are encountered it is almost certain that a nuclear incident has occurred. Put plan "A" into effect without delay.

If no reading is detected, carefully approach the alarm control panel to determine which detector was tripped. This will indicate which area must be investigated further. If no radiation is detected in the indicated area, a further check of the entire area within the fenced enclosure will be made.

Call the following persons in order listed until one has been contacted:

	HOME	OFFICE
R. A. Holthaus		
G. N. Briggs		
R. C. Johnson		
J. A. Lindberg		

If the person contacted agrees, the "ALL CLEAR" signal may be given and personnel may be readmitted to the plant. Particular care must be taken in startup of equipment left running at the time of the alarm.

Leave the alarm system in the silenced condition until the defective nuclear detector has been replaced with the spare detector. Contact Mr. Briggs or Mr. Giel for replacement of defective detector.

6. The HPS Group will perform air sampling and smear surveys of the local surroundings to determine if radioactive materials have been released and the extent of the release, if any.

7. The HPS Group will determine when the area(s) is free from contamination and/or radiological hazards.

8. If the effected area does not constitute a radiological hazard, the Group will perform such normal safety functions as stipulated by the Emergency Coordinator.

VIII. CRITICALITY/Potential - EMERGENCY PROCEDURE

In the event of an emergency which may result in the accidental relocation or change in geometric design of storage of SS nuclear material, the following action will be taken:

1. If sufficient advance notice is given, (impending hurricane, flood condition, fire in an adjacent area, etc.) the SS material shall be transferred under the direction of the Criticality Engineer or responsible Criticality Supervisor or his assistants to a safe location. The Criticality Engineer or responsible supervisor may establish temporary storage zones and temporary allowable limits of material therein as long as these locations comply with the best interests of safety and security.

2. Where no advanced warning is given and an accidental relocation of SS material results, movement and storage of this material shall be accomplished under the direction of the Plant Superintendent or responsible Criticality Supervisor. Criticality precautions shall take precedence over health physics, safety, accountability and, if necessary, security to prevent the formation of a critical mass.

207.2 Criticality Control

207.2.1 General

The general criticality control procedures follow the recommendations included in such recognized publications as:

TID-7016, Rev. 1 - "Nuclear Safety Guide"
K-1019, 5th Rev. - "Basic Critical Mass Information and Its Application to Oak Ridge Gaseous Diffusion Plant Design and Operation"
TID-7019 - "Guide to Shipment of U-235 Enriched Uranium Materials"

The primary criticality control procedures observed are either limited safe batch, limited safe geometry or limited safe volumes. In some specific cases, the nuclear safety of a piece of equipment or a process is evaluated on the basis of actual critical data published in the many AEC reports. In any event, each process, equipment item or storage area in which enriched uranium is handled must be approved by the AEC Division of Licensing and Regulation (as required by 10 CFR, Part 70) or the appropriate AEC Operations Office. Many of the processes and equipment items for which license approval is herein requested are duplicates of or essentially similar to those already licensed and used at our Hematite operations. Thus, general reference is made to our file under SNM33 and in particular to information contained in our application for license renewal of July 15, 1963.

Unless otherwise stated the following tabulated multiplication factors will be used to evaluate equipment interaction. Also the following solid angles are used to determine safe interaction:

Individual Safe Feature	Multiplication Factor, K	Safe Solid Angle, Steradians
5" Diameter	0.58	3.2
Limited Safe Mass	0.65	2.5
Limited Safe Volume	0.71	~~2.0~~ 1.9 ←
Limited Safe Geometry	0.80	1.0

207.2.4 Material Identity

Each order received in the plant will be assigned an identifying job symbol. Records will be kept which make it possible to determine the enrichment and customer when knowing only the job symbol.

A tag on which this job symbol and U-235 enrichment is shown will be attached to each uranium container. As the uranium passes through the process, each batch and lot will be identified by a sequential number and the job symbol. This then becomes part of the information on the container tag.

As an additional aid to maintain enrichment identify, the in-process container tags will be color coded as follows:

% U-235 Enrichment	Tag Color
0-- 5.99	Green
6 - 19.99	Blue
20 - 39.99	Yellow
$\geq$ 40	Red

For further detail on procedures to protect material identity see Section 500, Non-Processing Storage - Facilities and Equipment.

207.2.5 Separation of Licensed and Accountability Station Material

Licensed and accountability station material are sometimes processed concurrently in the same plant areas. In this event, licensing regulations on ~~the applicable~~ criticality, radiation protection and health physics procedures in effect in the area are uniformly applied to both types of material.

The procedures for material identity discussed in paragraph 207.2.4 applies to both station and licensed material. However, to maintain the identity of station and licensed material, accountability station identification letters will be stamped in one inch high letters on the tags of all containers of station material.

The cyclone normally is not flooded with liquor. It can only be flooded if the evaporator is overfilled. Under conditions of a flooded cyclone safety if assured since the 6" diameter is safe for an infinite length under conditions of minimal reflection. Conditions of nominal reflection are assured since the wall thickness is only 5/16" whereas up to 1" of steel constitute minimal reflection (page 13, TID-7016, Revision 1). Also is is 13' above the floor so that reflection by water is impossible. Finally, it is sufficiently separated from other items such that their effect can be assumed not to exceed the 1½" thick steel reflector limit for minimal reflection.

c) Entrainment Separator

This separator is used to remove any mists that may pass through the cyclone. A vent line from the evaporator system is lower than the separator eliminating the possibility of flooding the separator.

d) Interaction

The maximum solid angle calculated for the evaporator system is less than 1 steradian.

e) General

The following operating controls will be applied to the evaporator:

1. In operation pressure on shell side exceeds tube side preventing any leak of uranium into shell side.

2. The steam condensate drain from the evaporator shell will be kept open while evaporator is not in use. (This will prevent accumulation of uranium containing solution on shell side.) A vacuum break valve will be installed below the expansion joint to avoid a vacuum on the shell after shutdown. This will avoid forcing OK liquor into the shell from the tubes in the event of a tube leak.

3. During startup the shell side condensate will be drained into a 5" diameter sample container and checked for acidity (to indicate any possible leak into the shell side).

4. After shutdown, tube side will be drained, and drain line valve will be left open to prevent uranium solution inadvertently filling tube side.

Tanks and Vessels with Raschig Rings

Extractor Feed Tank (1-D-41)

Solvent Feed Tank (1-D-5)

Raffinate Slop Tanks (1-D-21A and B)

ADU Filtrate Tanks (1-D-24A and B)

Entrainment Separator on Evaporator (1-E-2)

4. All overflow and vent bottles used in the facility will be 5" diameter.

5. All pumps casings are less than ~~[illegible]~~ 4.8 liter volume.