

CONTAMINATION CONTROL

KMS FUSION, INC.

1. BACKGROUND INFORMATION

- 1.1 Removable radioactive contamination on floors, benches, and equipment poses, in most cases, an immediate external radiation hazard. If not promptly removed, this material may subsequently contaminate clothing and skin. Studies have shown that skin contamination almost invariably leads to internal contamination. The usual route into the body is by ingestion; absorption through the skin or by inhalation is also possible in certain cases. In the case of tritium, the external hazard is not present, as the low-energy beta particles emitted by tritium will not penetrate the epidermis. Contamination of laboratory surfaces by tritium leads to contamination of skin and clothing, and is a precursor of airborne radioactivity. In the case of tritium, inhalation and absorption through the skin are both likely routes of internal contamination.
- 1.2 Surface contamination, when present in quantities below what is considered a hazardous amount, should nevertheless be removed and minimized as far as reasonably practicable. Such contamination may be a warning of future problem areas, faulty equipment, or inexperienced technique.

2. POLICY

- 2.1 Wipe tests of laboratory areas designated by the Radiation Safety Officer (RSO) shall be done weekly, following high-level tritium operations, and otherwise as designated by the RSO.
- 2.2 The wipe test survey is intended to look for radioactive contamination in places where contamination should not normally be present, and when it is important that an oft-contaminated area be free of contamination. Areas which are routinely contaminated should be routinely decontaminated; wipe tests should be performed after the decontamination. Areas or surfaces which are routinely contaminated, that need not be kept clean, may be designated as radioactive surfaces by the RSO and marked as such. Personnel should handle or work with these surfaces using gloves and other proper radioisotope handling methods. In this case, the action levels in Section 6 do not apply, and wipe tests may be performed only to ensure that surface contamination does not become excessive.

3. PROCEDURE

- 3.1 Use latex rubber gloves.
- 3.2 Using a paper (or other specified material) filter disc, wipe approximately 100 cm². Assuming that your wipe path is 1 cm wide,

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a path of 100 cm (about 3 feet) in length results in a wiped area of 100 cm². It is often convenient to use three one-foot motions in a "Z" pattern.

4. COUNTING PROCEDURE

- 4.1 Set the liquid scintillation counter to the current settings specified for wipe tests and prepare the samples according to the current procedure.

5. CALCULATION AND REPORTING OF RESULTS

- 5.1 The disintegrations per minute (dpm) are calculated by the counter, or by

$$\text{dpm} = \frac{\text{gross cpm} - \text{background cpm}}{\text{counting efficiency}} .$$

The efficiency is obtained from a previous calibration experiment.

- 5.2 Record the results on the report form.

- 5.3 Distribute the report to approved users.

6. ACTION LEVELS

Contamination level, dpm/100 cm ²	Floors	Working surfaces, benches, microscopes, etc.
< 100	<u>not hazardous - no action necessary</u>	
100 - 1000	maintenance personnel wet mop during next scheduled visit	laboratory personnel clean at next regularly scheduled time but not later than one week
1000 - 10,000	laboratory personnel clean as soon as practicable	laboratory personnel clean as soon as practicable, but not later than one week
10,000 - 100,000	<u>laboratory personnel decontaminate immediately</u> RSO mark contaminated areas and rewipe when decontaminated by approved user	
100,000 - 1,000,000	<u>laboratory personnel decontaminate immediately</u> RSO mark contaminated areas and rewipe when decontaminated by approved user	
> 1,000,000	<u>laboratory personnel decontaminate immediately</u> Clean-up has higher priority than continuation of work. Rope off area or otherwise restrict access. Notify RSO.	

- 6.1 In the case of higher values of surface contamination, prompt action is necessary both to minimize any health hazard and to reduce the likelihood of the spread of contamination.
- 6.2 If surface contamination exceeds 100,000 dpm/cm², wipe test surveys should be done on selected personnel (hands, face, clothing, shoes). If personnel contamination more than 1,000 dpm/100 cm² is found, advise thorough washing of hands and face, and ensure that the individual is included in the next scheduled urine bioassay.

7. FOLLOW-UP

- 7.1 Do not assume that notification ensures decontamination, or that decontamination is effective. Rewipe areas indicating more than 10,000 dpm/1002 to verify decontamination.

8. DECONTAMINATION GUIDELINES

- 8.1 If possible, confine the spill as soon as it is determined that an area is radioactive. Take measures to ensure that people do not walk through a contaminated area.
- 8.2 Put on protective clothing and latex rubber gloves.
- 8.3 Check shoes and lab coats for possible contamination. If shoes are contaminated, they should be removed before leaving the contaminated area. If lab coats are contaminated, they should be changed.
- 8.4 If dispersal of radioactive dusts or mists may be a problem, shut off ventilators, air conditioners and fans. Preferably, this should be done by someone not involved in the spill, to avoid spreading contamination.
- 8.5 Notify the person in the section qualified to supervise decontamination. If the spill or contamination is a major spill, notify the RSO.
- 8.6 In general, inexperienced people should not attempt to clean up a major contamination. It is better to wait a little while for the supervisor than to risk spreading contamination by erroneous procedures. If the spill is covered up, and bystanders are kept a few feet or more away, there is little danger from radiation.
- 8.7 If any radioactive material has splashed onto a person or his clothing, immediate steps should be taken to remove it. Laboratory coats or outer garments should be removed and left in the contaminated area. Hands or other contaminated skin areas should be washed thoroughly with a radioactive material decontaminating detergent. If this is not available, ordinary soap will suffice. If it is certain that shoes are not contaminated, it is permissible to walk to a washing facility, which subsequently, however, must be treated as contaminated until released by the RSO. If there is doubt about contamination of the feet, bring a washbowl to the suspect area,

- and decontaminate feet before leaving the suspect area.
- 8.8 One person should do the clean up. This is usually assigned to the person who made the spill, if qualified. Use waterproof gloves, a surgical gown, and depending on the condition of the floor, protective shoe covers. If dusts or aerosols are involved, use a surgical mask.
- 8.9 Liquids should be carefully blotted. Save all contaminated clean-up materials for later transfer to the RSO for disposal. After liquids have been blotted, when wiping is necessary, wipe once from the periphery of your contaminated area towards the center, never the reverse. Using fresh materials, repeat as necessary. Do not use circular motions as this spreads contamination. Use detergent and water and paper towels. For tritium, ordinary industrial or household cleaners are adequate. For other radionuclides a commercially prepared decontaminating cleaner will usually prove superior. Discard the wet paper towels into a plastic bag. In the case of a spot floor contamination, mop from the periphery to the center once, then rinse mop. For widespread floor contamination, mop as usual. Change the cleaning solution frequently. Discard contaminated solution to the sanitary sewer. Failure to change wash water frequently spreads contamination.
- 8.10 Powders should be dabbed up with damp paper towels until all of the loose material is removed. Take care to avoid causing particulate material to become airborne. When all loose material is removed, follow the procedure for liquids. Throw nothing away; save all contaminated materials in a plastic bag for later proper disposal.
- 8.11 Wipe test the area to monitor the progress of the decontamination effort. The area may be returned to service when cleared by the RSO.

9. DISPOSAL OF WASTE

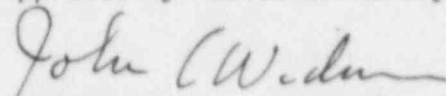
- 9.1 Dispose of liquid scintillation fluid to the chemical waste. Dispose of filter discs and empty bottles to the ordinary trash.
- 9.2 Liquid waste from cleaning should be turned over to the RSO for assay and disposal.
- 9.3 Wet solid waste from decontamination activities (paper towels, etc.) may be disposed of in ordinary trash if the decontaminated areas were assayed at less than 1,000 dpm/100 cm². Otherwise, obtain an evaluation from the RSO as to the activity of the waste material and dispose of as radioactive waste.

10. REFERENCES

1. Gibson, J.A.B. and Wrixon, A.D., Methods for the calculation of derived working limits for surface contamination by low-toxicity radionuclides. Health Physics 36, 311, 1979.
2. Code of Federal Regulations, Title 10 parts 20.201 and 20.401.

Numerous other articles on this subject are given in the references cited by Gibson and Wrixon (above).

Approved by Radiation Safety Committee

A handwritten signature in cursive script, appearing to read "John C. Widman".

John C. Widman, Chairman

22 April 1985

INSTRUCTIONS TO APPROVED USERS

DECONTAMINATION GUIDELINES

1. BACKGROUND INFORMATION

- 1.1 Removable radioactive contamination on floors, benches, and equipment poses, in most cases, an immediate external radiation hazard. If not promptly removed, this material may subsequently contaminate clothing and skin. Studies have shown that skin contamination almost invariably leads to internal contamination. The usual route into the body is by ingestion; absorption through the skin or by inhalation is also possible in certain cases. In the case of tritium, the external hazard is not present, as the low-energy beta particles emitted by tritium will not penetrate the epidermis. Contamination of laboratory surfaces by tritium leads to contamination of skin and clothing, and is a precursor of airborne radioactivity. In the case of tritium, inhalation and absorption through the skin are both likely routes of internal contamination.
- 1.2 Surface contamination, when present in quantities below what is considered a hazardous amount, should nevertheless be removed and minimized as far as reasonably practicable. Such contamination may be a warning of future problem areas, faulty equipment, or inexperienced technique.

2. POLICY

- 2.1 Wipe tests of laboratory areas designated by the Radiation Safety Officer (RSO) shall be done weekly, following high-level tritium operations, and otherwise as designated by the RSO.
- 2.2 The wipe test survey is intended to look for radioactive contamination in places where contamination should not normally be present, and when it is important that an oft-contaminated area be free of contamination. Areas which are routinely contaminated should be routinely decontaminated; wipe tests should be performed after the decontamination. Areas or surfaces which are routinely contaminated, that need not be kept clean, may be designated as radioactive surfaces. Personnel should handle or work with these surfaces using gloves and other proper radioisotope handling methods. In this case, the action levels in Section 3 do not apply, and wipe tests should be performed as necessary only to ensure that surface contamination does not become excessive.
- 2.3 Areas found to be contaminated should generally be decontaminated by personnel responsible for operations in the area. If contamination levels are sufficiently high to present a clear hazard to personnel, contact the RSO for instructions.

- 2.4 If a major spill or contamination incident occurs, decontamination efforts should be started promptly do not wait for the weekly wipe tests to reveal the contamination.

3. ACTION LEVELS

Contamination level, dpm/100 cm ²	Floors	Working surfaces, benches, microscopes, etc.
< 100	<u>not hazardous - no action necessary</u>	
100 - 1000	maintenance personnel wet mop during next scheduled visit	laboratory personnel clean at next regularly scheduled time
1000 - 10,000	maintenance personnel or laboratory personnel clean as soon as practicable	laboratory personnel clean as soon as practicable
10,000 - 100,000	<u>laboratory personnel decontaminate immediately</u>	
100,000 - 1,000,000	<u>laboratory personnel decontaminate immediately</u>	
> 1,000,000	<u>laboratory personnel decontaminate immediately</u> Clean-up has higher priority than continuation of work. Rope off area or otherwise restrict access. Notify RSO.	

- 3.1 In the case of higher values of surface contamination, prompt action is necessary both to minimize any health hazard and to reduce the likelihood of the spread of contamination.
- 3.2 If surface contamination exceeds 100,000 dpm/cm², wipe test surveys should be done on selected personnel (hands, face, clothing, shoes). If contamination more than 1,000 dpm/100 cm² is found, thoroughly wash hands and face, and ensure that such individuals are included in the next scheduled urine bioassay.

4. DECONTAMINATION GUIDELINES

- 4.1 If possible, confine the spill as soon as it is determined that an area is radioactive. Take measures to ensure that people do not walk through a contaminated area.
- 4.2 Put on protective clothing and latex rubber gloves.
- 4.3 Check shoes and lab coats for possible contamination. If shoes are contaminated, they should be removed before leaving the contaminated area. If lab coats are contaminated, they should be changed.
- 4.4 If dispersal of radioactive dusts or mists could be a problem, shut off ventilators, air conditioners and fans. Preferably, this should be done by someone not involved in the spill, to avoid spreading contamination.

- 4.5 Notify the person in the section qualified to supervise decontamination. If the spill or contamination is a major spill, notify the RSO.
- 4.6 In general, inexperienced people should not attempt to clean up a major contamination. It is better to wait a little while for the supervisor than to risk spreading contamination by erroneous procedures. If the spill is covered up, and bystanders are kept a few feet or more away, there is little danger from radiation.
- 4.7 If any radioactive material has splashed onto a person or his clothing, immediate steps should be taken to remove it. Laboratory coats or outer garments should be removed and left in the contaminated area. Hands or other contaminated skin areas should be washed thoroughly with a radioactive material decontaminating detergent. If this is not available, ordinary soap will suffice. If it is certain that shoes are not contaminated, it is permissible to walk to a washing facility, which subsequently, however, must be treated as contaminated until released by the RSO. If there is doubt about contamination of the feet, bring a washbowl to the suspect area, and decontaminate feet before leaving the suspect area.
- 4.8 One person should do the clean up. This is usually assigned to the person who made the spill, if qualified. Use waterproof gloves, a lab coat or gown, and depending on the condition of the floor, protective shoe covers. If dusts or aerosols are involved, use a surgical mask.
- 4.9 Liquids should be carefully blotted. Save all contaminated clean-up materials for later transfer to the RSO for disposal. After liquids have been blotted, when wiping is necessary, wipe once from the periphery of your contaminated area towards the center, never the reverse. Using fresh materials, repeat as necessary. Do not use circular motions as this spreads contamination. Use detergent and water and paper towels. For tritium, ordinary industrial or household cleaners are adequate. For other radionuclides a commercially prepared decontaminating cleaner will usually prove superior. Discard the wet paper towels into a plastic bag. In the case of a spot floor contamination, mop from the periphery to the center once, then rinse mop. For widespread floor contamination, mop as usual. Change the cleaning solution frequently. Discard contaminated solution to the sanitary sewer. Failure to change wash water frequently spreads contamination.
- 4.10 Powders should be dabbed up with damp paper towels until all of the loose material is removed. Take care to avoid causing particulate material to become airborne. When all loose material is removed, follow the procedure for liquids. Throw nothing away; save all contaminated materials in a plastic bag for later proper disposal.
- 4.11 The area should be wipe tested to monitor the progress of the decontamination effort. The area may be returned to service when cleared by the RSO.

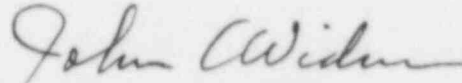
5. FOLLOW-UP

- 5.1 Do not assume that decontamination is effective. Areas indicating more than 10,000 dpm/1002 should be rewiped to verify decontamination.

6. DISPOSAL OF WASTE

- 6.1 Liquid waste from cleaning should be disposed of to the sanitary sewer, unless otherwise directed by the RSO.
- 6.2 Wet solid waste from decontamination activities (paper towels, etc.) may be disposed of in ordinary trash if the decontaminated areas were assayed at less than 1,000 dpm/100 cm². Otherwise, obtain an evaluation from the RSO as to the activity of the waste material and dispose of as radioactive waste.

Approved by Radiation Safety Committee



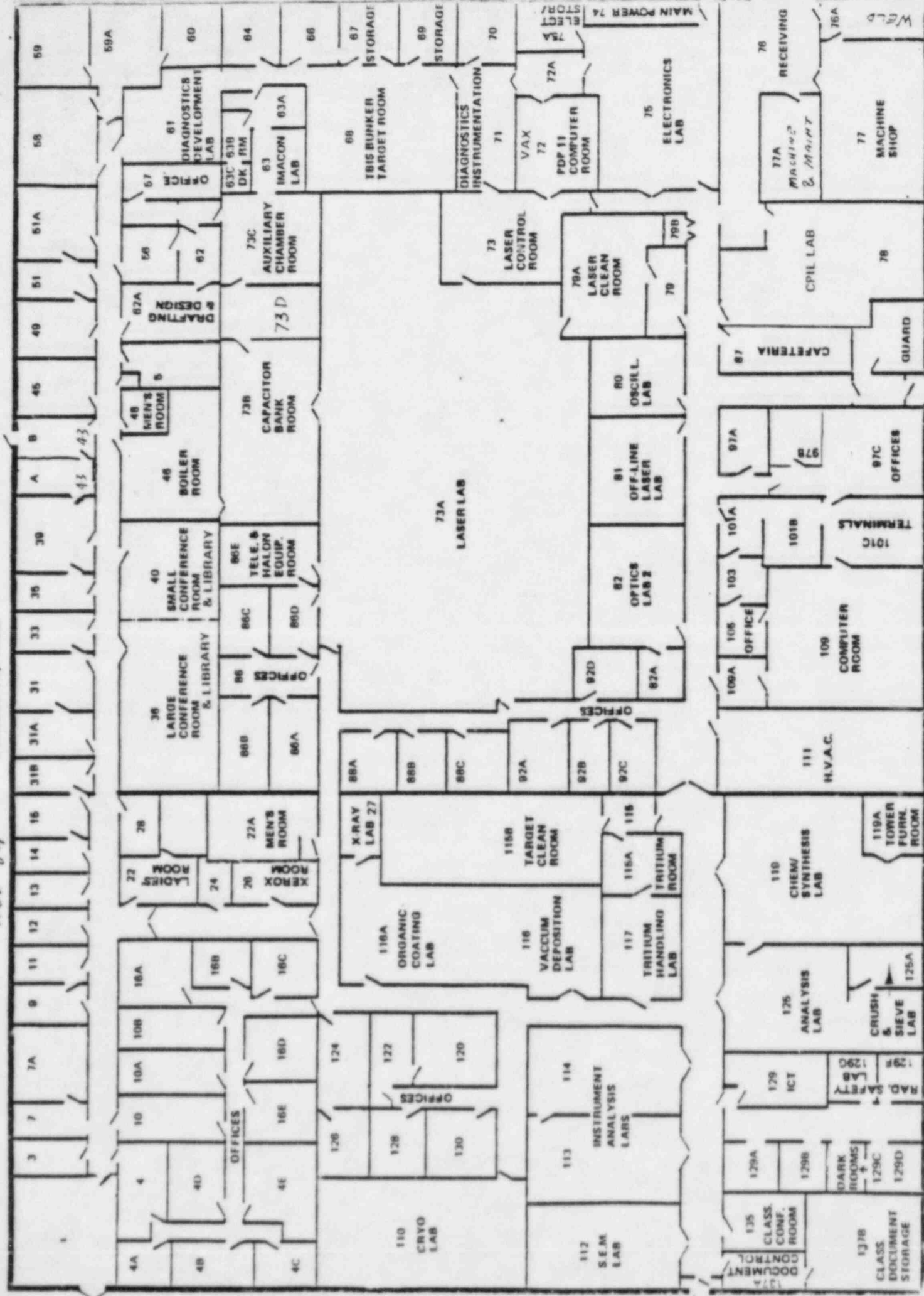
John C. Widman, Chairman
22 April 1985

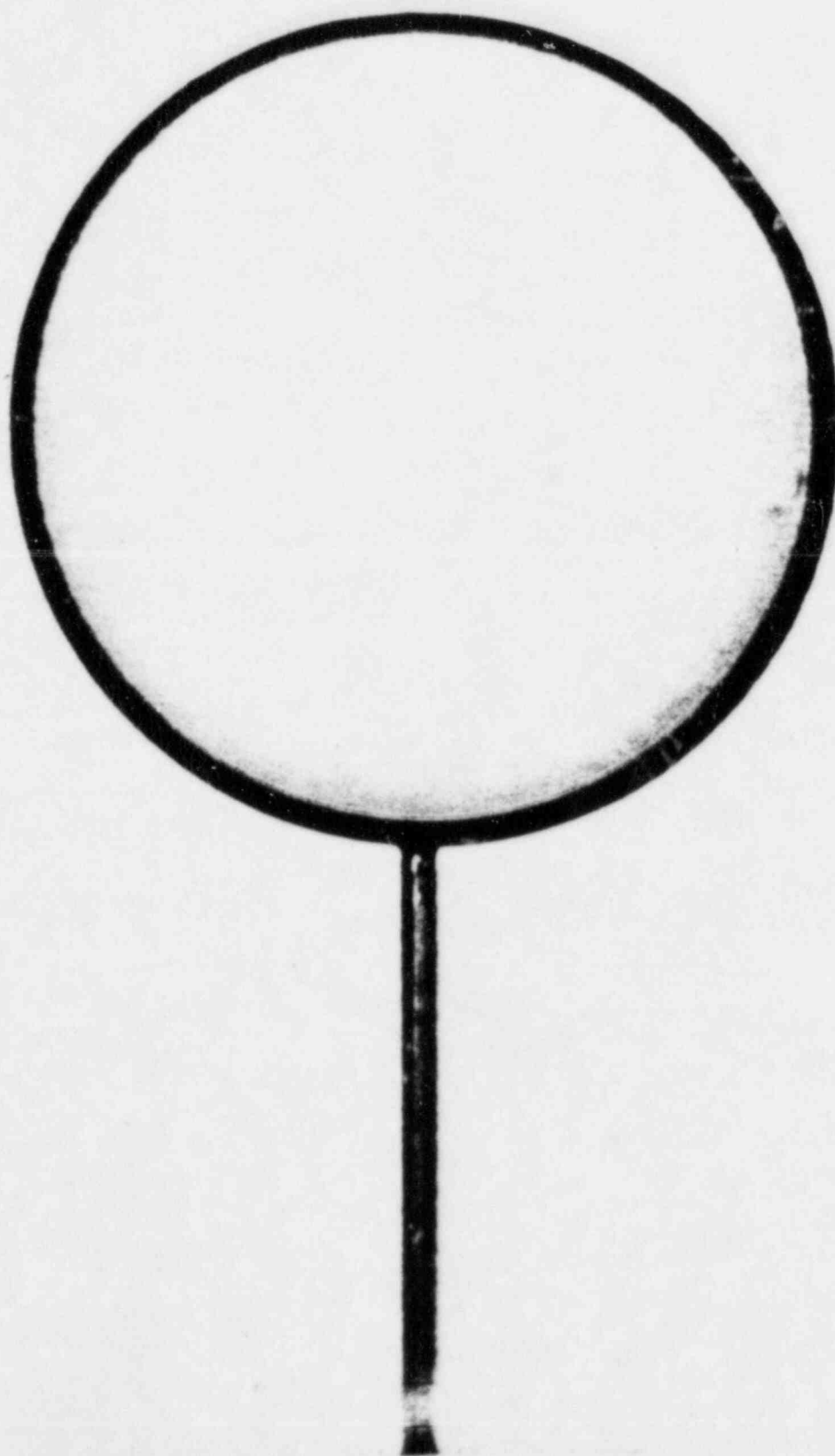
BUILDING No. 2 FLOOR PLAN

October 14, 1983

Nov 84

26.4 ft/inch





Shipper No. YYY
UNPACKING INSTRUCTIONS

The eggcrate assembly containing individual shells has not been opened. The shells were filled while in their holder. The eggcrates are being shipped in an aluminum tube, solid on one end and sealed with a removable nut on the other. A rolled piece of paper has been used as a spacer to hold the eggcrates in position and prevent them from moving during shipment.

Open the tube in a vented hood by removing the nut, extract the rolled paper spacer and tip the tube to permit the eggcrates to slide out. Treat the shells as fragile.

The shells have been filled with ten atmospheres of 1:1 D₂/T₂ mixture. The total calculated activity is forty (40) millicuries.

Shipper No. XXX
UNPACKING INSTRUCTIONS

The eggcrate assembly containing individual shells has not been opened. The shells were filled while in their holder. The eggcrates are being shipped in a glass vial. The vial is sealed in a plastic bag which is sealed in a one gallon paint can. Open the paint can, plastic bag and vial in a vented hood. Treat the filled shells as fragile.

The shells have been filled with one hundred atmospheres of DT. The total calculated activity is two hundred millicuries.