70-820 UNC RECOVERY SYTEMS

COMPLIANCE INVESTIGATION REPORT
VOLUME 3 - SUPPL. REPORT WITH EXHIBITS

Rec'd w/ ltr dtd 9/16/64 AA-3

~~OFFICIAL USE ONLY~~

Compliance

COMPLIANCE INVESTIGATION REPORT

Division of Compliance
Region I

Subject: UNITED NUCLEAR CORPORATION
SCRAP RECOVERY FACILITY
Wood River Junction, Rhode Island
License No. SNM-777

Type "A" case - Criticality Incident

Period of Investigation: August 20, 1964 to September 11, 1964

Volume 3 - Supplemental Report with Exhibits

Date: September 16, 1964

~~OFFICIAL USE ONLY~~

[redacted]

TABLE OF CONTENTS

[redacted]

SUMMARY AND ITEMS OF NONCOMPLIANCE

A criticality accident occurred at 6:06 p.m. on July 24, 1964 at the Fuels Recovery Plant of the United Nuclear Corporation, Wood River Junction, Rhode Island.

A Production Operator, Robert Peabody, poured the contents of a 5" diameter geometrically safe, 11 liter bottle into an 18" diameter by 24" deep tank that was about half full of 1 molar sodium carbonate solution. The 11 liter bottle actually contained concentrated uranium solution (200 grams of U-235 per liter or more) and the system became prompt critical when approximately 10 liters of the solution had been poured into the tank.

When the criticality alarms sounded, the five persons in the building at the time (including Peabody) evacuated the building and reassembled at the emergency evacuation building that is about 450 feet southeast of the plant. An ambulance was immediately called and various authorities were notified, as specified in the emergency plan.

At the emergency evacuation building, Peabody showed radiation sickness symptoms of nausea and stomach cramps, indicating that he had received a very high dose of radiation. Upon admission to Rhode Island Hospital at Providence, R.I., he was decontaminated placed in an isolation ward, and received special medical attention. He died at 7:20 p.m. on July 26, 1964, about 49 hours after the incident occurred. The Health and Safety Laboratory, Idaho Operations Office which is doing the analytical work in connection with the investigation, indicated that Peabody received a total dose (fast neutrons, thermal neutrons and gamma) in the order of 15,000 rad. This figure is subject to refinement by virtue of further analysis of additional information and samples furnished to Idaho.

The plant superintendent, Holthaus, and the shift supervisor, Smith, re-entered the building about two hours after the incident and drained the contents of the sodium carbonate make-up tank (1-D-11) into the organic wash column (1-C-9), and then into four one-gallon polyethylene bottles. The 3" diameter of the 1-C-9 column is a geometrically safe shape, and the 3.785 liter volume of the one-gallon bottles is a critically safe volume.

The plant superintendent, Holthaus, who received [redacted] of radiation when he re-entered the plant after the incident, and five other employees involved in the incident were sent to the hospital for examination and testing. Final film badge evaluation for the plant superintendent, Holthaus, indicated that he had received a dose of [redacted] The shift supervisor, Smith, who wore no film badge upon re-entry, was assumed to have received a gamma exposure equal to that of Holthaus. Both men [redacted] [redacted] Although medical examinations of the other four men revealed no radiation damage, they are continuing to submit specimens of blood and urine on a quarterly basis. Ex. 6

Examination of silver coins in the pocket of Holthaus by United Nuclear Corporation and Idaho Health and Safety Laboratory established that Holthaus had been [redacted] Further study is being conducted to determine the [redacted] The possibility that Smith also received a [redacted] is currently being investigated. Ex. 6

The Health and Safety Laboratory, on the basis of analysis to date, has estimated the magnitude of the excursion to be in the order of 10^{17} total fissions. This figure can also be expected to be refined on the basis of further analysis of additional samples submitted to Idaho.

On Monday, July 27, 1964, controlled re-entry to the plant area was made for observation and an assessment of decontamination requirements. Decontamination of the plant was started the next day and was substantially completed by August 7, 1964.

Surveys of the environment showed such small amounts of fission products escaped from the plant that no more than background radiation levels could be found three days after the incident. Surveys also showed that no significant fission product contamination was carried off site by vehicles parked in the area at the time of the incident or by vehicles used in the area after the incident. The ambulance used for transporting two men to the hospital was successfully decontaminated on Saturday, July 25, 1964.

In addition, the following facts were developed during the investigation:

1. The training program for the operators did not include any tests to determine their knowledge of procedures or familiarity with the equipment.

2. The operators employed at this plant had no prior experience in handling radioactive materials.

3. Two of the supervisors employed at the plant, Pearson and Chapman, had limited prior experience with nuclear materials. Smith had no such prior experience.

4. The Superintendent, R. A. Holthaus, did not regularly review the operators' and supervisors' logs.

5. The supervisors failed to inform the Superintendent of the change in the procedure to wash TCE by use of the sodium carbonate tank.

6. The supervisor who authorized the use of the sodium carbonate tank for uranium bearing solutions failed to realize that this use was not authorized under the license provisions.

7. There was no security in the storage of uranium bearing materials, nor was there a system of control for releasing in-process material to the operators for further handling.

8. The supervisors failed to enforce compliance with labeling requirements.

9. The failure of operators to follow procedures in connection with the use of labels with regard to initialling after sampling and disposal.

10. Failure of operators to follow instructions with regard to sampling solutions for subsequent analysis.

11. There had been no criticality audit subsequent to the start up of the plant.

12. There were only 10 safe carts available in the plant, necessitating leaving 11 liter bottles standing on the floor unsecured which could have caused spills and loss of material.

The following items of noncompliance were noted during the investigation:

A. Items of Noncompliance Contributing to the Incident

1. License Condition 8 and 10 CFR 70.3 - in that scrap recovery operations conducted on TCE wash solutions were not a part of the procedures specified in this condition, nor were they otherwise authorized in a license issued by the Commission.

(NOTE: Page 55 of "Nuclear Safety Calculations and Reference Sheets" submitted as part of the license application of 11/27/63 and referenced in Condition 8 states that no uranium will be used in the sodium carbonate wash tank, 1-D-11.)

2. License Conditions 8 and 14 - The scrap recovery operation on TCE wash solutions was set up without following the procedures required by Condition 8 for reviewing safety, instructing operators, and obtaining AEC approval; and constituted a procedural change prohibited by Condition 14. (See Pages 57-58 of Volume 1 and Exhibits A[1], B and V of Volume 2; - See also sections 20.7.2.1, 207.2.2 of UNC's "General Information and Procedures Applicable to the Handling of Special Nuclear Material.")

(NOTE: The third paragraph of the AEC letter of 3/5/64 transmitting the license to United Nuclear Corporation specifically called attention to Condition 14 and the prohibition on making unapproved changes in equipment or procedures.

B. Items of Noncompliance Otherwise Related to the Incident

3. 10 CFR 20.101(a) - in that six United Nuclear Corporation employees, including the three who made the initial re-entries following the criticality and three shift operators on duty at the time of the incident, received an external radiation dose in excess of [ ] in the second quarter of 1964. (See Page 78, Volume 1.) Ex. 6

(NOTE: Smith and Barton re-entered the facility on the night of the incident without wearing film badges. United Nuclear Corporation has estimated their doses based on the following:

a. Smith accompanied Holthaus who was badged. Smith's dose was assigned as being equal to that of Holthaus, although he reportedly did not enter areas with as high an existing dose rate as did Holthaus.

b. Barton has been assigned an arbitrary dose of [ ] This dose is evaluated from instrument readings obtained by Barton and from estimated time spent in the various areas of the plant.) Ex. 6

4. 10 CFR 20.201(b) - The re-entry personnel failed to properly evaluate hazards associated with re-entry to the facility following the criticality (See statements of Holthaus, Smith and Barton in Volume 2.)

5. 10 CFR 20.202(a)(3) - Two United Nuclear Corporation employees entered high radiation areas during re-entries following the criticality without wearing personnel monitoring equipment. (See statements of Barton and Smith in Volume 2.)

C. <u>Items of Noncompliance Not Related to the Incident</u>

6. License Condition 13 - The licensee failed to submit a report including results of air particulate and liquid waste effluent surveys and a proposed future survey program, including a minimum sampling frequency, to the Commission within 90 days of the start-up date, which was March 16, 1964. (See Page 56 and Page 10, Paragraph A of Volume 1)

7. 10 CFR 20.203(e)(1) - The licensee failed to post the following areas wherein U-235 is normally handled or stored with the standard "Caution - Radioactive Material" signs and symbols:

   a. the process area

   b. the storage area for incoming shipments of raw "pickle liquor".

   (See Pages 52 - 53, Volume 1.)

8. 10 CFR 20.203(b) - the licensee failed to post a storage area containing various polyethylene bottles of enriched uranium solutions with the standard "Caution - Radiation Area" sign and symbol. A dose rate of 50 mr/hr was noted at the entrance to the area. (See Pages 52 and 53, Volume 1.)

(NOTE: Corrected as of 9/2/64 visit by one "Caution - Radiation Area" sign, which was only sign posted in the entire plant.)

9. 10 CFR 20.301 - The licensee disposed of small quantities of special nuclear material by dumping contaminated TCE wash solutions onto the grounds at the rear of the plant, a manner of disposal not authorized by this section. (See Pages 49 - 50 and Page 9, Volume 1.)

10. License Condition 8 - The licensee failed to adhere to the following calibration procedures, incorporated in Section XIV of the Health Physics Manual.

    a. The licensee failed to activate one of the nuclear alarm detectors weekly, utilizing a gamma source, as specified in Section XIV-A. Further, detection units were not calibrated at 3 month intervals.

    b. The licensee failed to calibrate the emergency beta-gamma instruments at 3 month intervals, as specified in Section XIV-B.

    c. The licensee failed to calibrate other meters at 3 month intervals as specified in Section XIV-C. (See Pages 43 - 44, Volume 1.)

11. License Condition 8 - Total alpha contamination limits as specified in Section VIII-A of the Health Physics Manual were exceeded on the facility roof as a result of a 7/20/64 spill and allowed to remain without effective clean-up. (See Page 55, Volume 1.)

12. 10 CFR 20.201(b) - Surveys involving only collection of air particulate samples from filtered air exhausts on only 3 occasions by non-isokinetic sampling procedures and collection of only one air particulate sample each week at the fence line downwind of the plant without coordination with plant operations were not adequate to ensure compliance with permissible effluent limits in 10 CFR 20.106. (See pages 46, 47 and 55 of Volume 1.)

The Use of One Gallon Jars, 11 Liter Bottles, and Stainless Steel Trays

A. Description of the Jars and Bottles

It was intended that all U-235 material taken from the process equipment would be collected in either one gallon polyethylene jars, or 11 liter polyethylene bottles, either of which will safely contain any concentration of U-235 in solution. The one gallon jars are 6" in diameter and 10" high. The 11 liter bottles are 5" outside diameter by 48" tall. The minimum storage spacing for one gallon jars or 11 liter bottles is 24" center to center.

B. Materials Stored in the 11 Liter Bottles and One Gallon Jars

Materials and uranium concentrations normally found in the 11 liter bottles are:

a. Floor wash - 500 ppm from the pickle liquor area, or 1000 ppm from the evaporator-precipitator area.

b. Trichloroethane (TCE) - less than 100 ppm in normal TCE, or 700 to 900 ppm in TCE, that had resulted from organic floods, or that had been used for equipment washes.

c. Sodium Carbonate Solution - less than 50 ppm.

d. OK Liquor - 5 to 30 g/l, as uranyl nitrate.

e. Concentrated OK Liquor - 70 to 120 g/l, as uranyl nitrate.

f. Miscellaneous Solutions - any uranium concentration from very low to very high concentrations.

The gallon jars are normally used for the containment of small volumes of floor wash material, or for material drained from the columns. These solutions would be expected to have uranium concentrations of below 5 g/l. On occasion, when equipment is cleaned out, a gallon jar is filled with more concentrated solution and then emptied into 11 liter bottles. In this case the gallon jar is merely used as a transfer container. In actual practice, the gallon jars are not filled completely, but usually contain 3 liters of solution or less.

C. Storage of Bottles

Originally it was planned to store the 11 liter bottles in a storage rack of rigid steel construction. The storage rack was to be designed for a total of 24 bottles, separated by 2' edge to edge spacing. There were to be two rows of 12 compartments, placed along the east-west center line by Bay 13. The bottles were to be held in the compartment by chains. Before the rack was designed, it was decided that ten portable "safe" carts should be designed, which would maintain the 11 liter bottles on 24" edge to edge spacing. These "safe" carts were fabricated and 10 corresponding storage spots were marked off on the floor in Bay 13, as two rows of 5 spots each.

Because more than 10 of the 11 liter bottles were being used for solution storage, additional storage space for the bottles was needed. It was decided to adapt the product storage area to the storage of 11 liter bottles, by placing the bottle between two storage shelves and maintaining a 32" center to center spacing between the 11 liter bottles. This also meant that none of the one gallon jars could be stored on the shelves between the 11 liter bottles, so it reduced the storage capacity of the product storage area. When it became necessary to use more of the product storage area, some of the 11 liter bottles were stored on the floor, not in a "safe" cart, but in a single row, maintaining 24" edge to edge separation between the bottles and other bottles of material. This storage condition for the 11 liter bottles normally applied to bottles with low uranium concentrations (less than 5 g/1). Bottles with higher uranium concentrations or those bottles that had not been analyzed were either stored in the product storage area, or in "safe" carts.

D. <u>Stainless Steel Trays</u>

Stainless steel trays were used to avoid spilling uranium bearing solutions on the floor. Whenever solution is to be drained into a jar or bottle, a stainless steel tray is placed under the jar or bottle. The trays used in the building were cut from a 4' x 8' sheet of 16 gauge stainless steel and have an overflow depth of 0.707". One tray is 2' x 8', two trays are 2' x 2', one tray is 2' x 3', and one tray is 2' x 7". The balance of the stainless steel was used for making two dust pans with handles. The two dust pans are 4" deep by 1' long.

The Identification and Labeling of Jars and Bottles

A. Original Labels

The original plans for identifying the contents of each in-process uranium container, involved the use of an attached tag on which pertinent information was to be written. As an additional aid in maintaining enrichment identity, the container tags were to be color coded as follows:

Red	-	U-235 enrichments above 40%
Yellow	-	20 to 40% U-235 enrichments
Blue	-	6 to 20% U-235 enrichments
Green	-	0 to 6% U-235 enrichments

When the plant first started up this system was not used, but instead, a yellow, pressure sensitive gummed label was placed on the polyethylene bottles. (See Exhibit 1, Volume 2.) Material identification was written on this sticker under the heading "contents". When the sticker was filled with writing, the operators found it difficult to remove the old sticker. Also after the bottles had been in use for awhile, it was discovered that solvent on the outside of the bottle prevented the new sticker from adhering to the bottle. As a result of these problems, it was decided that a new tagging procedure should be developed.

B. Tags Developed by Chapman

Dale Chapman designed five different types of tags (see Exhibit 1, Volume 2), which were to be held onto the bottles by scotch tape. Subsequent experience with the scotch tape showed that the solvent on the outside of the bottle also prevented the tape from sticking to the bottle and tags could not be securely affixed to the bottles. As a solution to the problem, rubber bands were used for holding the tag on the bottle. These are still used today, but they are not completely satisfactory either, since tags can be easily knocked off while lifting or handling the full bottles.

Only three of these new tags were to be used for identifying the contents of the 11 liter bottles. One was to be used only for residues and one was to be used only for sampling. After a short time, the only tag that was used properly and consistently, was the sample tag.

When a sample was to be taken from the solution in an 11 liter bottle or a gallon jar, a tag was filled out to identify the sample bottle. The first 11 liter bottles used for uranium solutions were permanently marked with a marking pen to provide container identification. The numbers used began with 11001 and ran serially through 11015. This permanent identification was listed on the sample tag. The new 11 liter bottles introduced to the system did not have any permanent markings. Instead the bottle identification was a part of the tag information. No special system was used, although on occasion they used letters such as X, Y, Z, etc. Gallon jars were either tagged individually or as groups and were identified by location or just tagged with a descriptive title for identification.

The bottle tag and the sample tag had information concerning the source or origin of the solution. The identical information was recorded in the sample log book (see Volume 1, Attachment #3) and a log book number was assigned to the sample tag. When the analysis results were returned, the sample tag was checked against the bottle and the log and the analysis was recorded on the bottle tag. If the information on the sample tag could not be correlated with the log and the bottle, the operator was required to check with his supervisor.

C. Actual Use of Tags

Two problems soon developed. A large number of tags were being used, and it became apparent that some record should be provided concerning the material previously contained in the 11 liter bottles.

Apparently the tag supply began to dwindle rapidly, based on the large number of tags actually needed by the plant. This created some incentive for not using quite so many tags. In addition, although the largest portion of the tag could be discarded with the regular burnable wastes, the top 1" of each tag which had the warning "Radioactive Material" printed on it, had to be torn off and saved for controlled incineration. This also encouraged the use of fewer tags.

To meet these tagging needs, the operators started using the back of the tag, which was a light yellow color and contained no printing. Information could be written on the tag by the operators under their penciled-in column headings, which identified the material in the bottle, its analysis and disposition. By merely drawing a line through the last entry and then making a new entry it was possible to reuse the tag. Data was recorded for the solution that was to be added to the bottle and it was also possible to determine what had previously been in the bottle. By writing carefully, an 11 liter bottle tag could be reused six or seven times. When a tag was to be used on a one gallon bottle, only the back of the tag would normally be used and only one entry would be made concerning the bottle's contents. The tag would then be discarded. Because the operators knew that the tag was only to be used once, the writing on the back of these tags was not restricted in size. The only limitation on the amount of space used was the space needed for writing down the analysis on the tag, prior to disposing of the bottle's contents.

Description of Nuclear Safety Alarms (Exhibit 12, Volume 2)

The Wood River Junction facilities have six nuclear safety alarms, made by Nuclear Measurements Corporation, Model GA-2A. Power is supplied by a diesel auxiliary generator when the main power line is off. The locations are:

1. On the south wall of the laboratory - mezzanine floor.

2. On the north wall of the process area near the shift office - Bay 10.

3. Outside the building near the drum storage area - north of Bay 13.

4. On the south wall of the process area near the product storage shelves - Bay 12.

5. Near the stairway to the mezzanine in the evaporator-precipitator area - Bay 21.

6. On the north wall of the first floor tower room - Bay 20.

The monitors are normally set to alarm if the radiation level at the monitor exceeds 10 mr/hr and they will respond within two seconds of a sudden change in radiation levels. Maximum scale reading of the meter and maximum set-point is 50 mr/hr. As long as the gamma radiation level is above the set-point of the monitor, the bell and siren continue to sound. As a result, the initial criticality excursion starts the alarm and as long as radiation levels remain above the 10 mr/hr set-point, additional excursions cannot be detected by the monitor.

Nuclear Safety Audits

The design of the Wood River Junction facilities in Rhode Island, was reviewed for nuclear safety by Louis J. Swallow, Operations Control Manager of the Chemical Operations, Fuels Division at Hematite, Mo. He was also principally responsible for preparation of the license application (SNM-777) for the Wood River Junction plant.

During the design phase, Mr. Swallow reviewed and approved equipment design and equipment locations, as submitted by the H. K. Ferguson Company, who constructed the plant. Most of the nuclear safety calculations were done by a Dr. Cantrell, Consultant to the H. K. Ferguson Company, and they were compared by Mr. Swallow with practices at the Hematite plant, as well as the recommendations in recognized publications, such as the "Nuclear Safety Guide" - TID 7016 - Rev. I, etc.

After construction started, Mr. Swallow only visited the plant twice, once in January and once in February of 1964. At no time did he participate in the training program for the supervisors or operators or in any audit of the nuclear safety practices. He did not inspect the final installation or use of equipment at the Wood River Junction plant.

After the plant started operations, no formal safety committee or audit team was appointed. It was expected that Mr. Barton, the Technician that followed health physics practices, the shift supervisors, Smith, Chapman and Pearson, and the Plant Superintendent, Mr. Holthaus, would observe the daily operations and correct any questionable practices whenever they were noticed. No written reports of these observations were required or recorded.

Discussion of Shift Assignments

Nineteen people were employed by the United Nuclear Corporation, to operate the Wood River Junction facilities. In addition, guard service was provided by the Burns International Detective Agency, and advice and consultation were available from personnel at the New Haven plant. The plant was operated continuously from Monday through Friday, using three shift coverage.

During the week of July 20 through July 24, 1964 the shift schedule assigned shift supervisors William Pearson to the 12 to 8 a.m. shift, Dale Chapman to the 8 a.m. to 4 p.m. shift and Clifford Smith to the 4 p.m. to 12 shift. (See Exhibit 4 in Volume 2) Normally, the shift operators work the same shift for two weeks at a time, but the shift supervisors change shifts at the end of each week. A rigid shift schedule was not followed, since Mr. Holthaus did not care particularly who was working on each shift, as long as someone was present. The men were allowed to trade shifts with each other, at their convenience. Mr. Peabody wanted to work the 4 to 12 shift, so he always traded shift assignments with Mr. Kenyon or Mr. Simas.

Mr. Peabody had previously been an auto mechanic and apparently was still doing some work on automobiles during the day time, in addition to his work at United Nuclear. When he first applied for a job at United Nuclear, he applied for the job of mechanic, but was told that Mr. Bitgood had already been hired. Mr. Peabody then agreed to work as an operator, hoping to have the first chance at the mechanic's job, if Mr. Bitgood ever left the company. Mr. Peabody must have felt that there was a good chance of Mr. Bitgood's leaving because he knew that Mr. Bitgood's real interest was in the training of race horses and since the incident, Mr. Bitgood has in fact accepted a position as a horse trainer.

Discussion of Entries in the Operators' Log Book A (Attachment 1, Volume 1 and Exhibit 8, Volume 2)

The operators' log book A was originally suggested by Dale Chapman, based on a similar log that was used at Hematite, Mo. Mr. Chapman thought that the log would be a good method of passing shift information along and a good way of getting operator "gripes" discussed openly. The log was started in May and each operator was asked to use it as a "shift turnover" log.

In actual practice, the log was not used very consistently and although some operators did make entries, most of them only used it occasionally. Entries were brief and only concerned items that they thought more than one shift would be interested in knowing about. Apparently the operators preferred to tell their relief man what was happening rather than write it down.

Items excerpted from the operators' log book A show:

1. That column floods were drained into one gallon bottles and reworked through the columns, presumably by pouring the solution into the scrub column return line that goes to column 1-C-6.

2. That 1-D-11 was used to wash TCE on July 17, 1964.

3. That "gallon jugs in the precipitator area contain concentrate from the evaporator troubles", signed by G. J. Spencer.

4. That the stainless steel dissolver contained 16 liters of concentrated liquor (later found to be 6 liters) that came from the evaporator.

Discussion of Entries in the Supervisors' Log (Attachment 2, Volume 1 and Exhibit 9, Volume 2)

The shift supervisors' log was used for informing and reminding the relieving supervisor of plans and problems that should be worked on during the new shift. It originally started as a note from one shift to the next, but was started as a permanent log when operations started. This log was used by each of the shift supervisors and contained much more information that the operators' log. It was generally considered to be the best source of process information.

Items excerpted from the supervisors' log show:

1. On July 17, 1964, Bill Pearson wrote in his log, item 4: "Wash Umpteen bottles of TCE". This indicates his knowledge of the new TCE washing process. (As performed by Peabody in the sodium carbonate tank 1-D-11.)

2. That the criticality alarm was accidentally set off by Mr. Peabody when he was washing down the first floor of the tower room. Recommendations were also made for emergency evacuation procedures, based on the building evacuation.

3. That Mr. Holthaus read the supervisors' log and wrote a note in it himself, in answer to "Cliff's" question.

4. That concentrated liquor from the evaporator was processed through the stainless steel dissolver in four batches (37, 38, 39, and 40.)

Discussion of the Operating Report Sheets (Volume 1, Attachment 12 and Supplement, Exhibit "A"

Operating report forms are used for recording the operating data for each of the major operations. As an example of the data recorded and the information about process operating conditions that are discussed, the dissolver operating sheets for batches 29 through 42 and the extraction system operating sheets for the month of July 1964 are included in Volume 1, Attachment 12, and Exhibit "A" of this supplement.

The dissolver sheets show the material charged to the dissolver, the weight of solution sent to the storage tanks, the operators working on the dissolver and an occasional miscellaneous item of information.

The extraction sheets show the way that the columns operated, the operators working on the various shifts, the inventory of feed and product solution and occasional notes on items of general interest to the column operators.

The operating report sheets informed the relief operator of the things that had happened on the previous shift and it could be used for "shift turnover" easier than the operators' log book. Unfortunately, neither the log book or the operating report sheets were used consistently by all of the operators. Much of the information was transmitted verbally in the locker room at shift change rather than by recording it formally.

The Analysis of Clean-Up Solutions and Incident Material

The United Nuclear Corporation has provided the AEC with analytical data on the uranium that was cleaned up from the tower room area and the material drained from the sodium carbonate make-up tank 1-D-11. Copies of the data may be found in Exhibit "B" of this supplement.

Most of the clean-up solutions of irradiated material from the tower area were collected in gallon jars, given an identification number and then sampled. Some of the more concentrated solutions were collected in 11 liter bottles, that had permanent identification numbers on them, and then sampled. An attempt was made to identify all uranium bearing solutions that resulted from cleaning up the uranium ejected from the sodium carbonate make-up tank at the time of the incident, and the spills that occurred when the tank was drained. The uranium content of these solutions is totalled up on page 3 of the tower room clean-up, sample data. The total is 224.59 grams of uranium.

The UNC sample data on pages 4 and 5 of Exhibit "B" shows the total uranium content (2018.0 grams) of the solution and precipitate from the sodium carbonate make-up tank, that had been dissolved in nitric acid and then sampled. This material was involved in the nuclear incident.

Additional Information Obtained from UNC People by W. G. Browne

During an interview of Mr. Holthaus on 7/25/64, by Mr. Lindberg of United Nuclear Corporation, Mr. Holthaus made the following comments:

1. Fifteen feet from Mr. Peabody's clothing, a reading of 100 mr/hr was obtained.

2. Mr. Holthaus believed that a trichloroethylene bottle was used but it may have been uranyl nitrate because both bottles are the same.

3. Mr. Holthaus was told that Peabody was on the third floor of the column building and exited by the column door. Peabody removed his clothes at the fence and went to the emergency shack naked.

4. Smith and Mastriani returned to the building with Holthaus. Holthaus wanted to get the sodium carbonate make-up tank (1-D-11) solution into safe geometry containers.

5. Holthaus stated that the 11 liter bottle was empty when he removed it from the tank.

6. Holthaus did not wear any protective clothing during his radiation survey of the plant or while he worked in the area, draining the 1-D-11 tank.

7. All contaminated clothing was placed in a roped off area near the emergency shack.

8. Normally, trichloroethylene is washed in an 11 liter bottle. It is separated from the carbonate wash and solvent is sent to storage for analysis.

9. Peabody is energetic but does things without thinking things through too well. He is intelligent and may have been planning to do the TCE washing faster. The foreman may have asked him to wash TCE as his assignment.

10. 895 contract material is the principal material in the plant.

11. The feed mixture to the columns is about 30 g/l.

12. The carbonate column is changed once per shift.

13. It is Mr. Holthaus' opinion that Peabody is accident prone. He has recently been involved in an accident at the plant and has previously been involved in two more. Some of these were eye accidents. He is Ex. 6

During an interview of Mr. Smith on 7/25/64, by Mr. Lindberg of the United Nuclear Corporation, Mr. Smith made the following comments:

1. Mr. Peabody told Mr. Smith that he thought he poured TCE into the 1-D-11 tank.

2. All telephone calls were completed by 6:25 p.m.

3. When Mr. Smith re-entered the column room, he observed a greenish solution spilled on the east side of the first floor of the tower room. At the third floor level there was a uranium solution spill on the floor by the door. The "lighting" tank agitator was running. Smith and Holthaus drained the 1-D-11 tank into the 3" column 1-C-9.

4. As the column was drained into one gallon bottles, Smith observed a 1-1/2 to 2 r (times 100) on the plastic bottle as it filled up.

5. First floor readings were over 100 r/hr in Bay 20 (first floor of tower room.)

6. Smith and Holthaus were in the plant from 7:45 p.m. to 8:30 p.m.

7. Mr. Smith stated that he did not know that Peabody was working on the third floor of the tower room.

8. The TCE washing procedure for the sodium carbonate make-up tank 1-D-11 used 22 liters of sodium carbonate solution for each 11 liters of TCE. This washing procedure had been used before. The glass column is used as a separator.

9. TCE bottles were always analyzed before they were taken up to the third floor of the tower room. Smith did not allow over 1000 ppm in the TCE. The sodium carbonate wash solution from the TCE washing is normally acidified

and put back into the 1-D-41 tank.

10. Mr. Peabody ran the pulse columns. Mr. Smith did not usually give him specific instructions. He must have attempted to wash TCE on his own initiative. Normally, Peabody would check with Smith before doing an unusual operation like the TCE washing.

11. The 11 liter bottles was probably taken by portable cart from the product storage rack. There are other materials in the 11 liter bottles than TCE.

12. Tags identify the bottle contents, all bottles look the same. The tags are held on by rubber bands and/or tape.

In an interview with Elmer Barton at 11:00 a.m. on 7/26/64, he stated that:

1. His radiation dose is unknown, but he did have a film badge while he was in the area.

2. Mr. Barton is a Health Physics Technician and he came in to the plant about 8:30 p.m., or 8:45 p.m. on 7/24/64.

3. Barton turned down the criticality alarm monitors on the south side of the process area - first floor.

4. Mr. Barton took a reading at the first floor tower door and got a 50 r reading on his instrument.

Information obtained from Bill Pearson on 7/26/64:

Mr. Pearson came to the plant about midnight on Friday. He had a badge with him, that he brought from home. This badge was not at the plant at the time of the incident. He wore the badge for all of his work, from that time on. Mr. Pearson went through the storage area about 3:00 a.m. to investigate a statement made to him by Barton, that the evaporator was overflowing.

Mr. Pearson discovered that the evaporator was overflowing so he dashed down to the evaporator-precipitator area and shut off the valve to the evaporator. He estimated that this did not take him more than 10 seconds for the round trip.

Information on the Sodium Carbonate Make-Up Tank (1-D-11), 7-27-64

The distance from the rim of the 1-D-11 tank to the floor is 60 inches. The platform on which the 1-D-11 tank is placed, is 5 inches above the floor level.

Mr. Holthaus Explained the UNC Record System on 8-5-64

1. ADU precipitate started the week of April 27, 1964.

2. Pickle liquor was first introduced to the plant on March 16, 1964, but this was only a token receipt. Actual sustained receipts of pickle liquor began on the week of May 11th.

3. Pickle liquor is the only material used in the plant, the uranium is all 93% enrichment material.

4. Plant start-up problems involved gaskets, the teflon bellows, glass to gasket seals and the pump seals. Viton A material supplied with the pulsers was quickly dissolved by the organic solvent.

5. No cold or depleted uranium runs were made during the plant start-up. The only equipment checks were made with nitric acid, water or stoddard solvent and TBP.

6. An "AVO" form is used by the maintenance man as his work assignment order. It is kept in the foreman's office and became a sort of record of major equipment failures.

7. The pickle liquor drums are listed by the operator as they come in. This list is sent to Shirley Perrolle, the records clerk, and she logs the data. The analysis of each drum is compared with the shipper's value for U-235.

8. After job number 0007, a complete physical inventory was taken. This was during the week of June 22, 1964, prior to the open house for the plant, which was held on June 27th. Inventory difference was a loss of just slightly less than one kilogram of U-235.

New people hired at Wood River Junction after the incident:

8/18 - Dana Worth Osborne

8/18 - Joseph Frederick Travers

8/18 - Daniel (NMN) Lynch

The Neutron Activation of Coins in Mr. Holthaus' Pocket

Mr. Holthaus was not at the plant when the nuclear incident occurred, but arrived at the plant about half an hour after the incident occurred. (Volume 2, Exhibit B, Page 2.) Mr. Holthaus and Mr. Smith re-entered the plant and drained the uranium solution from the sodium carbonate make-up tank on the third floor of the tower room, into a 3 inch diameter glass column on the third floor of the tower room and then into gallon jars. An analysis of silver coins in Mr. Holthaus' pocket indicates that he was [ ] at sometime during his entry to the building. Ex. 6

According to Mr. Holthaus' testimony (Volume 2, Exhibit B, Page 3), he walked up to the sodium carbonate make-up tank, removed the 11 liter bottle from the tank and dropped the bottle to the floor. He walked to the west of the tank and turned off the agitator. He again approached the tank and took an instrument reading at the side of the tank and another reading over the top edge of the tank. He then left the room.

When solution did not drain out of the pipe line on the second floor, Mr. Holthaus returned to the third floor of the tower room and again walked to the west of the sodium carbonate make-up tank so that he could turn on the agitator. After turning on the agitator he again left the room.

When the sodium carbonate make-up tank was almost empty, the hose from the pipe line to the 1-C-9 column funnel flipped out on the floor. Mr. Holthaus shut off the valve and returned to the third floor of the tower room where he looked in the tank and found it was empty. He then turned off the agitator and went down to the second floor to drain the last of the material from the pipe line into the funnel. He estimates his total time in the tower area at 5 minutes, most of which he spent on the second floor.

In questioning both Mr. Holthaus and Mr. Smith about the draining operation, they both agreed that the solution from the sodium carbonate make-up tank was not warm to the touch. Mr. Holthaus did not have gloves on and could not feel any unusual heat when he touched the hose, the pipe, or the valve. Mr. Smith did have rubber gloves on his hands but he said they were sweaty, so heat would easily be conducted through the gloves to his hands when he picked the bottles up to carry them out into the process area. He does not recall any noticeable warmth of the bottle. He also spilled some solution on his glove and did not notice that it was warm.

From examining a picture of the sodium carbonate make-up tank (1-D-11) it is apparent that the tank is reflected only on the north side by the concrete block wall and on the bottom by the floor. This system should have a high neutron leakage as it approaches criticality so the approach of a hydrogenous reflector, such as Mr. Holthaus, should have a significant effect on the criticality of the system.

The two situations that have a high likelihood of being the times when a high neutron flux could have existed are:

(1) The time that Mr. Holthaus took the bottle out of the tank since he was probably within a foot of the tank, reflecting a large portion of the tank, and he was also changing the void and agitation pattern of the solution as he removed the bottle.

(2) At the time Mr. Holthaus turned on the agitator, when he came up from the second floor. The precipitate had been settled and, as the agitator started, it would change the distribution of uranium of the system while Mr. Holthaus, as a reflector, was within two feet of the tank.

Activities in Exposure & Excursion Magnitude Evaluations

General

The report of August 14, 1964 indicated that four separate efforts were being made to evaluate the Peabody exposure and that the Health and Safety Laboratory, USAEC, Idaho Falls, Idaho was acting as the primary agent in these evaluations for CO:I. Since the initial report, samples of hair from Peabody, Holthaus and Smith have been furnished to the Los Alamos Scientific Laboratory, Los Alamos, New Mexico for the evaluation of exposure to these men. This report also indicated that evaluations of the exposures to Holthaus and Smith, who made the initial re-entry into the plant were being carried out. Since then, the fact that Holthaus had been exposed to [ ] has been established by the finding of activated silver in coins carried by Holthaus. The possibility that Smith also received [ ] is currently being investigated. Holthaus and Smith, as well as the other personnel present in the plant during the excursion are being medically followed. Silver coins in the pockets of Holthaus during the initial re-entry into the plant have been examined by United Nuclear Corporation personnel and the Health and Safety Laboratory, USAEC, Idaho Falls, Idaho. Additionally, an indium foil from the visitors' badge worn by Smith during the initial re-entry is currently being examined at United Nuclear Corporation and will also be examined by the Idaho Laboratory. Whether the tank in which the excursion occurred was still critical when Holthaus and Smith re-entered the plant, or whether the remaining contents of the tank again went critical by Holthaus approaching the tank and/or manipulating equipment on the tank, is a subject presently being investigated by United Nuclear Corporation. Ex. 6

Present Status

It is expected that final reports from the Health & Safety Laboratory, USAEC, Idaho Falls, Idaho, Dr. John Stanbury; Massachusetts General Hospital, Boston, Massachusetts, The Los Alamos Scientific Laboratory, the United Nuclear Corporation, and C. Gooth, ORNL, will be completed within two weeks of this report. A semi-definitive "dose" value based only on blood sodium activation has been prepared by Mr. J. Auxier at ORNL. This material is included as Exhibit "D." The pathology report being prepared by Drs. Fanger and Lushbough will be completed in about 2 months.

Current Medical Evaluations

According to Mr. W. L. Allison, United Nuclear Corporation, all personnel present in the plant during the excursion, and all personnel exposed to significant amounts of radiation after the excursion are to be medically followed until definitive information is obtained that these examinations are no longer required. Allison stated he has placed Holthaus and Smith (initial re-entry personnel) in a class one category and that exhaustive medical tests consisting of sperm counts, slit lens eye examinations, blood and urine evaluations, and hair activation studies are being done and will continue to be done until medical advice indicates that no further information can be obtained. Mastriani, Coon, and Barton are considered to be in a class two category and will submit specimens of blood and urine at quarterly intervals until it has been determined that this is no longer required. George Spencer, an operator in the plant during the excursion has resigned and left the area. Allison stated he has made arrangements for Spencer to submit samples of blood and urine at quarterly intervals for at least two more quarterly periods.

Present Estimates of Dose and Excursion Magnitude

On 8/21/64, a telephone call from personnel at the Health & Safety Laboratory, USAEC, Idaho Falls, Idaho indicated that Peabody had received a total dose (fast neutrons, thermal neutrons and gamma) in the order of 15,000 rad and that the total fissions occuring during the excursion were in the order of 1.4 x 10^{17}. Since that time, additional information and samples have been furnished to Idaho personnel which will revise these figures to a limited extent but not by an order of magnitude. Present estimates from Idaho indicate that the new values will be in the order of 10^4 rad and 10^{17} fissions respectively.

Additionally, the laboratory has conducted evaluations on the coins carried by Holthaus during the initial re-entry. Preliminary estimates are that Holthaus received [ ] Ex. 6
exclusive of the beta-gamma contribution from fission products.

The laboratory has additionally carried out an examination on samples of the tags found in the tower area in an effort to establish whether one of these tags had been exposed to neutron radiation. Results were negative. At the request of CO:HQ, it was learned that UNC would be willing to make the entire tags available for this analysis even though it would mean destruction of the tags. The laboratory is willing to renew these examinations but feel doubtful that positive results can be obtained.

The laboratory has carried out a chemical analysis of the precipitate found in the solutions received from the tank in which the excursion occurred. It was determined that the chemical composition was $Na_4UO_2(CO_3)_3 \cdot 2H_2O$. Additionally, the laboratory will submit an estimate of the amount of fissionable material present in the tank when the excursion occurred.

The transcript of the 8/21/64 telephone report is included as Exhibit "E."

Addition to the Vehicle Survey Report (Pages 81 - 85 of Volume 1 of the Report Details

From July 27 to July 29, P. J. Knapp made 127 smears on vehicles known to have been in the vicinity of the United Nuclear plant near the time of the incident. These smears were evaluated by HASL for alpha and gamma radiation. No gamma contamination greater than 20 disintegrations per minute above background (5 disintegrations per minute) was found.

The alpha counting equipment had a background count rate corresponding to 0.02 disintegrations per minute. Twenty-five smears from 13 vehicles displayed a small but detectable amount of alpha contamination. None of these smears showed above 10 disintegrations per minute.

One smear from the steering wheel and buttons of the vehicle of [ ] revealed 440 alpha disintegrations per minute. This vehicle, erroneously reported on page 85 of Volume I of the report details as being present on the morning of July 27, was actually present on the morning of July 25. As noted on the above mentioned page, a contaminated employee slept for a few hours in the rear of this vehicle. Ex. 6

The finding of low-level alpha contamination in the [ ] vehicle was reported to Mr. W. L. Allison, United Nuclear Corporation, New Haven, Connecticut on September 1, 1964. Mr. Allison stated he would follow-up on this matter and ensure that the vehicle would be decontaminated if still necessary. Ex. 6

Supplemental Information: Decontamination Procedures, Pages 59 - 64

The following is a summary of wipe survey results taken by the CO:I inspector of the United Nuclear Corporation, Wood River Junction plant as indicated on page 63 of the initial report. These wipes, analyzed by HASL-NYOO, were taken prior to the licensee's completion of decontamination. This wipe survey was taken at the time the direct radiation survey was made as reported on page 63 of the initial report. Locations of wipe surveys referenced below may be located on Exhibit 23 in the initial report. Maximum results of specific areas are given and average results are included when the 2000 dpm limit was exceeded. (2000 dpm established by UNC - see page 61 of report.)

Locations	α dpm/100 cm^2	$\beta\gamma$ dpm/100 cm^2
Lab. (Chem. Lab.)	145	278
H & V Equip. (Heating & Ventilating Equipment Room)	19	46
Stairway (To Chem. Lab)	70	138
Shipping & Receiving	38	29
Storage	160	158
Maintenance	220	235
Utility Room	270	231
Process Area		
Office	620	1160
North third of floor area	390	544
Center third of floor area	1200	2670
		900 (Avg)
Mezzanine over center third of Process Area	2700 500 (Avg)	3540 300 (Avg)
South third of floor area	750	910
Evaporator area and Mezzanine	2600	3430
	1000 (Avg)	1200 (Avg)
Tower Stairwell	990	7600
		1200 (Avg)
Tower, 1st floor	2300	16,500
	600 (Avg)	600 (Avg)
Tower, 2nd floor	850	4500
		800 (Avg)
Tower, 3rd floor	540	3600
		1000 (Avg)

Methods of Supervision at Wood River Junction Fuels Recovery Plant, United Nuclear Corporation

With regard to supervision of the operators, Dale Chapman stated that there is direct communication from supervisor to supervisor at the change of shifts. There is also some degree of operator to operator communication at the change of shifts, but this is not dependable because occasionally an operator may be late in arriving for his shift. Chapman states he communicates directly to an operator any specific orders or instructions he has received for them from the preceding supervisor or from the plant superintendent. He observes the men in their work and instructs them in any unusual problems that may arise. On routine matters, the men are not closely supervised, but reliance is placed on observation of the activities in the course of the shift.

In addition to the supervisor to supervisor communication, Chapman stated that additional pertinent information is recorded in the Supervisors' Log Book 1, which he reviews and that the operators are supposed to utilize a log (called the Operators' Log Book A), but this is not used to the same detailed extent as the supervisors' log.

Clifford Smith stated that the operators would get their information for their shift activity from the operator on the previous shift during the shift change. He stated that the operators would go to their respective areas, that is the dissolver, precipitator or pulse column areas. The log sheet at these locations would be read by the operator for entries made by the preceding operator. Smith stated that during the shift he would visit the men at each of these areas, he would check the log sheet, see what the operator was doing and then do whatever tasks he had to do.

Smith states that on July 23, 1964 at the 4:00 p.m. change of shift, Robert Peabody was talked to by Charles Kenyon, the operator on the preceding shift, with regard to the clean out of the evaporator. Smith states that on July 23, 1964, he had told Peabody to help George Spencer put the evaporator flange back together. He believes he gave this instruction to Peabody before Spencer had completed cleaning out the feed leg of the evaporator. Smith also stated that he visited the tower area, second floor, because of trouble that had developed with the concentration of material and some flooding.

On Friday, July 24, 1964, Smith states he did not talk with Peabody in the lunchroom area before the shift started. He believes Peabody talked with Kenyon and was told of the condition of the columns. Smith stated that about a little before 6:00 p.m. Peabody had spoken to him about bottles being mislabeled, 11 liter and some gallon bottles. Smith states he told Peabody that samples would be taken later and if Smith had time, he would do an analysis of these samples. Smith stated he told Peabody at this time, that if there was time later, the precipitators would be washed with TCE. Smith stated that sometime during this early period on the 4 to 12 shift, July 24, 1964, he saw a safe cart in the first floor stairwell, but he does not remember whether he saw a bottle in it or not. Smith says he had not seen Peabody in the process area.

Smith states he has no idea what material Peabody took or from where he got it. Smith stated he did not recall that Peabody made up sodium carbonate on Thursday night on the 4 to 12 shift. Smith says he may have done so if he found the tank was low.

According to William Pearson, supervision is effected by observation of the men in the course of the shift as frequently as his duties permit, not less than once during a shift, as frequently as hourly. If special instruction is necessary it is given to the men individually depending on the man's job assignment. Pearson states some men need closer supervision than others. If a problem arises, the men will usually ask him for assistance. If Pearson sees a situation that requires correction, he stated he will tell the men how to correct it.

Use of Sodium Carbonate Make-Up Tank

Charles Kenyon states that he worked the pulse columns on July 24, 1964. Kenyon states he did not make up any sodium carbonate on his 8 to 4 shift on July 24, 1964. Kenyon stated that during the course of his shift he does not recall that he looked into the sodium carbonate make-up tank to determine whether there was sodium carbonate in it. He states that he observed the columns and saw sodium carbonate in the column and it appeared to be OK. Kenyon stated it did not take more than 15 minutes to make up a batch of sodium carbonate. Kenyon did not recall when he last made up a batch of sodium carbonate. (Examination of the operators' log indicates Kenyon made up a batch of sodium carbonate on his shift Tuesday, July 21, 1964.) Kenyon described the procedure for making up the sodium carbonate as follows: He stated that originally he would add 3/4 of a pound of soda ash to a gallon of water, weighing out the soda ash. He said the batch he would make up would consist of approximately 7½ pounds of soda ash to 10 gallons of water. This would fill half a tank. Kenyon does not now recall specifically what he did on his shift on July 24, 1964. He believes that when he came into work on that morning he checked the columns and found they were running OK. The TCE column was OK and was not changed. He stated the carbonate column was running OK and does not recall changing it. Kenyon was questioned about the possibility of any material, other than soda ash and water, having been introduced into the sodium carbonate make-up tank. He stated that, to the best of his recollection, he did not put any material into this tank, he could not remember when he had last made up a batch of sodium carbonate and did not recall whether he had looked in the tank to determine the quantity of sodium carbonate in it. He stated he is unaware that anyone else introduced any material into the tank other than the ingredients for making the sodium carbonate.

On August 24, 1964, Ryan and Browne reinterviewed Joseph Simas, an operator at the Wood River Junction Plant. Simas stated that he did not make up any sodium carbonate on his two 12 to 8 shifts Thursday morning, July 23 or Friday morning, July 24, 1964. He ordinarily works in the pulse column area and was so assigned on those two days. He stated that the sodium carbonate make-up tank identified as 1-D-11 had a good 25 gallons of sodium carbonate in it when he came on duty at midnight July 22, 1964 for the 12 to 8 shift, July 23, 1964. Simas stated he believes that this batch of sodium carbonate had been made up by the operator preceding him on the 4 to 12 shift, July 22, 1964, Robert Peabody. Simas stated he used between 8 and 12 gallons on the shift, midnight to 8 on July 24, 1964 leaving about 12 to 15 gallons in the tank.

Reinterview of Operating and Supervisory Personnel - August 24, 1964, August 26, 1964 and August 31, 1964

Reinterviews were conducted with operating and supervisory personnel to determine when bottle Y had last been seen by each individual, to identify the individual who may have moved bottle Y and to determine its final disposition. The following tabulation, based on the shift organization, contains the results of this effort:

8 to 4 Shift, 7/23/64	Bottle Y filled	Stored	Seen On 7/23/64	Seen On 7/24/64	Taken By
Dale Chapman			X	No	No
Leroy Roode	X	X	X	X ?	No
Charles Kenyon			X	Does not recall	No
James Aiello			X	Does not recall	No
4 to 12 Shift, 7/23/64					
Smith			No	No	No
Mastriani			Uncertain	Uncertain	No
Spencer			X	Uncertain	No
12 to 8 Shift, 7/24/64					
Pearson				X at end of shift	No
Simas				X	No
Nowakowski				Absent	No
Murphy				Does not remember	No

From these reinterviews it can be seen that bottle Y was filled by Roode on the 8-4 shift on 7/23/64 and placed by him in the safe storage area during his shift. He placed three yellow wooden posts around bottle Y. It was seen during the 8-4 shift on 7/23/64 by the foreman, Dale Chapman, and the other two operators, Kenyon and Aiello. On the 4 to 12 shift 7/23/64, bottle Y was not observed by the foreman, Smith. Mastriani and Spencer, operators on this shift remember seeing the yellow posts in the storage area, but are uncertain as to whether this was 7/23/64 or 7/24/64.

On the 12-8 shift 7/24/64, the shift foreman, Pearson and an operator, Simas, saw bottle Y, Pearson, toward the end of the shift. Murphy, an operator, does not remember seeing bottle Y or the yellow wooden posts. Nowakowski was absent from work on the 12-8 shift 7/24/64. All of these people state they did not take bottle Y from the area where Roode had put it.

Reinterview with George J. Spencer

Spencer was reinterviewed on September 2, 1964 in the office of the Compliance Division, Region I. A three page signed statement was obtained from him in connection with the clean out of the evaporator on July 23, 1964 between 4 p.m. and 8 p.m. and the subsequent reassembly of the evaporator and flange. Spencer did not recall specifically seeing bottle Y set out in the storage area by Roode, but has the impression that he did see this bottle. W. G. Browne had requested A. F. Ryan to discuss additional information with Spencer as follows:

Spencer was shown 10 prints of pictures taken in various parts of the process area of the Fuels Recovery Plant at Wood River Junction. He was able to comment only on two of the 10 prints, print #2 which was the picture of a tag which was attached to bottle Y by Roode, and print #10. Spencer discusses the tag in his statement indicating therein that he originated this tag in connection with ADU filtrate during the week of July 20, 1964. The other picture on which he commented is print #10 which was taken in the precipitator area and in which he identified the metal strap used to hold the 11 liter bottle while it was being filled with material from the evaporator, and the steam coil around the precipitator from which the steam line was run to the evaporator. Spencer had no knowledge about the gloves or tags shown in pictures taken in the first floor stairwell or other pictures of tags, the writing on which he stated was not his.

With regard to the log book entry made July 23, on the 4 to 12 shift, Spencer stated the entry concerning the gallon jugs referred to gallon jugs that contained material from the evaporator which he had not put into the second 11 liter bottle he filled, for lack of time.

Spencer was unable to comment on the inventory of containers and the evaporator and precipitator summary as shown on Page 26 of the report prepared by the United Nuclear Corporation. He stated he would be unable to affirm or deny the information as set out therein, as he had not noted the disposition of the various containers. With regard to the identity of tag #3, Spencer stated this could not have applied to a gallon jug because he had not labeled or tagged the gallon jugs filled with material from the evaporator.

Spencer's response to the question concerning reintroduction of OK liquor of product quality through the 1-C-10 column to the 1-D-10A and B tanks was that this would be a reasonable procedure provided that the individual was positive that the material was OK liquor of product quality. However, Spencer pointed out that it would be reintroduced into the system through the strip column rather than the 1-C-10 column. With regard to the question of finding one or two gallon bottles of OK liquor around the precipitator area, Spencer pointed out that he had no recollection of having found any gallon jugs filled with material from the evaporator, he, Spencer, had left several gallon jugs partially filled with this material. Spencer also indicated very strongly that the filled 11 liter bottle and the partially filled 11 liter bottle of material he had got from the evaporator had been put in the shelf storage area. He had not put a bottle in the stainless steel dissolver area.

Interviews with George N. Briggs, Manager, Industrial Relations Department and Dr. Robert Brubaker, Medical Consultant, UNC

Briggs informed Ryan that John Geil, Health Physicist and Dr. Robert Brubaker, Medical Consultant, had made the arrangement for the services of Dr. Howard G. Laskey, to serve as plant physician at the Wood River Junction Fuels Recovery Plant. Briggs stated the company began looking for a doctor in December 1963. Brubaker and Geil first spoke with Laskey on December 30, 1963. At about the same time, Brubaker and Geil, according to Briggs, visited Westerly Hospital. There they saw Mr. Petrie, Director, Dr. Singer, Pathologist and Mr. Wilson the Comptroller. According to Briggs, who was reading from a report, they toured the emergency room, the laboratories, and X-ray facilities. They saw a new wing of the hospital under construction and were told that further expansion was planned.

In their meeting with Dr. Laskey, according to Briggs, Brubaker and Geil were advised of the availability of ambulance service at the State Police barracks at Hope Valley, Rhode Island. Wilson told them of the Westerly ambulance service.

Briggs stated that on January 6, 1964 personnel security questionnaires were sent to Dr. Laskey to be completed by him. His "Q" clearance was granted April 7, 1964.

Briggs showed Ryan a letter dated January 26, 1964 from Laskey replying to Brubaker's letter dated January 24, 1964. Brubaker's letter outlined Laskey's duties as plant physician. It indicated his primary duties as pre-employment examinations. He was to be available for emergencies on a 24 hour basis, or provide coverage when he was unavailable. He was to act as medical advisor on the physical status of employees on their return to work following illness and was to advise on health problems. The following quote is from Brubaker's letter to Laskey: "Geil will send a very good handbook on radiation injuries which will give you a good idea of the potential problems in work of this nature". This is the only reference in the correspondence to radiation injuries. The letter discusses another potential problem "Accidents with acids, nitric acid and hydrofluoric, irritating to eyes accompanied by pulmonary effects".

Briggs informed Ryan on the basis of information in Laskey's personnel security questionnaire that his date of birth is [redacted] He was graduated from Harvard University June [redacted] with a degree of Associate in Arts (AA). Laskey was graduated from Boston University in June 1934 with a degree of Doctor of Medicine. He indicates therein he has been a practicing physician since June 1934 and is a Fellow of the American College of Angiology. Laskey also indicated in his PSQ, according to Briggs, that he has a Master of Arts degree from the University of Rhode Island, granted June, 1960.

Ex. 6

Briggs outlined the projected medical program for Wood River Junction Fuels Recovery Plant. It is the intention of the corporation to engage a consultant in the field of radiation medicine. It will also take steps to insure against any misunderstanding of the relationship between the corporation and the plant physician. It will establish liaison with Westerly Hospital and inform the hospital of accident victim criteria in order that the hospital can be properly equipped to handle any emergencies. Briggs stated the corporation would endeavor to select a registered nurse at the hospital who would be trained in radiological health in a program similar to that given by the U. S. Public Health Service.

Briggs stated Laskey would be asked to provide appropriate training to ambulance personnel both at Westerly and at Hope Valley. It is intended to obtain a larger type of vehicle to replace the present open body truck, which could be used as an ambulance in an emergency. It is intended to train all plant personnel in first aid and to provide equipment for patient care including decontamination, patient comfort and sampling containers. In this regard, Briggs pointed out that stretchers will be provided at the Wood River Junction Plant, one in the plant and the other at the emergency shed. In addition, plant personnel would be trained as a fire brigade and would utilize fire extinguishers and fire hose recently received which Briggs states had been on order prior to the accident.

With regard to the retraining of the plant personnel, Briggs stated Dr. DesJardins of the University of Rhode Island is conducting classes for the operators and supervisors in fundamental nuclear physics. By utilizing the technique of general discussion among the operators (brain storming sessions), Briggs hopes to receive suggestions to use in an emergency control plan. It is planned to hold four full scale emergency drills. The employees will be given instruction in the principles of detection instruments through representatives of the Nuclear Measurements Corporation.

The employees, as part of their training, were taken to the reactors at Rowe, Massachusetts, and at Fort Kearney, Rhode Island. They have also been shown films on various aspects of the atomic energy industry. Briggs states there will be intensive review of the health physics procedures. Environmental sampling will be undertaken as part of the health physics program.

Briggs stated that Dr. Joe Howland of the University of Rochester has been asked to come in to discuss the rationale of 10 CFR 20 with regard to personnel exposure and to discuss bioassay techniques. Briggs stated that the review of operating procedures is continuing with a view to updating these procedures. Three new men, according to Briggs, have been hired as replacements for Peabody, Spencer, and Bitgood. These are Dana W. Osborne, Joseph F. Travers and Daniel Lynch.

Dr. Robert Brubaker was interviewed in the Medical Department of Olin Mathieson Chemical Corporation which is next door to the United Nuclear Corporation's building. Brubaker is head of the Medical Department for Olin Mathieson and serves as a Medical Consultant to the United Nuclear Corporation. Brubaker told Ryan that he was asked to interview Dr. Howard G. Laskey at Carolina, Rhode Island and did so in the company of John Geil, a Health Physicist at the United Nuclear Corporation. Brubaker stated that Laskey was selected because of his proximity to the plant. Brubaker acknowledged that he had written the letter to Laskey dated January 24, 1964. Brubaker stated that Laskey had informed him that he had no experience in handling radiation injuries, although he did represent other industrial plants in the area as plant physician and Laskey considered himself competent to handle industrial injuries. Brubaker stated that in discussing coverage in the event Laskey would not be available he was told that Dr. Freeman Bruno Agnelli would substitute for Laskey in his absence. Laskey also informed Brubaker of the availability of the Hope Valley Ambulance Corps which he identified as the nearest ambulance service. He also gave Brubaker the name and telephone number of his nurse.

Brubaker stated that it was his opinion that Laskey was a competent physician, that he considered him a qualified general practicioner and that because of his work for other companies in the area as plant physician, he thought he would be well suited for a similar assignment at the Wood River Junction Plant. Brubaker acknowledged that he and Geil had visited Westerly Hospital, that they were interested in seeing how the institution was set up, that they had talked with representatives of the hospital and had toured its facilities. Brubaker stated that they were satisfied with the physical arrangements of the hospital, but no follow-up visits were made and he does not know of any special considerations that were discussed with the hospital personnel whom they met.

Since the accident occurred, Brubaker states he and John Geil went down to see Dr. MacDougal, head of the Medical Department at the General Dynamics Corporation, Electric Boat Division, Groton, Connecticut. This visit was made because of the scope of MacDougal's wide variety of injuries encountered, as well as the program in effect in connection with radiation injuries.

Brubaker pointed out in conclusion that he was retained as Medical Consultant to the United Nuclear Corporation and that he considers Dr. Laskey to be the plant physician at Wood River Junction.

Interviews with Plant Physician and Westerly Hospital Personnel

The following individuals were interviewed August 20, 1964 by A. F. Ryan, Investigation Specialist, Region I, Division of Compliance, at the places indicated:

Dr. Howard G. Laskey, [ ] Rhode Island

Ex. 6

Mr. Francis M. Petrie, Administrator, Westerly Hospital
Westerly, Rhode Island

Dr. Dominic F. Chimento, [ ]
Rhode Island

Dr. Freeman Bruno Agnelli, [ ]
Rhode Island

Dr. Laskey stated he received a call from Smith, Foreman at the plant, shortly after 6:00 p.m. on July 24, 1964. He immediately called the State Police Barracks at Hope Valley, a nearby community, to notify the Hope Valley Ambulance Corps that a man injured at the plant was to be taken to Rhode Island Hospital at Providence Rhode Island. He then called Rhode Island Hospital to alert its emergency team and proceeded to the scene of the accident. Upon his arrival, he was informed that the Westerly Ambulance Corps had just left with the injured man, Robert Peabody, for Westerly Hospital. Laskey realized Westerly Hospital would not have a bed available for this emergency case and that the hospital was not equipped to handle a radiation exposure case. Laskey called Westerly Hospital. There he spoke to Agnelli, who was on duty. He explained the situation to Agnelli, who agreed Westerly Hospital was not equipped to handle this type of case. Laskey suggested to Agnelli that the ambulance be redirected to Rhode Island Hospital at Providence, Rhode Island.

Dr. Agnelli confirmed the statement made by Dr. Laskey with regard to the hospital, that its personnel had had no training in the handling of this type of case and would not have known how to set up a health physics program to reduce contamination of the area. Agnelli stated the hospital has no instrumentation, possessing only a Civil Defense survey instrument which is kept in a storeroom. When the ambulance arrived, Agnelli directed the driver to go to Rhode Island Hospital. He suggested that the driver wait for a police escort. However, before Agnelli could stop them they had taken off for Providence.

Dr. Dominic F. Chimento stated he was on duty at Westerly Hospital on July 24, 1964. Although he did not speak directly to Dr. Laskey, he assisted Agnelli in calling together an emergency team to take care of an undesignated number of people reportedly injured in a plant "explosion". Chimento stated he and Agnelli were expecting persons suffering from burns or physical injuries resulting from a chemical explosion, not a radiation accident. Like Agnelli, he added that the hospital was not equipped to handle radiation injuries.

Francis M. Petrie stated that about a year ago he was visited by two men from the United Nuclear Corporation. He did not remember their names. He did recall they were interested in ascertaining facilities available to handle injuries which might be incurred in the operation of a plant that was to be built in the area. Petrie believes that this was a chemical plant and that the injuries anticipated were those incidental to chemical operations. No mention was made, in his presence, of radiation injuries. Petrie referred the visitors to Dr. Anspringer, the Westerly Hospital Radiologist, now in Europe on vacation, and Dr. Richard Singer, Pathologist. From these men, Petrie learned that the visitors were interested in making a survey of the facilities available, but no reference was made to radiation injuries. Dr. Singer, was not available for interview on this date.

Petrie stated the hospital is not equipped to handle radiation injuries. It has one Civil Defense survey meter which is kept in a storeroom. There was no subsequent contact by the visitors with the hospital. He stated that the emergency personnel had been given no instruction for the special handling of patients from the United Nuclear Corporation nor had any specialized equipment been obtained.

A check of licenses available at CO:I does not indicate that Westerly Hospital, Westerly, Rhode Island, has a byproduct material license nor do Drs. Agnelli, Chimento or Laskey have byproduct material licenses.

Environmental Survey - Supplementary Data

The type and amount of activity noted following analysis of wipes and environmental samples collected at the United Nuclear Corporation plant and environs is tabulated below. Wipes were counted by the Health and Safety Laboratory, NYOO; water, soil and vegetation samples were analyzed by the Health and Safety Laboratory of the Idaho Operations Office.

Wipe	Location	DPM Alpha	DPM Beta-Gamma
A.	Emergency Shed, Front	0.1	∠± 0.4
B.	Emergency Shed, Roof	0.3	9.5
C.	Emergency Shed, Rear	∠± 0.03	12.3
D.	500' E. Pole 196 at turn to North, Narragansett Trail	∠± 0.03	∠± 0.4
E.	250' E. of turn in Narragansett Trail	∠± 0.03	∠± 0.4
F.	250' W. Pole 196, Narragansett Trail	0.1	8.3
G.	Foliage, Tree trunks, etc. along dirt road, southwest boundary of lawn surrounding plant	0.1	3.5
H.	Foliage, Tree trunks, etc. along dirt road, southwest boundary of lawn surrounding plant	∠± 0.03	2.7
I.	Foliage, Tree trunks, etc. along dirt road, southwest boundary of lawn surrounding plant	∠± 0.03	10.7
J.	Foliage, Tree trunks, etc. along dirt road, southwest boundary of lawn surrounding plant	0.2	3.9
K.	Foliage, Tree trunks, etc. along dirt road, southwest boundary of lawn surrounding plant	∠± 0.03	∠± 0.4
L.	Foliage, Tree trunks, etc. along dirt road, southwest boundary of lawn surrounding plant	∠± 0.03	14.2
M.	Foliage, Tree trunks, etc. along dirt road, southwest boundary of lawn surrounding plant	∠± 0.03	∠± 0.4
W1	Plant roof, center, north end	0.3	19.3
W2	Roof near Hood A2	24.0	68.7
W3	Roof northwest corner	0.6	20.6
W4	Cover, Hood A-64	0.9	38.4
W5	Roof near hood A-64	0.6	15.4

Wipe	Location	DPM Alpha	DPM Beta-Gamma
W6	Cover, Intake A-65	1.2	8.9
W7	Roof near Intake A-65	12.4	25.0
W8	Cover, Lab vent A-66	0.9	34.3
W9	Roof under lab vent A-66	1.3	5.5
W10	Cover, Intake A-63	0.6	28.0
W11	Roof under A-63	0.6	15.6
W12	Cover, Intake A-62	0.14	21.8
W13	Roof under A-62	0.2	18.2
W14	Cover, Vent A-37	1.7	7.7
W15	Roof under A-37	7.2	63.0
W16	Cover, vent A-61	0.5	4.8
W17	Roof under A-61	14.0	32.0
W18	Roof center, south edge	15.3	15.0
W19	Roof, center, south edge	2.0	7.5
W20	Cover, Process Area Vent A-52	1.6	14.6
W21	Roof near Process Area vent A-52	13.2	22.0
W22	Roof, about midway between vents A-37 and A-52	1.6	15.6
W23	Roof, midway between vents A-52 and A-65	2.9	21.0
W24	Roof, midway between vents A-52 and A-63	0.5	9.7
W25	Cover, vent A-53	17.7	27.0
W26	Roof under A-53	56.3	69.0
W27	Cover, hood A-59	2.8	18.0
W28	Roof under A-59	40.0	28.5
W29	Cover, Hood A-58	3.0	2.9
W30	Roof under A-58	49.4	23.7
W31	Inside exhaust stack, vent 1-B-17	4.6	7.9
W32	Roof near 1-B-17	25.2	22.0
W33	Inside exhaust stack, vent 1-B-12	5.2	1.9
W34	Roof near vent 1-B-12	6.4	18.4
W35	Finger wipe	1.4	0.3
W36	Inside vent 1-B-8	5.3	13.2
W37	Roof near 1-B-8	9.0	11.3
W38	Inside exhaust stack, vent 1-B-5	21.7	22.3
W39	Roof near 1-B-5	13.2	13.2
W40	Inside sample port, exhaust, vent 1-B-16	6.5	2.4
W41	Roof near 1-B-16	10.8	32.0
W42	Inside sample port, exhaust, vent 1-B-14	1.8	<± 0.4
W43	Roof near 1-B-14	6.7	21.7

Wipe	Location	DPM Alpha	DPM Beta-Gamma
W44	Outside, vent 1-B-15	3.6×10^2	54.8
W45	Roof near 1-B-15	13.6	9.4
W46	Inside exhaust stack, vent 1-B-13	16.0	7.7
W47	Roof near 1-B-13	10.7	14.0
W48	Inside exhaust stack, vent 1-B-18	74.0	4.0
W49	Finger wipe	2.1	<± 0.4
W50	Roof near 1-B-18	13.6	9.5
W51	Inside exhaust stack, vent 1-B-2	21.0	12.5
W52	Roof near 1-B-2	5.5	32.0
W53	Inside exhaust stack, vent 1-B-3	0.1	0.3
W54	Roof near vent 1-B-3	22.6	17.4
W55	Inside exhaust stack, vent 1-B-4	4.0	20.5
W56	Roof near vent 1-B-4	2.41×10^3	2.9×10^2
W57	Inside exhaust stack, vent 1-B-7	1.7×10^2	78.0
W58	Roof near vent 1-B-7	7.7	24.2
W59	Inside exhaust vent V3	0.2	<± 0.4
W60	Inside exhaust stack A-36	2.8	5.2
W61	Roof near A-36	4.6	19.3
W62	Inside vent V1	0.2	10.0
W63	Inside vent 1-B-16	0.2	0.9
W64	Inside vent 1-B-15	30.0	7.7
W65	Inside vent 1-B-14	0.7	4.6
W66	Inside vent V2	0.4	<± 0.4
W67	Inside vent V4	0.1	<± 0.4
W68	Finger wipe	0.1	0.9
W69	Inside vent V5	4.1	<± 0.4
W70	Inside vent V6	0.7	5.8
W71	Inside vent V7	<± 0.03	3.5
W72	Inside vent V8	0.4	<± 0.4
W73	Outside, vent V9	0.6	7.0
W74	Inside, vent V10	0.1	10.0
W75	Inside, vent V11	0.1	0.12
W76	Inside, vent V12	<± 0.03	<± 0.4
W77	Inside, vent V13	6.2	53.6
W78	Inside, vent V14	19.2	15.6
W79	Inside, vent V15	3.5	2.1
W80	Inside, vent V16	2.8	<± 0.4

Wipe	Location	DPM Alpha	DPM Beta-Gamma
W81	Inside, vent V17	4.1×10^2	75.6
W82	Inside, vent V18	15.0	2.8
W83	Inside, vent V19	2.1	1.8
W84	Inside, vent V20	0.4	∠ ± 0.4
W85	Finger wipe	1.2	∠ ± 0.4
W86	Outside, vent V21	52.0	32.7

ENVIRONMENTAL SAMPLE ANALYSIS REPORT
IDAHO OPERATIONS OFFICE

SAMPLE NO.	SAMPLE DESCRIPTION SOIL	ANALYSIS FOR	COUNT TIME MINUTES	TOTAL COUNT	GROSS c/m	BACK-GROUND c/m	NET c/m	ACTIVITIES IDENTIFIED
1 S	Dirt road, SE. boundary of woods.	Gamma	2	3951	1976 ± 32	1847 ± 30	129 ± 42	
2 S	Same as 1 S above.	"	2	3861	1930 ± 32	1850 ± 30	80 ± 42	
3 S	Same as 1 S above.	"	2	3972	1986 ± 32	1850 ± 30	136 ± 42	
4 S	Same as 1 S above.	"	2	4068	2034 ± 32	1847 ± 30	187 ± 42	
5 S	Same as 1 S above.	"	2	4219	2109 ± 32	1850 ± 30	259 ± 42	
6 S	Near Pole 196.	"	2	4006	2003 ± 32	1847 ± 30	156 ± 42	
7 S	250' S Pole 196 on Narragansett Trail.	"	2	4001	2000 ± 32	1850 ± 30	150 ± 42	
8 S	250' N Pole 196 on Narr. Tr.	"	2	3968	1984 ± 32	1847 ± 30	137 ± 42	
9 S	250' E of turn on Narr. Tr.	"	2	3726	1863 ± 32	1850 ± 30	13 ± 42	
10 S	500' S of Pole 196 on Narr. Trail.	"	2	4238	2119 ± 32	1847 ± 30	272 ± 42	

ENVIRONMENTAL SAMPLE ANALYSIS REPORT
IDAHO OPERATIONS OFFICE

SAMPLE NO.	SAMPLE DESCRIPTION SOIL	ANALYSIS FOR	COUNT TIME MINUTES	TOTAL COUNT	GROSS c/m	BACK-GROUND c/m	NET c/m	ACTIVITIES IDENTIFIED
S 1	Edge of swamp, Kings Factory Rd. at Burdick-ville Rd.	Gamma	2	4191	2095 ± 32	1850 ± 30	245 ± 42	
S 2	Burdickville Rd. at Shumankanuc Hill Rd.	"	2	4122	2061 ± 32	1847 ± 30	214 ± 42	
S 3	Shumankanuc Hill Rd. at Buckeye Brook Rd.	"	2	4570	2285 ± 32	1850 ± 30	435 ± 42	Ce-141 and/or Ce-144, Ru-103 and/or Ru-106, Cs-137, Zr-Nb-85, Mn-54.
S 4	Rt. 112 at N. Y., NH & Hartford RR crossing.	"	2	4486	2243 ± 32	1847 ± 30	396 ± 42	Same as S 8 below.
S 5	Rt. 91 at Narrag-ansett Trail.	"	2	4323	2161 ± 32	1847 ± 30	314 ± 42	
S 6	Narr. Tr. at Rt. 112	"	2	4099	2049 ± 32	1850 ± 30	199 ± 42	
S 7	Burdickville Rd. at RR bridge.	"	2	4170	2085 ± 32	1850 ± 30	235 ± 42	
S 8	Rt. 91 at Chapman Pond.	"	2	4550	2275 ± 32	1847 ± 30	428 ± 42	Ce-141 and/or Ce-144, Cs-137, K-40.

(CONTINUED)

ENVIRONMENTAL SAMPLE ANALYSIS REPORT
IDAHO OPERATIONS OFFICE

SAMPLE NO.	SAMPLE DESCRIPTION SOIL	ANALYSIS FOR	COUNT TIME MINUTES	TOTAL COUNT	GROSS c/m	BACK-GROUND c/m	NET c/m	ACTIVITIES IDENTIFIED
S 9	Rt. 91, 1 mile North of Burdickville Rd.	Gamma	2	4148	2074 ± 32	1850 ± 30	224 ± 42	
S 10	Burdickville Rd. at Rt. 91.	"	2	4530	2265 ± 32	1847 ± 30	418 ± 42	Same as S 8 above.

ENVIRONMENTAL SAMPLE ANALYSIS REPORT - IDAHO OPERATIONS OFFICE
FLUOROMETRIC ANALYSIS FOR TOTAL URANIUM;
FOUR SOIL SAMPLES SHOWING HIGHEST GAMMA ACTIVITY.

SAMPLE NO.	SAMPLE DESCRIPTION SOIL	SAMPLE QUANTITY - GRAMS	VOLUME OF SAMPLE - ML.	GROSS READING	BACKGROUND READING	NET READING	TOTAL U CONTENT ug/Kg
S 3	Shumankanuc Hill Rd. at Buckeye Brook Rd.	36.7	0.01	8.5	.4	8.1	2.5×10^2
S 4	Rt. 112 at N. Y, NH & Hartford RR crossing.	28.6	"	5.1	.4	4.7	1.9×10^2
S 8	Rt. 91 at Chapman Pond.	20.6	"	3.8	.4	3.4	1.9×10^2
S 10	Burdickville Rd. at Rt. 91.	42.2	"	4.1	.4	3.7	1.0×10^2

ENVIRONMENTAL SAMPLE ANALYSIS REPORT
IDAHO OPERATIONS OFFICE

SAMPLE NO.	SAMPLE DESCRIPTION GROUND WATER	ANALYSIS FOR	QUANTITY USED, ML.	COUNT TIME MINUTES	TOTAL COUNT	GROSS COUNT c/m	BKGD. c/m	NET COUNT c/m	uuc/l
W 1	Sample from tap on 3rd. floor tower	Gamma	125	2	3351	1675 ± 29	1596 ± 28	09 ± 40	
	from overhead tank. Drawn by P. Knapp, 11:15	Beta	5	30	114	3.8 ± .3	3.5 ± .3	.3 ± .4	<2 x 10^2
	a.m., 7/30/64 (Given to E. Resner for inclusion with activation analyses samples.)	*Alpha	5	30	3	6 ± 4	6 ± 3	0 ± 5	<60
W 2	Lagoon sample, obtained 7/30/64, Map A.	Gamma	220	2	3616	1808 ± 30	1731 ± 29	77 ± 42	
		Beta	5	30	126	4.2 ± .4	3.5 ± .3	.7 ± .5	<2 x 10^2
		*Alpha	5	30	2	4 ± 2	6 ± 3	0 ± 4	<60
W 3	Aliquot of Lagoon sample taken 9:00 a.m.,	Gamma	240	2	3325	1663 ± 28	1596 ± 28	67 ± 36	
	7/20/64 (before incident); Note: No flow from lagoon	Beta	5	30	105	3.5 ± .3	3.5 ± .3	0 ± .4	<2 x 10^2
	since 7/20/64, Map A.	*Alpha	5	30	17 14	34 ± 8 28 ± 8	6 ± 3	28 ± 9 22 ± 9	

(CONTINUED)

ENVIRONMENTAL SAMPLE ANALYSIS REPORT
IDAHO OPERATIONS OFFICE

SAMPLE NO.	SAMPLE DESCRIPTION GROUND WATER	ANALYSIS FOR	QUANTITY USED, ML.	COUNT TIME MINUTES	TOTAL COUNT	GROSS COUNT c/m	BKGD. c/m	NET COUNT c/m	uuc/1
W 4	Plant waste water discharged at Pawcatuck River outflow, 7/30/64, Map A	Gamma	180	2	3615	1808 ± 30	1731 ± 29	77 ± 42	
		Beta	5	30	144	4.8 ± .4	3.5 ± .3	1.3 ± .5	5 x 10^2
		*Alpha	5	30	18 22	36 ± 8 44 ± 9	6 ± 3	30 ± 9 38 ± 10	180
W 5	Pawcatuck River at Rt. 91 Bridge (upstream of Plant), Map B.	Gamma	250	2	3384	1692 ± 29	1596 ± 28	96 ± 40	
		Beta	5	30	87	2.9 ± .3	3.5 ± .3	0 ± .4	<2 x 10^2
		*Alpha	5	30	7	14 ± 6	6 ± 3	8 ± 7	<80
W 6	Cedar Swamp Brook, just N. of Narr. Trail Cul-vert. Map B	Gamma	210	2	3550	1775 ± 30	1731 ± 29	44 ± 42	
		Beta	5	30	117	3.9 ± .3	3.5 ± .3	.4 ± .4	<2 x 10^2
		*Alpha	5	30 30	3 6	6 ± 4 12 ± 9	6 ± 3 6 ± 3	0 ± 5 6 ± 6	<60 <60

ENVIRONMENTAL SAMPLE ANALYSIS REPORT
IDAHO OPERATIONS OFFICE

SAMPLE NO.	SAMPLE DESCRIPTION GROUND WATER	ANALYSIS FOR	QUANTITY USED, ML.	COUNT TIME MINUTES	TOTAL COUNT	GROSS COUNT c/m	BKGD. c/m	NET COUNT c/m	uuc/l
W 7	Burlington State Park (Watchaug Pond), Map B.	Gamma	220	2	3302	1651 ± 28	1596 ± 28	55 ± 39	
		Beta	5	30	98	3.3 ± .3	3.5 ± .3	0 ± .4	$<2 \times 10^2$
		*Alpha	5	30	9	18 ± 6	6 ± 3	12 ± 7	<80
W 8	Pawcatuck River, 100' downstream from United Nuclear Co. outflow - Map A	Gamma	235	2	3521	1761 ± 30	1731 ± 29	30 ± 42	
		Beta	5	30	114	3.8 ± .3	3.5 ± .3	.3 ± .4	$<2 \times 10^2$
		*Alpha	5	30	9	18 ± 6	6 ± 3	12 ± 7	<80
W 9	Pond at intersection of Rt. 91 and Hope Valley Rd. - Map B	Gamma	240	2	3336	1668 ± 28	1596 ± 28	72 ± 39	
		Beta	5	30	99	3.3 ± .3	3.5 ± .3	0 ± .4	$<2 \times 10^2$
		*Alpha	5	30	8	16 ± 6	6 ± 3	10 ± 7	<80

ENVIRONMENTAL SAMPLE ANALYSIS REPORT
IDAHO OPERATIONS OFFICE

SAMPLE NO.	SAMPLE DESCRIPTION GROUND WATER	ANALYSIS FOR	QUANTITY USED, ML.	COUNT TIME MINUTES	TOTAL COUNT	GROSS COUNT c/m	BKGD. c/m	NET COUNT c/m	uuc/l
W 10	Watchaug Pond, Map B.	Gamma	235	2	3462	1731 ± 29	1731 ± 29	0 ± 41	
		Beta	5	30	109	3.6 ± .3	3.5 ± .3	.1 ± .4	< 2 x 10^2
		*Alpha	5	30	7	14 ± 6	6 ± 3	8 ± 7	< 80
W 11	Chapman Pond at Rt. 91, Map C	Gamma	235	2	3371	1686 ± 29	1596 ± 28	90 ± 40	
		Beta	5	30	120	4.0 ± .3	3.5 ± .3	.5 ± .4	< 2 x 10^2
		*Alpha	5	30	8	16 ± 6	6 ± 3	10 ± 7	< 80

* Alpha activities reported in c/hr.

(CONTINUED)

ENVIRONMENTAL SAMPLE ANALYSIS REPORT
IDAHO OPERATIONS OFFICE

SAMPLE NO.	SAMPLE DESCRIPTION DRINKING WATER	ANALYSIS FOR	QUANTITY USED, ML.	GROSS COUNT READING	BKGD. READING	NET COUNT	ug/l
DW 6	Wood River Junction sample, Package Store, N/S Rt. 91, just W. of Hope Valley Rd. Wood River Junction. Map C.	Uranium	.5	.4	.4	0	<.9
DW 7	Auto sales agency & Gas station, NE. corner, intersection Rt. 91 and Rt. 112, Carolina. Map C.	"	.5	.4	.4	0	<.9
DW 8	Ice Cream, Candy & Grocery Store, N. side of road entering Shannock from Rt. 112. Map C.	"	.5	.4	.4	0	<.9
DW 9	Alton sample from Holmes Garage, N. side of Rt. 91. Map C.	"	.5	.4	.4	0	<.9
DW 10	Bradford sample, Gas station at N/W intersection Rt. 91 and Rt. 216. Map C.	"	.5	.4	.4	0	<.9

ENVIRONMENTAL SAMPLE ANALYSIS REPORT
IDAHO OPERATIONS OFFICE

SAMPLE NO.	SAMPLE DESCRIPTION VEGETATION	ANALYSIS FOR	COUNT TIME MINUTES	TOTAL COUNT	GROSS c/m	BACK-GROUND c/m	NET c/m	ACTIVITIES IDENTIFIED
V 1	Composite of tree and bush foliage at downwind edge of woods, approx. 350' from plant - See Map A.	Gamma	2	13,777	6888 ± 58	1566 ± 27	5322 ± 64	Ru-103 and/or Ru-106, Mn-54 and Ba-La-140.
V 2	Burdickville Rd. between Rt. 91 and RR bridge. - See Map B.	"	2	7,075	3537 ± 42	1723 ± 28	1814 ± 50	Ce-141 and/or Ce-144, Ru-103 and/or Ru-106, Cs-137 and K-40.
V 3	Buckeye Brook Rd. at Rt. 216. - See Map B	"	2	7,769	3885 ± 44	1566 ± 27	2319 ± 51	Ce-141 and/or Ce-144, Ru-103 and/or Ru-106, Cs-137 and Mn-54.
V 4	Rt. 95 at Rt. 138. See Map C	"	2	9,290	4645 ± 48	1723 ± 28	2922 ± 55	Same as V 3 above.
V 5	Rt. 102 about 3 mi. west of Exeter. - See Map C.	"	2	10,053	5026 ± 50	1566 ± 29	3460 ± 56	Same as V 3 above.

Operating Report Sheet

7/9/64 [illegible] 0008

[illegible] and Operator [illegible] [illegible] [JRM] [illegible]

[illegible] Conditions

[illegible] Started	1700
[illegible] Stopped	2020
[illegible]	216°
[illegible] Inlet Temp.	215°
[illegible] Temp.	45°
[illegible] Liquor Feed [illegible]	.2 - .3
[illegible] Gravity [illegible]	1.20

[illegible] Tank

[illegible] Start

[illegible] Level Finish

4 8 Support m/4

Remarks:

Exhibit A

[illegible]

Operating Report

Operating Report Sheet

Job Symbol Rewoalk

Enrichment 93%

Date 7/22/64

Batch Number 29

I. Weight Check

Scrap Container No.	Material Description	Supplier's Net Wt. ( )	Our Weights ( ) Gross	Tare	Net	Initials Oper.	Supr.
4109			1761	154	1607	RM	

II. Dissolver Charge

Material Charged	Weight or Volume Chgd.	Time Charged Start	Finish	Oper. Initials	Comments
U	1607	22:00	22:05	RM	
H2O	41 L	22:05	22:20	RM	
Nitric	9 L	22:20	22:25	RM	

III. Dissolution and Adjustment (" = time)

	Operator
Circulation Started at 22:16 "	RM
Steam Added to Heating-Cooling Coil at 22:10 "	RM
Dissolver Solution Temperature 200 °F at 22:45 "	RM
208 °F at 23:15 "	RM
210 °F at 23:45 "	RM
Water to Heating-Cooling Coil at 23:45 "	RM
5.0 Kgs of Aluminum Nitrate added at 0010 "	JM
Dissolver Solution Initial Excess Acid = 3.33 N	JM
Ammonia Addition	
______ cfh from ______ " to ______ "	
Excess Acid = ______ N	
______ cfh from ______ " to ______ "	
Excess Acid = 3.33 N = Final Excess Acid	JM
Cooling Finished at 0020 " Solution Temperature = 110 °F	JM
Filtration Started at 0025 " and Finished at 0050 "	JM

IV. Comments

55.310 Kgs to 1-D-9 A+B

Operating Report Sheet

Operating Report

Job Symbol Rework

Enrichment 93%

Date 7/23

Batch Number 30

I. Weight Check

Scrap Container No.	Material Description	Supplier's Net Wt. ( )	Our Weights (Kgs) Gross	Tare	Net	Initials Oper.	Supr.
410964111	UO_2		1.913	.155	1.758	JM	

II. Dissolver Charge

Material Charged	Weight or Volume Chgd.	Time Charged Start	Finish	Oper. Initials	Comments
UO_2	1.758	0050	0055	JM	
H_2O	41L	0055	0110	JM	
HNO_3	9L	0110	0115	JM	

III. Dissolution and Adjustment (" = time)

Operator

Circulation Started at 0110 " — JM

Steam Added to Heating-Cooling Coil at 0115 " — JM

Dissolver Solution Temperature 200 °F at 0150 " — JM

200 °F at 0220 " — JM

200 °F at 0250 " — JM

Water to Heating-Cooling Coil at 0250 ". — JM

5.0 Kgs of Aluminum Nitrate added at 0255 " — JM

Dissolver Solution Initial Excess Acid = 3.35 N — JM

Ammonia Addition

_______ cfh from _______ " to _______ "

Excess Acid = _______ N — _______

_______ cfh from _______ " to _______ "

Excess Acid = 3.35 N = Final Excess Acid — JM

Cooling Finished at 0330 " Solution Temperature = 140 °F — JM

Filtration Started at 0330 " and Finished at 0400 " — JM

IV. Comments

63.660 Kgs to 1-D-9 A&B

Exhibit A

UNCLASSIFIED

Operating Report

Operating Report Sheet

Job Symbol ________

Enrichment ________

Date 7/23

Batch Number 31

I. Weight Check

Scrap Container No.	Material Description	Supplier's Net Wt. ( )	Our Weights (Kgs) Gross	Tare	Net	Initials Oper.	Supr.
4111	UO_2		1.759	.155	1.604	JM	

II. Dissolver Charge

Material Charged	Weight or Volume Chgd.	Time Charged Start	Finish	Oper. Initials	Comments
UO_2	1.604	0400	0405	JM	
H_2O	12 L	0405	0410	JM	
ADU-	29 L	0410	0425	JM	ADU dissolved in HNO_3
HNO_3	6 L	0425	0430	JM	

III. Dissolution and Adjustment (" = time)

	Operator
Circulation Started at 0425"	JM
Steam Added to Heating-Cooling Coil at 0430"	JM
Dissolver Solution Temperature 200 °F at 0500"	JM
206 °F at 0530"	JM
200 °F at 0600"	JM
Water to Heating-Cooling Coil at 0600"	JM
5.0 Kgs of Aluminum Nitrate added at 0605"	JM
Dissolver Solution Initial Excess Acid = 3.2 N	JM
Ammonia Addition	
______ cfh from ______" to ______"	
Excess Acid = ______ N	______
______ cfh from ______" to ______"	
Excess Acid = 3.2 N = Final Excess Acid	JM
Cooling Finished at 0635" Solution Temperature = 140 °F	JM
Filtration Started at 0645" and Finished at 0745"	JM

IV. Comments

64.020 Kgs to 1-D-9-Bank

Exhibit A

DISSOLVER

Operating Report

Operating Report Sheet

Job Symbol Remark

Enrichment 93%

Date 7/22

Batch Number 32

I. Weight Check

Scrap Container No.	Material Description	Supplier's Net Wt. ( )	Our Weights ( ) Gross	Tare	Net	Initials Oper.	Supr.
4111	UO_2		1.757	155	1.602	JM	

II. Dissolver Charge

Material Charged	Weight or Volume Chgd.	Time Charged Start	Finish	Oper. Initials	Comments
UO_2	1.602	0715	0720	JM	
H_2O	41 L	0720	0730	JM	
HNO_3	9 L	0730	0735	JM	

III. Dissolution and Adjustment (" = time)

	Operator
Circulation Started at 0730"	JM
Steam Added to Heating-Cooling Coil at 0735"	JM
Dissolver Solution Temperature 198 °F at 0815"	JA
210 °F at 0840"	JA
215 °F at 0910"	JA
Water to Heating-Cooling Coil at 0915".	JA
5 KG of Aluminum Nitrate added at 0930"	JA
Dissolver Solution Initial Excess Acid = ______ N	
Ammonia Addition	
______ cfh from ______" to ______"	
Excess Acid = ______ N	
______ cfh from ______" to ______"	
Excess Acid = ______ N = Final Excess Acid	
Cooling Finished at 0945" Solution Temperature = 125 °F	JA
Filtration Started at 0950" and Finished at 1025"	JA

IV. Comments

63.750 xfer To 1-D-9 A+B

Exhibit A

[illegible]

Operating Report

Operating Report Sheet

Job Symbol Rework

Enrichment 93%

Date 7-23-64

Batch Number 33

I. Weight Check

Scrap Container No.	Material Description	Supplier's Net Wt. ( )	Our Weights ( ) Gross	Tare	Net	Initials Oper.	Supr.
#4111	U.O2		1.755	.152	1.603	JA	

II. Dissolver Charge

Material Charged	Weight or Volume Chgd.	Time Charged Start	Finish	Oper. Initials	Comments
U.O2	1.603	1030	1035	JA	
H2O	4 L	1035	1045	JA	
HNO3	9 L	1045	1050	JA	

III. Dissolution and Adjustment (" = time)

Operator

Circulation Started at 1040" — JA

Steam Added to Heating-Cooling Coil at 1040" — JA

Dissolver Solution Temperature 200 °F at 1120" — JA

215 °F at 1140" — JA

215 °F at 1215" — JA

Water to Heating-Cooling Coil at 1220" — JA

5 KG of Aluminum Nitrate added at 1250" — JA

Dissolver Solution Initial Excess Acid = ______ N

Ammonia Addition

______ cfh from ______" to ______"

Excess Acid = ______ N

______ cfh from ______" to ______"

Excess Acid = ______ N = Final Excess Acid

Cooling Finished at 1305" Solution Temperature = 135 °F — JA

Filtration Started at 1340" and Finished at 1415" — JA

IV. Comments

[illegible] 1-0-9 [illegible]

Exhibit A.

DISSOLVER

Operating Report

Operating Report Sheet

Job Symbol Rework

Enrichment 93%

Date 7-23-64

Batch Number 34

I. Weight Check

Scrap Container No.	Material Description	Supplier's Net Wt. ( )	Our Weights ( ) Gross	Tare	Net	Initials Oper.	Supr.
4111+4112	U O2		1.756	154	1.602	JA	

II. Dissolver Charge

Material Charged	Weight or Volume Chgd.	Time Charged Start	Finish	Oper. Initials	Comments
U O2	1.602	1415	1420	JA	Balc. of 4111 plus some
H2O	414	1420	1430	JA	from 4112
HNO3	94	1430	1435	JA	

III. Dissolution and Adjustment (" = time)

Operator

Circulation Started at 1425 " — JA

Steam Added to Heating-Cooling Coil at 1425 " — JA

Dissolver Solution Temperature 200 °F at 1500 " — JA

210 °F at 1530 " — JA

200 °F at 16:00 " — RM

Water to Heating-Cooling Coil at 16:00 " — RM

5 KGS of Aluminum Nitrate added at 16:25 " — RM

Dissolver Solution Initial Excess Acid = 3.2 N — RM

Ammonia Addition

______ cfh from ______ " to ______ "

Excess Acid = ______ N

______ cfh from ______ " to ______ "

Excess Acid = 3.2 N = Final Excess Acid — RM

Cooling Finished at 16:35 " Solution Temperature = 145 °F — RM

Filtration Started at 16:40 " and Finished at 17:00 " — RM

IV. Comments

60.4 KG. To 1-D-9 AFB

Exhibit A

Operating Report Sheet

7/23 ?

DISSOLVER

Operating Report

Job Symbol Rework

Enrichment 9890

Date 7/22/64

Batch Number 35

Weight Check

Scrap Container No.	Material Description	Supplier's Net Wt. ( )	Our Weights ( ) Gross	Tare	Net	Initials Oper.	Supr.
4112			1746	154	1,592	RM	

I. Dissolver Charge

Material Charged	Weight or Volume Chgd.	Time Charged Start	Finish	Oper. Initials	Comments
UO_2	1,592	17:00	17:05	RM	
H_2O	41 LR	17:05	17:30	RM	
HNO_3	9 LR	17:30	17:35	RM	

III. Dissolution and Adjustment (" = time)

Operator

Circulation Started at 17:20 " — RM

Steam Added to Heating-Cooling Coil at 17:20 " — RM

Dissolver Solution Temperature 200 °F at 17:55 " — RM

200 °F at 18:20 " — RM

200 °F at 18:55 " — RM

Water to Heating-Cooling Coil at 18:55 " — RM

5 KG of Aluminum Nitrate added at 19:05 " — RM

Dissolver Solution Initial Excess Acid = ________ N

Ammonia Addition

________ cfh from ________ " to ________ "

Excess Acid = ________ N

________ cfh from ________ " to ________ "

Excess Acid = ________ N = Final Excess Acid

Cooling Finished at 19:10 " Solution Temperature = 145 °F — RM

Filtration Started at 19:15 " and Finished at 19:55 " — RM

IV. Comments

597 KG. TO 1-D-9 A&B-C

Exhibit A

DISSOLVER

Operating Report

Operating Report Sheet

7/23

Job Symbol Rawaal C

Enrichment 93 %

Date 7/22/64

Batch Number 36

I. Weight Check

Scrap Container No.	Material Description	Supplier's Net Wt. ( )	Our Weights ( ) Gross	Tare	Net	Initials Oper.	Supr.
4112			1826	154	1673	RM	

II. Dissolver Charge

Material Charged	Weight or Volume Chgd.	Time Charged Start	Finish	Oper. Initials	Comments
UO2	1673	20:15	20:20	RM	
H2O	25 LR	20:43	20:50	RM	15 LR CONC. LIQ. FROM GROUND AVE.
HNO3	1 LR	20:50	20:55	RM	

III. Dissolution and Adjustment (" = time)

Operator

Circulation Started at 20:45 " RM

Steam Added to Heating-Cooling Coil at 20:50 " RM

Dissolver Solution Temperature 200 °F at 21:10 " RM

200 °F at 21:35 " RM

200 °F at 22:10 " RM

Water to Heating-Cooling Coil at 22:10 " RM

5 KG of Aluminum Nitrate added at 22:35 " RM

Dissolver Solution Initial Excess Acid = 3.6 N

Ammonia Addition

_______ cfh from _______" to _______"

Excess Acid = _______ N

_______ cfh from _______" to _______"

Excess Acid = 3.6 N = Final Excess Acid RM

Cooling Finished at 22:45 " Solution Temperature = 145 °F RM

Filtration Started at 22:50 " and Finished at 23:15 " RM

IV. Comments 525 KG 1-0-9 A&B ICTD

Exhibit A

Operating Report

Operating Report Sheet

Job Symbol Rework

Date 7/24/64

Enrichment ________

Batch Number 41

I. Weight Check

Scrap Container No.	Material Description	Supplier's Net Wt. ( )	Our Weights ( ) Gross	Tare	Net	Initials Oper.	Supr.
4114			632	155	477		

II. Dissolver Charge

Material Charged	Weight or Volume Chgd.	Time Charged Start	Finish	Oper. Initials	Comments
Vaz	477	17:30	17:35	RM	

III. Dissolution and Adjustment (" = time)

Operator

Circulation Started at ________" ________

Steam Added to Heating-Cooling Coil at ________" ________

Dissolver Solution Temperature ________°F at ________" ________

________°F at ________" ________

________°F at ________" ________

Water to Heating-Cooling Coil at ________" ________

________ of Aluminum Nitrate added at ________" ________

Dissolver Solution Initial Excess Acid = ________N ________

Ammonia Addition

________ cfh from ________" to ________"

Excess Acid = ________ N ________

________ cfh from ________" to ________"

Excess Acid = ________ N = Final Excess Acid ________

Cooling Finished at ________" . Solution Temperature = ________ °F ________

Filtration Started at ________" and Finished at ________" ________

IV. Comments

Exhibit A

DISSOLVER

Operating Report

Operating Report Sheet

Job Symbol ________

Enrichment ________

Date 7/24/64

Batch Number 42

I. Weight Check

Scrap Container No.	Material Description	Supplier's Net Wt. ( )	Our Weights ( ) Gross	Tare	Net	Initials Oper.	Supr.
4112+4114	U O2		1.753	153	1.600	[illegible]	

II. Dissolver Charge

Material Charged	Weight or Volume Chgd.	Time Charged Start	Finish	Oper. Initials	Comments
U O2	1.600	1515	1520	[illegible]	Bal. of 4112 plus
H2O	41 L	1520	1530	[illegible]	same from 4114
HNO3	91 L	1530		[illegible]	

III. Dissolution and Adjustment (" = time)

Operator

Circulation Started at 1530 " — [illegible]

Steam Added to Heating-Cooling Coil at 1530 " — [illegible]

Dissolver Solution Temperature 203 °F at 16:00 " — RM

210 °F at 16:30 " — RM

203 °F at 17:00 " — RM

Water to Heating-Cooling Coil at 17:00 " — RM

5 KG of Aluminum Nitrate added at 17:05 " — RM

Dissolver Solution Initial Excess Acid = ________ N

Ammonia Addition

________ cfh from ________ " to ________ "

Excess Acid = ________ N

________ cfh from ________ " to ________ "

Excess Acid = ________ N = Final Excess Acid

Cooling Finished at 17:05 " Solution Temperature = 145 °F — RM

Filtration Started at 17:40 " and Finished at 17:45 " — RM

IV. Comments

60.5 KG 1-0-9 A&B+C.

Exhibit A

SP

Operating Report Sheet

[illegible]

7/1 Job Number 0008 [illegible]

[illegible] Operator 12-8 Simas 8-4 CEK 4-12

[illegible] Conditions			
[illegible]	Running	Running	
[illegible]	Shutdown		
[illegible]	100	100	
" "	40-50	50	
[illegible]	18.00	20	
[illegible]	(20)		
[illegible] Level Start/Finish	Odor guage 16"		
[illegible]	.02	.15	
[illegible] Acid Feed Rate	.08-10 [illegible]	.11	
Pulse Frequency	[illegible]	✓	
[illegible] Stroke Length	[illegible]	✓	
[illegible] Column Interface	ok	✓	
Scrub " "	"	✓	
Strip " "	"	✓	

[illegible]

1-D-41 Start/Finish	9 bolts full	14½ barrels	
1-D-[illegible] Start/Finish			
1-D-10 Start/Finish	A.B. 9.5 sup 11.5	11½ Sup	

[illegible]:

See operators' log

Exhibit A

Operating Report Sheet

7/2 0008

Semas

Running

no

~~100~~

40-50 55

18-20

100 ppm

.20 5"

.02

.06-.08 1.2

ok

3 bolts & full

11 Sup 17 Sup

Pumped over 1-D 21A @ 00.30 See oper book

Exhibit A

Operating Report Sheet

7/6/64 0008

CEK Peabody

0230	Running 1210	Running
100	100	100
56	56 65	54
17	17	20
1.0 PPM		
20"	15"	17"
.02	02	02
06	06	8

6 bolts 20 Bolts

6 1/2 Supports 825 sup

Switched slop Tanks – Pumped 1-D-21-A into 1-D-41
Changed Carbonate 4 Times

Exhibit A

Operating Report Sheet

EXTRACTION SYSTEM

Date 7/7/64 Job Number 0008 Run Number ____

Shift and Operator 12-8 CEK 8-4 Simas 4-12 ____

Operating Conditions			
Started	Running	Running	
Stopped			
Extractor Feed Pump Setting	100	100	
" " " S.G.	56-60	50-64	
Solvent Feed Pump Setting	21	2-00	
Raffinate - ppm U			
[illegible] Level Start/Finish	22'	A 17" 35	
Scrub Feed Rate	.015		
Strip Acid Feed Rate	.08		
Pulse Frequency	[illegible]	[illegible]	[illegible]
Pulse Stroke Length	[illegible]	[illegible]	[illegible]
Extractor Column Interface			
Scrub " "			
Strip " "			

Inventory			
1-D-41 Start/Finish	Empty		
1-D-9 Start/Finish			
1-D-10 Start/Finish	9 Supports	8.5	

Remarks:

Exhibit A

Operating Report Sheet

EXTRACTION SYSTEM

Date 7/21 Job Number Re Run Run Number 2

Shift and Operator 12-8 J. Simas 8-4 ______ 4-12 ______

Operating Conditions

Time Started	00 30 0630	Running		
Time Stopped	0600			
Extractor Feed Pump Setting	90 100			
" " " Speed	50 30-50	41		
Solvent Feed Pump Setting	20	18-19		
Raffinate - ppm	5.6			
1-D-[illegible] Level Start/Finish	2"			
Scrub Feed Rate	.08 → .02	.04		
Strip Acid Feed Rate	20% - 20%	20%		
Pulse Frequency	S OK — —	✓	S	
Pulse Stroke Length	S — —	✓	S	
Extractor Column Interface	1.0	✓		
Scrub " "	1.6	✓		
Strip " "	1.4	—		

Tanks

1-D-41 Start/Finish	136 bbls 40 bbls
1-D-9 ____ Start/Fin	M!
1-D-10 ____ Start/Fin	50 gal

Switched to 1-D-41 for feed @ 00 30
Pumped over 28" from 1-D-21 B high PPM
slop. Switched to 1 D-9A @ 0630

Exhibit A

Operating Report Sheet

EXTRACTION SYSTEM

7/22 Job Number Re Run Run Number

Shift and Operator 12-8 Semas 8-4 CFR 4-12

Operating Conditions	12-8	8-4	4-12
Time Started	Running	Running	010
Time Stopped	No		
Extractor Feed Pump Setting	100	40	
" " " Speed	40	36	
Solvent Feed Pump Setting	17	17	
Raffinate - ppm U	40	—	
Level Start/Finish	28"	MT	9'
Feed Rate	08—02	.06	
Acid Feed Rate	20%	20%	
Pulse Frequency	E OK Sc ✓ St ✓	E ✓ Sc St	E Sc
Pulse Stroke Length	E OK Sc ✓ St ✓	E ✓ Sc St	E Sc
Extractor Column Interface	✓	✓	
Scrub " "	✓	✓	
Strip " "	✓	✓	

Inventory	12-8 / 8-4	4-12
1-D-41 Start/Finish	5.75 btls 13 Ahrids	13 btls
1-D-9 Start/Finish	25 gal 25 gal	25 gal
1-D-10 Start/Finish	69 gal. 40 gal 25 gal	34

Remarks:

Switched to B slap @ 0500

Exhibit A

Operating Report Sheet

EXTRACTION SYSTEM

7/23 Job Number Re Run Run Number ____

Shift and Operator 12-8 Simas 8-4 Down 4-12 Down

Operating Conditions			
Time Started	0100		
Time Stopped	0640		
Extractor Feed Pump Setting	50		
" " " Speed	40		
Solvent Feed Pump Setting	18		
Raffinate - ppm U	5		
1-D-1 Level Start/Finish	9' 11"		
Scrub Feed Rate	.015		
Strip Acid Feed Rate	.207		
Pulse Frequency	E — Sc — St —	E Sc St	E Sc
Pulse Stroke Length	E — Sc — St —	E Sc St	E Sc
Extractor Column Interface	✓		
Scrub " "	✓		
Strip " "			

Inventory			
1-D-41 Start/Finish	13 Box		
1-D-9 Start/Finish	25 gal mt @ stop		
1-D-10 Start/Finish	85 full at stop		

Remarks:

Switched to 1-D-41 @ 0630

Shut down due to full 1-D-10 A & B

Exhibit A

Operating Report Sheet
EXTRACTION SYSTEM

Date 7/24 Job Number Ac Run Run Number ____

Shift and Operator 12-8 Simas 8-4 ____ 4-12 ____

Operating Conditions	12-8	8-4	4-12
Time Started	0130		
Time Stopped	NO		
Extractor Feed Pump Setting	50		
" " " Speed	40		
Solvent Feed Pump Setting	19 → 21		
Raffinate - ppm U.	28 @ 0245		
1-D-21 B Level Start/Finish	11" → 16.5		
Scrub Feed Rate	.015		
Strip Acid Feed Rate	20%		
Pulse Frequency	E ✓ Sc ✓ St ✓	E Sc St	E Sc St
Pulse Stroke Length	E ✓ Sc ✓ St ✓	E Sc St	E Sc St
Extractor Column Interface	✓		
Scrub " "	✓		
Strip " "	✓		

Inventory	12-8	8-4	4-12
1-D-41 Start/Finish	13 Bar 13		
1-D-9 Start/Finish A+B	75 gal. 50 gal		
1-D-10 Start/Finish A+B	70 gal 17 gal		

Remarks:

21
15.5 30

Exhibit A

?28/64
W.R. PEARSON

Exhibit B (1)

Analysis of Clean-Up Solution

ALL CLEAN-UP SOLUTIONS IRRADIATED MATERIAL

BOTTLE #	DESCRIPTION AND REMARKS	TOTAL WT.-GRAMS	PPM "U"	GRAMS "U"
14	IRRADIATED SAMPLE EQUIPMENT WASH	908	11	0.01
18	WATER (RINSE FROM SPECIMANS FROM TOWER)	9300	7	0.07
19	WATER (RINSE FROM SPECMANS FROM TOWER)	9300	3.6	0.04
20	HNO_3 (WASH FROM SPECIMANS FROM TOWER)	9300	13	0.10
44	FLOOR WASH 1st FLOOR COLUMNS	11000	500	5.55
52	HNO_3 WASH FROM 3rd FLOOR	3100	300	0.93
54	HNO_3 WASH FROM 3rd FLOOR TOWERS. PUT INTO 11-L BOTTLE # 11014.		1,000	—
58	TOWER EQUIPMENT WASH	1816	28	0.05
?9	TOWER EQUIPMENT WASH	1816	240	0.43
?1	TOWER AREA EQUIPMENT	2270	34	0.07
62	TOWER EQUIPMENT WASH	2270	280	0.63
63	FLOOR WASH. PUT INTO 11-LITER BOTTLE # 11032.		2,600	—
64	PULSE COLUMN ROOM.	1816	740	1.3
65	FLOOR WASH FROM COLUMNS.	454	1,700	0.77
67	TOWER EQUIPMENT	2724	88	0.23
68	3rd FLOOR TOWER	2043	320	0.65
69	3rd FLOOR OVERHEAD WASH	1362	80	0.10
70	TOWER AREA	908	420	0.38
71	3rd FLOOR TOWER	1135	360	0.40
72	3rd FLOOR	908	260	0.23
73	FLOOR WASH FROM 1st FLOOR PULSE COLUMNS	4086	780	3.18
?4	3rd FLOOR EQUIPMENT	1589	520	0.82
?5	FLOOR WASH. PUT INTO 11-LITER BOTTLE # 11032.		1,934	—
76	3rd FLOOR.	1589	660	1.0
77	1st FLOOR TOWER. PUT INTO 11-LITER BOTTLE # 11031.		1,394	—

Exhibit B

Analysis of Clean-Up Solution

?LE #	DESCRIPTION and REMARKS	TOTAL WT.-GMS.	PPM "U"	GRAMS "U"
?8	TOWER.	1362	640	0.87
?9	2nd LEVEL TOWER EQUIPMENT	1816	52	0.09
0	3rd FLOOR OVERHEAD WASH WATER	3178	220	0.69
1	3rd FLOOR OVERHEAD WASH WATER	3632	134	0.48
2	PULSE COLUMN WASH. PUT INTO 11-LITER BOTTLE # 11030.		5,000	—
3	3rd PULSE COLUMN WASH. PUT INTO 11-LITER BOTTLE # 11030.		12,770	—
5	3rd PULSE COLUMN WASH	2270	610	1.38
6	3rd PULSE COLUMN WASH FLOOR. PUT INTO 11-L BOTTLE # 11031.		2,000	—
7	3rd PULSE COLUMN WASH FLOOR. PUT INTO 11-L BOTTLE # 11030.		2,200	—
8	3rd PULSE COLUMN WASH FLOOR.	3859	810	3.12
9	3rd PULSE COLUMN WASH FLOOR.	1466	2,000	2.93
	3rd PULSE COLUMNS.	1589	600	0.95
?7	1st FLOOR TOWER.	2497	240	0.59
?0	FLOOR WASH COLUMNS. PUT INTO 11-LITER BOTTLE # 11014.		6,800	—
?8	RINSE FROM 1-C-9. PUT INTO 11-LITER BOTTLE # 11032.		2,900	—
?1	FLOOR WASH COLUMNS. PUT INTO 11-LITER BOTTLE # 11032.		2,400	—
?2	FLOOR WASH COLUMNS.	1399	4,400	6.16
?3	FLOOR WASH COLUMNS. PUT INTO 11-LITER BOTTLE # 11031.		1,060	—
19	1st FLOOR TOWER WASH.	2270	1,000	2.27 ✓
22	FLOOR WASH 3rd PULSE COLUMNS.	2270	480	1.08 ✓
25	1st FLOOR WASH IN COLUMNS.	2724	740	2.01
26	1st FLOOR WASH IN COLUMNS	2270	660	1.49
27	1st FLOOR WASH IN COLUMNS	2270	680	1.54
28	1st FLOOR WASH IN COLUMNS.	2497	760	1.89
	3rd FLOOR WASH IN COLUMNS. PUT INTO 11-L BOTTLE # 11030.		7,400	—
30	3rd FLOOR WASH IN COLUMNS. PUT INTO 11-LITER BOTTLE # 11030.		7,200	—
33	1st FLOOR WASH IN COLUMNS. PUT INTO 11-L BOTTLE # 11029		7,800	—
34	1st FLOOR WASH. PUT INTO 11-LITER BOTTLE # 11029.		[illegible]	—

10/64
[illegible]
(...DIATED CLEAN-UP CONT.)

Exhibit B

Analysis of Clean-Up Solution

TILE #	DESCRIPTION and REMARKS	TOTAL WT.-GMS.	PPM "U"	GRAMS "U"
37	2nd + 3rd FLOOR STAIRS	782	1,100	0.86
39	SOLUTION FROM LEACHED TILE	2,724	460	1.25
40	1st FLOOR WASH. PUT INTO 11-LITER BOTTLE #	11029.	1,140	———
41	NOT MARKED. PUT INTO 11-LITER BOTTLE #	11029.	1,220	———
42	NOT MARKED.	707	1,060	0.75
43	1st FLOOR TOWER. PUT INTO 11-LITER BOTTLE #	11029	2,200	———
58	WASH FROM COLUMNS.	1029	(NOT ANALYZED)	
	Bottle #11014 Containing Bottles # 54 and 80.	11240	3,900	43.87
	Bottle #11029 Containing Bottles # 133, 134, 140, 141 + 143	11250	3,316	37.30
	Bottle #11030 Containing Bottles # 82, 83, 87, 129, 130	11050	6,830	75.47
	Bottle #11031 Containing Bottles # 79, 86, 113,	11300	4,379	49.48
	Bottle #11032 Containing Bottles # 63, 75, 108, 111,	11400	3,127	35.68
	Grams U from above 5 bottles applicable to this area =			161.83
	Grams U from 1st Floor Clean-up (Identifiable)			15.34
	Grams U from 2nd Floor Clean-up (Identifiable)			0.95
	Gram U from 3rd Floor Clean-up (Identifiable)			14.08
	Total Gram U in all irradiated Clean-up Solutions			208.43
dd on	Bottles: - as per Conversation with; Mr. Willis Brown 8/28/6[illegible]			
149	Unknown	2020	6200	12.52
..1	1st Floor Wash. Put into 11L Bottle #1103[illegible]	1900	820	1.56
150	1st Floor Wash.	1589	840	1.33
	New Total			224.59

Analysis of Clean-Up Solution

UNITED NUCLEAR CORPORATION

INTER-OFFICE MEMO

TO L. Allison AT Wood River DATE 19 August 1964

FROM J. Deluty AT Wood River COPY TO file

SUBJECT Samples Analyzed for total "U"

Listed below are the results of the first ten (10) samples analyzed for total "U":

SAMPLES	Net wt. of* Material - gm	PPM	Gm/Gm	Total U - gm
HA-1	2158	72,704	0.06281	135.5
HB-1	[illegible]	38,056	0.03446	62.4
HA-4	1075	73,954	0.06411	68.9
HB-4	1174	25,560	0.02366	27.8
HA-15	[illegible]	77,021	0.06623	132.0
HB-15	2124	32,262	0.02989	[illegible]
HA-18	[illegible]	69,069	0.05952	102.5
HB-18	2772	36,125	0.03310	91.8
HA2-1c9	[illegible]	33,512	0.03080	36.8
HB2-1c9	[illegible]	21,925	0.02066	[illegible]
				769.49

J. Deluty

* These weights do not include the 50 ml sample taken from each bottle of material.

Exhibit B

Analysis of Clean-Up Solution

INTER-OFFICE MEMO

UNITED NUCLEAR CORPORATION

TO W.L. Allison AT New Haven DATE 20 August 1964

FROM J. Deluty AT Wood River COPY TO file

SUBJECT These are the analyses for the remaining (15) Samples as per telecon this date.

SAMPLES	Net wt. of Material-gm.*	TOTAL ppm	U gm/gm	Total U-gm.
HA-2	1411	86,275	0.07376	104.1
HB-2	1882	30,345	0.02773	52.2
HA-3	1018	99,960	0.08447	86.0
HB-3	2135	31,178	0.02840	60.6
HA-17	1315	54,978	0.04794	63.0
HB-17	2384	29,631	0.02702	64.4
HA-20	1455	85,680	0.06483	94.3
HB-20	2674	44,922	0.04028	107.7
HA-21	2138	74,970	0.06424	137.4
HB-21	2479	34,510	0.03126	77.5
HA-1-1c9	2198	86,513	0.07335	161.2
HB-1-1c9	2165	73,185	0.06626	143.4
HA3-1c9	1508	27,668	0.02537	38.3
HB3-1c9	1857	22,908	0.02131	39.6
HA4-1c9	798	25,704	0.02369	18.9
				1248.6 g

Total 2018.0 g.

J. Deluty

J. Deluty

* These weights do not include the 50 ml. sample taken from each bottle of material.

Exhibit B

Samples Taken From 11 Liter Bottles After Incident

Bottle Nos.	Comments on Tag	Description	Lab No.	Analysis in PPM
11001		* ADU dissolved in HNO_3	1389	460
11002	No orig tag	Carbonate wash from TCE	1363	920
11003		HNO_3 used for Leach Calc. Ash	1368	3.5 g/l
11004		Boiled TCE washed in carbonate	1390	720
11005		TCE wash from evaporator	1360(Aqueous)	18 g/l
			1361(Organic)	0.5 g/l
11006		TCE from OK Liquor wash column	1365	2.1 g/l
11007		Stoddard solvent from precipitators	1376	144
11008		TCE wash from evaporator	1366(Aqueous)	38.9 g/l
			1373(Organic)	3.9 g/l
11009		Not in existence		
11010		ADU filtrate	1364	10
11011		OK Liq that has been filtered	1358	103 g/l
11012	No orig tag	Carbonate wash from TCE	1362	880
11013		Wash from Evap Area - Composite	1305	1400
11014		3rd floor tower & pk liq rm wash	1306	2000
11015		ADU filtrate	1391	102
11016, 11017, 11018, 11019 - Skipped these numbers				
11020		(Bottle X) ½ full of solids		
11021		Conc. Liq from pump that has been filtered	1359	150 g/l
11022		Wash from SS Diss filters, washed in HNO_3 & H_2)	1386	4.9 g/l
11023		Mop up from around 1-D-12 pump	1370	200
11024	Mislabeled as TCE	ADU filtrate (TCE orig label)	1369	2.2
11025	Mislabeled as TCE	TBP & stoddard solvent (TCE orig label)	1371	9.2 g/l
11026	Mislabeled as TCE	Carbonate wash from TCE (Washed TCE)	1374	1.9 g/l
11027		TCE from wash column	1375	15.3 g/l
11028	No orig label	Unknown sub fm 1st floor column	1367(Aqueous)	41.2 g/l
			1372(TCE)	22.6 g/l
11029		Floor wash tower area	1384	15.2 g/l
11030		Floor wash tower area	1383	21.6 g/l
11031		Floor wash tower area	1382	12.4 g/l
11032		Floor wash tower area	1385	6.1 g/l
11033		Composite of Lab samples	1387	3.4 g/l
11034		Composite of Lab samples	1388	2.8 g/l

Exhibit C

Analytical Log - United Nuclear Corporation - From July 1, 1964

Date	Sample Number	Operator	Description	Analysis in ppm	Weight in grams	From Tower Room
7-1-64	979	Peabody	1-D-21B	20		
	980	Peabody	1-D-21B	19.7		
	983	JS	1-D-5 Solvent Feed 46% TBP	200+		
	991	JS	ADU Rinse from Buchner	680		
	992	JS	ADU Rinse Water	640		
	993	JS	ADU Wash Water	580		
7-2-64	1003	Peabody	TCE (Acid Scrubbed)	840		
7-6-64	1028	CEK	TCE Washed	6.0		
	1029	GS	TCE Washed	680		
7-7-64	1040	VN	Floor Washing for open house (stainless steel drum)	4		
	1057	RM	Carbonate Solution - 1-D-12	500		
	1060	JS	Washed TCE (11015 and 11002)	24		
7-9-64	1063	BP	Washed TCE (11010)	8.2		
	1064	CEK	Solvent + TBP Drum	99		
	1065	CEK	Solvent + TBP Drum	100		
	1070	JS	Stripped Organic in Column	680		
	1071	JS	Solvent from 1-D-5 Feed Tank	80		
7-10-64	1072		Organic Drum #3 (TBP #3)	520		
	1073		Solvent - Red + Gray Drum	600		
	1078	JS	Stainless Steel Drum - Carbonate Solution	560		
7-13-64	1085	JS	TCE Washed with Carbonate	5		
	1087	JS	11012 TCE			
7-14-64	1091	LR	11013 TCE (1-D-10)	600		
	1092	LR	TCE Rinse from 1-D-10	100		
	1093	LR	TCE Wash from Evap. (11002)	540		
	1094	LR	TCE Wash from Evap. (11006)	600		
	1095	LR	TCE Wash from Evap. (11010)	460		
	1096	LR	TCE Wash from Evap. (11012)	440		
	1097		Carbonate Solution - Stainless Steel Drum #2	240		
	1099	GS	TCE After Carbonate Wash - Bottle E	1.2		
	1100	GS	TCE After Carbonate Wash - 11013	3.0		
	1104	JRM	Carbonate Acidified (Stainless Steel Drum #4)	660		
	1108	JRM	Strip Acid from TBP Wash (11010)	100		
	1109	JRM	TBP Washed with Strip (11013)	48		
	1110	Peabody	1-C-8 Stripped Organic	640		
	1111	Peabody	1-C-9 Carbonate	760		
	1112	GJS	TCE 11014	2.8		
	1113	GJS	TCE Bottle F	6.0		
	1114	GJS	TCE 11006	360		

Exhibit "C"

Date	Sample Number	Operator	Description	Analysis in ppm	Weight in grams	From Tower Room
7/16/64	1116	GS	Stripped Organic From Column	470		
	1117	GS	Stripped #1116 Organic with H_2O in Lab			
7-17-64	1118	VN	Spill Clean-up	800		
	1120		TCE 11014	540		
	1121		TCE 11003	660		
	1122		TCE #1	760		
	1123		TCE 11007	720		
7-17-64	1124		Washed TCE (Bottle F)	196		
	1125		Washing from Dissolver Filter	700		
	1126	Peabody	I-D-5 (acid in bottom - 10 gal.)	840		
7-20-64	1130	Peabody	11007 (TCE Washed)	36		
	1131	Peabody	11002 (TCE Washed)	21		
	1132	Peabody	11006 (TCE Washed)	12		
	1136		Carbonate	740		
	1137		11012 (Washed TCE)	104		
	1139	CEK	OK Liquor from overflow bottle	U-38,508		
7-21-64	1150	JS	Washed TCE	680		
7-22-64	1160	JRM	I-D-5 Carbonate	800		
	1163	JA	Dissolved UO_2 from dissolver (2.7N) Samp. #1	U-26,696		
	1164	JA	Dissolver sample #2 (2.8N) Samp. #2	U-27,832		
	1165	JA	Dissolver sample #3	U-24,026		
	1166	CEK	Stripped organic from Column to wash (TBP 17.3%)	U-22		
	1172		Bottle 2 Precipitator clean-up	700		
	1173		Carbonate	740		
	1174		Washed TCE	64		
	1175	CEK	ADU Filtrate (Bottler)	5		
	1176	JRM	(Rework) SS Dissolver	450 g/1		
7-24-64	1177	JS	Raffinate at 0500 Container 1-C-6 (Job# rework)	28		
	1178		Filtrate Tank A (1-D-24A) (Job# rework)	2.0		
	1179		Raffinate from Column (1-C-6)	4.8		
	1180	DC	Dried ADU ppt. - ADU #4020			
	1181	DC	Dried ADU ppt. - ADU #4021			
	1182	DC	Dried ADU ppt. - ADU #4023			

Exhibit C

Date	Sample Number	Operator	Description	Analysis in ppm	Weight in grams	From Tower Room
7-29-64	1183		Bottle #1, Pickle Liquor Room	U-68	9300	
	1184		Bottle #2, "	3.8	9300	
	1185		Bottle #3, "	7.0	9300	
	1186		Bottle #4, "	4.4	9300	
	1187		Bottle #5, " to Drums	1.6	9300	
	1188		Bottle #6, "	8.4	9300	
	1189		Bottle #7, " to Drums	10.0	9300	
	1190		Bottle #8, "	8.4	9300	
	1191		Bottle #9 " to Drums	5.6	11000	
	1192		Bottle #10, Evaporator	4.0	11000	
	1193		Bottle #11, Pump line	200	11000	
	1194		Bottle #12, Pickle Liquor Room Floor Wash	8	9300	
	1195		Bottle #13, "	3.4	11000	
	1196		Wash SS Dissolver	680		
	1197		11004	490		
	1198		11007	192		
	1199		11 liter Bottle in 1st. floor of tower (aqueous is acidic)	3000		
	1200		Sample Filtered ppt. analyzed for U, solid from Jug #3	Filtrate PH=7.4, No Carbonate, U-22% (wt. ppt. wet)		
	1201		Sample obtained from 1 gal. plastic jug - 0.1 ml sample - Residue from 11 liter bottle on 3rd. Fl. of tower.	U=229 gm/liter.		
7-30-64	1202		Bottle #15, Irradiated sample washings, Wash Prod. Stge. Shelves.	U=260	4000	
	1203		Bottle #16, Prod. Stge.	56	9300	
	1204		Bottle #17, "	64	9300	
	1205		Bottle #18, Water (Rinse from specimen, front hood).	7	9300	X
	1206		Bottle #19, "	3.6	9300	X
	1207		Bottle #20, HNO_3 (Rinse from specimen, front hood).	13.	9300	X
	1208		Bottle #5, Pickle liquor room Drums, I-D-20	720		
	1209		Bottle #21, HNO_3 Wash	320		
	1210		Bottle #22, Wash ADU filtrate tanks.	150	1100	

Exhibit C

Date	Sample Number	Operator	Description	Analysis in ppm	Weight in grams	From Tower Room
	1211		Bottle #23, HNO_3 floor wash	92	11000	
	1212		Bottle #24, Floor wash ADU filtrate tank area	220	11000	
	1213		Bottle #25, Reactor Process area	400	11000	
	1214		Bottle #26, Floor wash ADU filtrate tank area	360	9300	
	1215		Bottle #27, Equip, ppt area	32	11000	
	1216		Bottle #28, "	130		
	1217		Bottle #29, 2nd. Floor over evap.	660		
	1218		Bottle #30, "	640		
	1219		Bottle #31, "	540	2350	
	1220		Bottle #32, "	640		
	1221		Bottle #33, Hoods on washing glove box	130		
	1222		Bottle #34, Process area	76		
	1223		Bottle #35, Dissolver platform	340	9300	
	1224		Bottle #36, Process area	60	9300	
	1225		Bottle #37, "	76	9300	
7-31-64	1226		Bottle #38, Floor wash over evap. (Platform)	40		
	1227		Bottle #27, "	96	9300	
	1228		Bottle #40, "	800	9300	
	1229		Bottle #41, "	600	11000	
	1230		Bottle #42, SS Dissolver (outside)	520		
	1231		Bottle #43, Floor wash front stge	800		
	1232		Bottle #44, Floor wash 1st. Fl. Columns	500		X
	1233		Bottle #45, Floor wash Evap.	360		
	1234		Jug #2	91090		
	1235		Jug #17	29784		
	1236		Glove box & tray Dissolver	13		
	1237		Jug #4, Teflon Dissolver	11	4000	
	1238		Jug #10, Evaporator	720	2300	
	1239		Jug #46, OK liquor from floor	>25000		
	1240		Jug #47, Dirty OK liquor filtered	>25000		

Exhibit C

Date	Sample Number	Operator	Description	Analysis in ppm	Weight in grams	From Tower Room
	1241		Jug #49, Clean-up of filter press	700		
8-3-64	1242		Jug #50, OK liquor from floor	>1000		
	1243		Jug #51, Wash from floor over evap.	680		
	1244		Jug #52, HNO_3 Wash 3rd. floor tower	300		X
	1245		Jug #53, OK liquor from floor evap.	>1000		
	1246		Jug #54, HNO_3 Wash 3rd. floor tower.	>1000		X
	1247		Jug #55, Floor wash under evap.	>1000		
	1248		Jug #56, Elec. Furnace	420	2035	
8-4-64	1249		Tile	360		
	1250		Jug #57, HF tray hoods	76	1589	
	1251		Jug #58, Tower Equip. wash	28	1816	X
	1252		Jug #59, "	240	1816	X
	1253		Jug #60, ADU Mezzarine	220	1816	
	1254		Jug #61, Tower area equip.	34	2270	X
	1255		Jug #62, Tower equip. wash	280	2270	X
	1256		Jug #63, Floor wash (Tower)	2600		X
	1257		Jug #64, Pulse Column Room	740	1816	X
	1258		Jug #66, 3N HNO_3	188	1589	
	1259		Jug #67, Tower Equip.	88	2724	X
	1260		Jug #71, 3rd. Floor tower	360	1135	X
	1261		Jug #72, "	260	908	X
	1262		Jug #79, 2nd. Tower Equip.	52	1816	X
	1263		Jug #80, 3rd. Floor overhead wash water	220	3178	X
	1264		Jug #81, "	134	3632	X
	1265		Jug #76, 3rd. Floor	660	1589	X
	1266		Jug #78, Tower	640	1362	X
	1267		Jug #90, 3rd. Fl. Pulse Column wash	760	2724	
	1268		Jug #91, No label	620	3632	
	1269		Jug #95, 3rd. Fl. Pulse Column wash	600	1589	X
	1270		Jug #96, Glove Box & Tray Dissolvers	92	2497	
	1271		Jug #97, 1st. Fl. Pulse Column	240	2497	X
	1272		Jug #98, Evap. Process Fl.	400	2043	
	1273		Jug #106, SS Dissolvers	280	2497	

Exhibit C

ate	Sample Number	Operator	Description	Analysis in ppm	Weight in grams	From Tower Room
8-5-64	1274		Jug #93, No label	16	1816	
	1275		Jug #68, 3rd. Fl. Tower	320	2043	X
	1276		Jug #69, 3rd. Fl. over-head wash	80	1362	X
	1277		Jug #65, Fl. wash from Column	1700	454	X
	1278		Jug #70, Tower area	420	908	X
	1279		Jug #73, Fl. wash from 1st. Fl. Pulse Column	780	4086	X
	1280		Jug #74, 3rd. Fl. Tower Equip.	520	1589	X
	1281		Jug #82, Pulse Column wash	5000		X
	1282		Carbonate solution	268		
	1283		Carbonate solution	3300		
	1284		Carbonate solution	1900		
	1285		Carbonate solution	5100		
	1286		Carbonate solution	3900		
	1287		Carbonate solution	1200		
8-6-64	1288		Carbonate solution	3045		
	1289		Jug #75, Fl. wash	1934		X
	1290		Jug #77, 1st. Fl. Tower	1394		X
	1291		Jug #83, 11 liter bottle 3rd. Fl. Pulse Col. wash	12770		X
	1292		Jug #92, Evap. Plat. wash (Floor)	15363		
	1293		Jug #3, OK Liquor	35000		
	1294		Jug #4, OK Liquor	42000		
	1295		Jug #1, AH (Redis-solved)	=.0606 gm/gm		
8-7-64	1296		Jug #85, 3rd. Fl. Pulse Col. wash	610	2270	X
	1297		Jug #86, 3rd. Fl. Pulse Col. wash (Floor)	2000		X
	1298		Jug #87, 3rd. Fl. Pulse Col. Fl.	2200		X
	1299		Jug #88, "	810	3859	X
	1300		Jug #89, "	2000		X
	1301		Jug #94, Evap. plat-form Fl. wash	14000		
	1302		Jug #99, Evap. Process Floor	9800		
	1303		Jug #100, Wash 1 Drop, HD-19's	460	1816	
	1304		Jug #84, Calcined Ash Wash	3400		
	1305		Jug #101, Wash from Evap. area (11 l bottle)	1400		

Exhibit C

Date	Sample Number	Operator	Description	Analysis in ppm	Weight in grams	From Tower Room
8-7-64	1306		Jug #102, 3rd. Fl. Tower & Pickle Liquor Room	2000		
	1307		Jug #103, Floorwash	670	908	
	1308		Jug #105, Teflon Diss.	2000		
	1309		Jug #107, Prod. Stge. Area FW	2800		
	1310		Jug #108, Rinse from 1-C-9	2900		X
	1311		Jug #115, Floor wash Evap. 1-D-20 area	2900		
8-10-64	1312		Jug #122, Floor wash 3rd. Pulse Col.	480	2270	X
	1313		Jug #124, Floor wash process area	560	2497	
	1314		Jug #126, Floor wash process area	660	2270	X
	1315		Jug #127, Floor wash process area	680	2270	X
	1316		Jug #135, Wash from Dissolver trays	98	2497	
	1317		Jug #136, Pickle Liquor wash water	500	2497	
	1318		Jug #139, Solution from each tile.	460	2724	X
	1319		Jug #151, 1st. Fl. process area	120	2270	
	1320		Jug #104, Washing 2nd. Fl. over Evap.	960	1589	
	1321		Jug #125, 1st. Fl. wash process area	740	2724	X
	1322		Jug #128, ist. Fl. process area	760	2497	X
	1323		Jug #133, Floor wash 1st. Fl. column	7800		X
	1324		Jug #138, Floor wash	3400		
	1325		Jug #141, Not marked	1220		X
	1326		Jug #144, Floor wash process area	460	2497	
	1327		Jug #145, "	680	3405	
	1328		Jug #121, Evap. in 1D-19 of Fl. area	5400		
	1329		Jug #143, Floor wash process area	2200		X
	1330		Jug #14, Irradiated surveyer wash	11	908	X
	1331		Jug #109, unknown	6200		X
	1332		Jug #110, Floor wash Column	6800		X

Exhibit C

te	Sample Number	Operator	Description	Analysis in ppm	Weight in grams	From Tower Room
8-10-64	1333		Jug #111, Floor wash Column	2400		X
	1334		Jug #112, "	4400		X
	1335		Jug #113, "	1060		X
	1336		Jug #114, Fl. wash Col. 1-D-20 area	4800		
	1337		Jug #116, Floor wash	7000		
	1338		Jug #117, "	5200		
	1339		Jug #118, "	5800		
8-11-64	1340		Jug #119, 1st. Fl. Tower wash	1080	2270	X
	1341		Jug #120, Spill from ppt filter	2000		
	1342		Jug #129, 3rd. Fl. process area	7400		X
	1343		Jug #130, "	7200		X
	1344		Jug #131, "	6400		
	1345		Jug #132, "	6400		
	1346		Jug #137, 2nd. & 3rd. Fl. stairs & tower	1100		X
	1347		Jug #150, 1st. F. wash	840	1589	X
	1348		FE-199 (Filtered wash sol.)	46		
	1349		Jug #148, H_2O sample Fl. wash	50		
	1350		Jug #123, Fl. wash process area	540		
	1351		Jug #134, 1st. Fl. wash	1000		X
	1352		Jug #140, "	1140		X
	1353		Jug #142, Not marked 0.7g	1060		X
	1354		Jug #149, 1st. Fl. wash	820		X
	1355		Jug #146, Painting utensils wash solutions	92		
	1356		Jug #147, "	4		
	1357		1-D-5	10(organic) 7600(aqueous)		
	1358		#11011	103 g/l		
	1359		#11021	150 g/l		
	1360		#11005, two layers - top aqueous	18 g/l		
	1361		#11005, Bottom TCE	0.5 g/l		
	1362		#158, Wash from Column			

Exhibit C

INTRA-LABORATORY CORRESPONDENCE
Oak Ridge National Laboratory

August 27, 1964

To: K. Z. Morgan

From: J. A. Auxier

Subject: United Nuclear Corporation's Accident of July 24, 1964: Mr. Peabody's Exposure

The only semi-definitive "dose" value I have for Mr. Peabody is based on blood sodium activation. Samples of his blood were sent to Gordon Brownell at Massachusetts General Hospital by Dr. Stanbury, also of Massachusetts General Hospital. Dr. Roger Rydin made the analyses on 2 ml samples of Peabody's blood serum; he found 2.64×10^{-2} uc/ml. I believe this to be the only unambiguous number available to me. Dr. Rydin and Dr. Brownell are unquestionably competent, and we supplied ORNL sodium standards for calibration. Our standards are good to ± 3% on an absolute basis.

Therefore, if a dose estimate is based on the blood sodium and the assumption that Peabody was exposed in the same geometry and to the same spectrum as the Y-12 cases (nothing more), one obtains a value of 2070 rad of fast neutrons (see Hurst, et al., HEALTH PHYSICS, Vol. 2, pp. 121-133, especially Table 7). Further, assuming a γ/n_f "dose" ratio of 3, the total dose was about <u>8200</u> rad.

I have analyzed the data in other ways and attempted many refinements which I won't discuss here in detail, but which include orientation effects, non-uniform exposure, (i.e., lower body received less dose), spectrum and γ/n ratio differences, etc. Some of these factors increase the total average "dose", some decrease it, but if I take the extremes, the minimum "dose" is about 7000 rad and the maximum, based on a uniform lateral exposure to neutrons from the HPRR or the Godiva II reactors, is about 19,000 rad. However, my best "guesstimates" (admittedly based on second- and third-hand descriptions which often differ) are that Peabody received an ~~"average"~~ of 2100 rad of fast neutrons and 6000 rad of gamma rays. I believe that ~~these~~ are within ± 25% at the 50% confidence level.

I learned today that others have made estimates much higher than these, but I am convinced that the sodium is less sensitive to perturbations due to the various geometrical, spectral, and temporal unknowns. I will attempt a

EXHIBIT D

better estimate if a reliable description of the physical environment becomes available to me.

J. A. Auxier

JAA:bbh

cc: W. H. Jordan
F. Nakache
E. Resner
R. Rydin
C. S. Shoup
W. S. Snyder

EXHIBIT D

Files August 24, 1964

Herman J. Paas, Jr., Special
Assistant to Director
Health and Safety Division, ID
UNITED NUCLEAR CRITICALITY INCIDENT

HS:HJP

Transcript of recording of long distance conference call between Dale Olson, Mr. Paas and Mr. Resner, NY., on 8/21.

Dale Olson: First of all may I explain to you that we count with a three inch by three inch sodium iodide crystal and a 400 channel analyser. We analyze the spectra and calculate the disintegration rates accepting the crystal to be a primary standard. We have two standard sources that we counted. The National Bureau of Standards and a Nuclear Chicago ASTM Standard and each of these we calculate within two percent of the values they give. From each of the 26 samples, we made separations for a Barium 140, Cerium 141-144 and Molybdenum 99. We calculated the total fission in each bottle and then summed all the bottles together and these are the values we came up with. From Ba 140, we calculated a total fission of 1.26×10^{17}, from Ce 141, we calculated 1.32×10^{17} and from Mo 99, we calculated 1.15×10^{17}, for an average of 1.24×10^{17} fissions. Now assuming only 90 percent of the material was available, 10 percent lost, the total fissions would, therefore, be 1.4×10^{17}.

From the piece of clip on Peabody's field badge, the iron on the clip, we calculated fast neutrons 5.07×10^{12}, that is from Mn54. From thermals using Fe 59, we calculated 6.67×10^{11}. From the screwdriver we took half of it and dissolved it - the other half we scanned as a solid and calculated disintegration rates for Mn 54. From the separated sample, we get 1.93×10^{13} and from the undissolved solids calculation we get 2.18×10^{15}. From Fe 59 on the same screwdriver, the separated sample, we get 1.37×10^{12}. For the solid piece we get 1.68×10^{12}. We accepted a cross section for Fe 59 as 2.5 barns but there is an uncertainty listed in the cross section back of two barns so there is a lot of uncertainty on the iron cross section. You must, therefore, remember that there is quite a bit of uncertainty on the cross section; however, we used a constant one so if it is biased, every result will be biased in the same direction. For Mn 54, the np reaction on iron 54, we had 65 millibarns as the cross section. We have more confidence on the 65 millibarns than we do on the cobalt.

Now let's go down to the first hose clamp at nine inches, we called ~~as~~ Sample 1. The Mn 54 was 5.64×10^{12}, Iron 59 was 1.18×10^{12}, Co 58 was 5.17×10^{12} and Cr 51 was 1.93×10^{12}. Cobalt 58 is from the fast on Ni 58 and the Cr 51 is thermal on Cr 50.

EXHIBIT E

We checked that by scanning the stainless steel sample and the chrome agreed very well. The other two peaks, the Co 60 and Fe 59, are in combination and Mn 54 and Co 58 are in combination, but here is the check on chromium which indicates I think that the separation is good and all is well. We get 1.75 x 10^{12} just scanning and calculating Cr 51 as compared with 1.9 which is desirably good.

The hose clamp No. 2 at 175 inches, Mn 54 was 1.62 x 10^{11}, Iron 59 was 1.70 x 10^{11}, Co 58 was 1.64 x 10^{11} and Cr 51 was 1.93 x 10^{11}. We got two pieces of Indium foil from his film badge. From one we got 1.99 x 10^{12}, from the other we got .91 x 10^{12}. This is Indium 114.

We got paper tags. All we saw on the paper tags was mixed fission products, something from the incident splashed out and got all over them. Regarding the aluminum solution, we found nothing there of any interest at all. From the pieces of lead in the film badge, there was no activity at all large enough to evaluate. The plastic just had fission products on the surface, we decontaminated it and there was nothing in it by way of induced activity. However, you would suspect it would be a pure beta matter and we did not go for that. From the original solutions, I can tell you what we saw in each if it is meaningful. You know the first 22 that came. Information is available on what we saw.

(Mr. Resner interrupted stating he thought it would not be necessary at this time but would like the information in the final report.)

From this information, it was calculated that the ratio of fast to thermals is two to three. Two to three fast neutrons to one thermal. From the configuration of the vessel and from the uranium in aqueous medium and from this ratio, it is assumed that this is sort of a Y 12 incident and spectra. Therefore, in calculating the dose to the man, we used this assumption that it was very close to the Y 12 and used the constant they used in calculation.

We get a gamma plus neutron dose of 1.5 x 10^4 rad total dose. That includes fast neutron, thermo neutron and gamma. Under the same assumption that this is a Y 12 spectrum and using the Na 24 blood information that they got at the hospital, it calculates 2.6 x 10^4 rad. We have not got a value for you in rems just yet. We can get it if you desire to have it.

(Mr Resner said he would like to have it in the final report.)

The uranium isotopic analysis in this material is 93.13% U-235, 1% U-234, .26% U-236 and 5.16% U-238. Haven't got a total uranium - that will be forthcoming. I think we are pretty well wound up as far as samples and calculations go. Two more pieces that you are probably ~~interested in~~ - there was a spring from his badge and a pin from his badge. We ~~have data~~ that came off this morning and these two pieces are real poor to calculate disintegrations from as compared to the clip, but we are still going to calculate and see that they do give. (End of pertinent data and calculation transmission.)

EXHIBIT E

Balance of telephone contact was devoted to reconfirming figures and methods. Plans for completion of all analysis and the ecological samples were agreed upon.

CC: C. W. Bills, ID
Dale Olson, ID
Mr. Resner, NY

HS

HJPass:pmw
8-24-64

EXHIBIT E

[ ] Ex. 6

September 2, 1964

I, George J. Spencer, state that I now live at [ ] Ex. 6 I have been shown 10 photographic prints. I can comment only on photos #2 and #10. Photo #2 is of a tag which I originated, printing on the reverse or yellow side of the tag "Bottle Y" and lined off spaces "log, description, sample, discard". I wrote in, under description, "ADU Filtrate". The absence of initials in the sample and discard columns would indicate to me that the contents of the bottle had not been sampled. Normally, the bottle would be sampled when filled. I believe I prepared this tag in the early or middle part of the week of July 20, 1964. I do not recall how much filtrate went into the bottle, but it was not filled because no sampling or disposal is shown. It is possible, but unusual, that Roode put the concentrated liquor from the evaporator into this bottle, as shown by his entry on the tag as initialled by him. I recall having seen the storage area near the foreman's shed, with the yellow posts around a bottle in a safe cart. I do not recall seeing the bottle, but I do remember the posts. I am unable to state whether I saw these on Thursday or Friday, the 23rd or 24th. Picture #10, of the precipitator area, shows a metal strap on the stairway which held the first bottle I filled from the evaporator and may also have held the second. I also recall a tygon hose from the precipitator steam line. I had used the steam line to melt concentrated material in the evaporator. Dale Chapman, on July 23, had instructed me, as did Dick Holthaus, in cleaning out the evaporator. There was some material in the bottle when I started to fill it. I used a sponge, a stainless steel beaker and a funnel to put the material into a one gallon jug, then into the 11 liter bottle. I filled one 11 liter bottle and I believe partially filled a second 11 liter bottle. I also had some of the material in about 3 one gallon jugs in the precipitator area. I believe I had cleaned out the evaporator by our supper break, at about 8 o'clock, and after the break, Peabody and I reassembled the evaporator and flange. The bottles I had filled I put in the shelf storage area. The gallon jugs were left in the precipitator area. I doubt that I labeled them. I had not left anything in the dissolver area. I had not taken or done anything with the bottle Roode put into the cart storage area. I have read page 26 of the UNC report, but am unable to confirm or deny the statements therein.

I have read the above statement. To the best of my knowledge it is true.

George J. Spencer

EXHIBIT F

August 26, 1964

UNITED NUCLEAR CORPORATION, WOOD RIVER JUNCTION, RHODE ISLAND

I, John Lindberg, state that I live in [ ] I am Vice President in charge of the Fuels Division, United Nuclear Corporation. The Fuels Division is comprised of the operations at Hematite, Missouri, at New Haven, Connecticut, Montville, Connecticut and the Fuels Recovery Plant at Wood River Junction, Rhode Island. Ex. 6

The United Nuclear Corporation was formed in June, 1961, by Mallinckrodt Chemical Works, St. Louis, Missouri, which had the Hematite Operation, Olin Mathieson Corporation which had the New Haven Plant and Nuclear Development Corporation of America, White Plains, New York. The Mallinckrodt Chemical Corporation obtained approximately a 10% stock interest in the new corporation, Olin Mathieson, approximately 60% and Nuclear Development of America approximately 30%. In April, 1962, the Sabre-Pinon Corporation of New Mexico merged with the United Nuclear Corporation; Sabre-Pinon was the surviving corporation but retained the name of United Nuclear Corporation. Mr. Richard Bokum became President of the Corporation.

On July 24, 1964, I was enroute from St. Louis, Missouri to New Haven, Connecticut. I had spent the three previous days at the Hematite plant. It was my intention to stop overnight in York, Pennsylvania where [ ] During a plane-change in Pittsburgh I telephoned Frank Hayes, Accounting Manager, in New Haven to inform him I was enroute and where I could be located that afternoon and night. I had appointed Mr. Hayes as being in charge of all Division activities during the two week shutdown at New Haven. These were the weeks of 7/13/64 and 7/20/64. Ex. 6

About 9:45 p.m. on the night of July 24, 1964, I received a telephone call from Arthur Rumbin, guard at the New Haven plant, who informed me that a nuclear incident had occurred at the plant in Rhode Island. I immediately called Bob Johnson at the Fuels Recovery Plant, who gave me a report. I told Bob Johnson to act as the senior official in charge until my arrival. I also told Bob Johnson I would call him back to let him know how I was coming. I then called the Company pilot at his home in Ridgely, Maryland to arrange for the Company plane to fly me to Westerly. The pilot said he would check the weather and call back, which he did later. He informed me during that call that there was no possibility of flying into the general area of Westerly because of weather and that the nearest we could possibly get to was Albany, New York. I abandoned thoughts of flying, called Bob Johnson at Rhode Island, and told Bob I would be driving up and would be leaving immediately. At that time the content of the initial press release was reviewed by Johnson and myself. I further told Johnson I would call in periodically enroute.

JAL - 9/4/64

EXHIBIT G

Ex. 6

[redacted] I left York, Pennsylvania about 11:20 p.m. and drove to [redacted] Enroute I called about 1:00 a.m. and talked further with Johnson. I called again about 3:00 a.m. and could not get through because of a busy line. When I was able to get through on the telephone about 4:00 a.m., things had pretty much quieted down and I learned that Bill Pearson, Supervisor, was receiving calls while the other people who had been there through the night were getting some rest. When I arrived at my home at [redacted] I rested for about a half-hour, changed my clothes, and then left for Wood River Junction, Rhode Island, arriving at about 8:30 a.m. In an earlier telephone call to the plant I had given instruction with regard to maintaining barricades and security of the premises as far as personnel were concerned and to monitoring the area. Upon arrival at the site I requested that a camera and tape recorder be obtained.

On Saturday afternoon, I interviewed Dick Holthaus, Superintendent, Fuels Recovery Plant and Clifford Smith, Shift Supervisor. They related the details of the incident as they knew them, Smith having been in the plant at the time the incident occurred and Holthaus having arrived upon notification shortly after the incident had occurred. They described their re-entry into the plant to drain the sodium carbonate tank. In explanation for this re-entry Holthaus stated to me that he had effected the re-entry on his own initiative that he realized the danger of a continuing criticality and the need for eliminating this hazard. Holthaus offered no other explanation for his re-entry.

Clifford Smith stated that he thought the re-entry was made as a result of a Holthaus phone call with someone from the Naval Reactors Branch, but he has subsequently stated that he had not participated in the telephone conversation on which he based his earlier statement and that he was withdrawing the statement made by him concerning the circumstances of the re-entry.

I spent the balance of the day outlining a plan of investigation and identifying individuals from our New Haven plant, who would participate in the various phases of this investigation. I then returned to my home. I was again at the plant on Sunday, July 26, 1964, and continued my study of the incident to determine how it had occurred, what may have contributed to it, what measures should be taken to set up a Company Investigating Team, and what areas should be investigated.

Dick Holthaus told me that he had had telephone conversation with Admiral Rickover the night of the accident. When asked during this interview why such a call was made, I explained that to me there are three possible explanations: (1) We had been notified that conversion of production quantities of SNM material for use in Naval fuel fabrication and scrap reprocessing will be conducted on a license basis. The operations of the Fuels Recovery Plant were under such license. Therefore the transition from station control to license control was being made, and it seems logical to me that Admiral Rickover wanted to reassure himself personally of the exact control status of the plant. (2) The identity and amount of material involved to me would have been important for Admiral Rickover to know, since I am sure he was aware of our intent to reprocess scrap material from contracts in his program at the Fuels Recovery Plant. (3) Also being the kind of individual he is, I believe Admiral Rickover would call to extend any help he or his people could provide in such a situation. In fact while I was still in York, Pennsylvania, I talked with Lawton Geiger, Manager, Pittsburgh Office of Naval Reactors by telephone. I confirmed to Mr. Geiger that I was sure the material involved was Naval Reactor material and it was under license. I also posted him on the general situation. Mr. Geiger extended us any help we may have desired and indicated a monitoring team composed of BAPL people were on a stand-by basis to come up immediately if requested. I told him that I understood one was coming up from NYOO and explained their assistance was not required but that I would call him if a need appeared.

I pointed out during this interview that after my arrival at the site on Saturday morning, 7/25/64, I kept Mr. Bokum completely posted on the situation to the best of my ability. Bob Johnson had informed me Friday night that he had advised Mr. Bokum of the incident after his arrival. Mr. Bokum confirmed our actions that the situation would be handled directly out of the Fuels Recovery Plant at my direction. I have had complete support within the Corporation and by top management. No pressure, instructions other than to be factual, or directions have been put on me with regard to the contents of the report submitted by the Corporation to the U. S. Atomic Energy Commission.

Subsequent to this incident serious consideration is being given to actions which can help prevent occurrence of another incident. An example of this is the institution of a comprehensive training program for all personnel. This program is utilizing outside services such as a professor from Rhode Island University, and a member of the medical staff of the University of Rochester. Further areas of consideration include operating procedures, criticality limits and control, health physics procedures and control, emergency procedures, and organization.

I have been with the United Nuclear Corporation since 1961 at which time I was works Manager at New Haven. I became Vice President of the Corporation in April 1962. Prior thereto I had held managerial positions with industrial firms beginning in 1948. I have a B.S. in Metallurgical Engineering from Carnegie Institute of Technology granted in December [ ] Ex.6

JAL - 9/4/64

EXHIBIT G

[August 31, 1964] Ex. 6

I, John A. Lindberg, state that I live at [ ] I am [ ] years of age and [ ] I am the vice president of the Fuels Division, United Nuclear Corporation and have my office in New Haven, Conn. I was first employed by United Nuclear Corporation as Works Manager at New Haven. I became vice president in April, 1962. The Wood River Junction Fuels Recovery Plant is a part of the Fuels Division. It is under the supervision of Dick Holthaus, superintendent. He is responsible to the Manager of Chemical Operations who has the Hematite operation and the Fuels Recovery plant (Wood River Junction) under him. Bob Johnson is Acting Manager of Chemical Operations. He became Acting Manager July 7, 1964. Dr. Kuhlman had been his predecessor in this position. Johnson is responsible to me. Holthaus reports directly to Johnson. I have given him direct instruction from time to time with direct answers. Johnson exercises supervision over Holthaus. Holthaus, during the construction phase at Wood River Junction, was resident construction engineer. He was responsible for the hiring of his people although the recruiting was done by George Briggs' people. Holthaus had been hired on October 1, 1963. Ground had been broken in about May, 1963. In the interviewing time Bob Kyser, superintendent of production planning, served as resident construction engineer. Bob Johnson was project engineer during construction. Bob Shearer was the coordinator on the application for the license. Lou Swallow did the criticality calculations in connection with the license application. I remember having seen the license application, but I do not remember approving it, per se. It would be my function to approve the license application by delegation. Although Dr. Kuhlman may have approved the application, final authority rested with me. The Manager for Chemical Operations is responsible for Hematite and Fuels Recovery Plant. This responsibility was contemplated at the beginning of construction of the Fuels Recovery Plant executed upon Holthaus's hiring and continues to the present time. Separate profit and loss statements have been set up for Wood River Junction. There is a relationship on accountability, industrial relations, purchasing, production planning. There is a relationship to New Haven in marketing. There is a relationship in industrial engineering. In terms of Health Physics, Barton reported to Holthaus for hiring and firing, but he had a functional relation to John Geil. In other areas, industrial relations were the responsibility of Holthaus in conjunction with the people here. Training was a direct responsibility of Holthaus, but under the functional relationship of Dr. Manny London. Training at Fuels Recovery plant was the responsibility of Holthaus. A manual of operating procedures was prepared by supervision and approved by Holthaus. I do not know whether this manual of operating procedures was approved by Dr. London or Mr. Briggs. Dr. London had charge of the orientation program for the employees at Wood River Junction. I do not know the exact extent of a formal training program for the employees. The appointment of Holthaus as superintendent

JAL - 8/31/64 as written by A. F. Ryan. Not dictated.

EXHIBIT G'

I am sure is documented. I do not know whether other relationships between New Haven and Wood River Junction are set out in any single document. Lou Swallow would be responsible for auditing criticality at the Wood River Junction plant. We have no record, to my knowledge, of an audit by Swallow, since operations commenced. Health physics is audited by Geil. I do not know at this time whether he has conducted such an audit, on the basis of any record I have seen. I know he has visited the plant subsequent to start up, but whether this was for audit or not, I do not know at this time. On July 24, 1964, I placed Bob Johnson in charge of Wood River Junction as superintendent, until August 5, 1964, when I returned it to Holthaus. On March 17, 1964, Kuhlman was given an assignment and Les Allison became Acting Manager of Chemical Operations until June 1, when Kuhlman again took over until July 7, when Johnson was designated Acting Manager of Chemical Operations. During the early period when the titanium contamination was discovered, I told Holthaus to let me know directly of any problems he had on that issue. I would guess this to be about the middle of June. Audit wise, we had a contract with Nuclear Science and Engineering Corporation for health physics and criticality. We have reports from N.S.E.C. for at least one audit and I believe a second audit. One was made by Dr. Edelman on approximately June 23, 1964, the earlier one was in March or April to review the start up procedures. I had made an oral statement to Mr. Ryan on August 26, 1964, which, when reviewed and corrected should be considered a part of this statement.

JAL - 8/31/64 as written by A. F. Ryan. Not dictated.

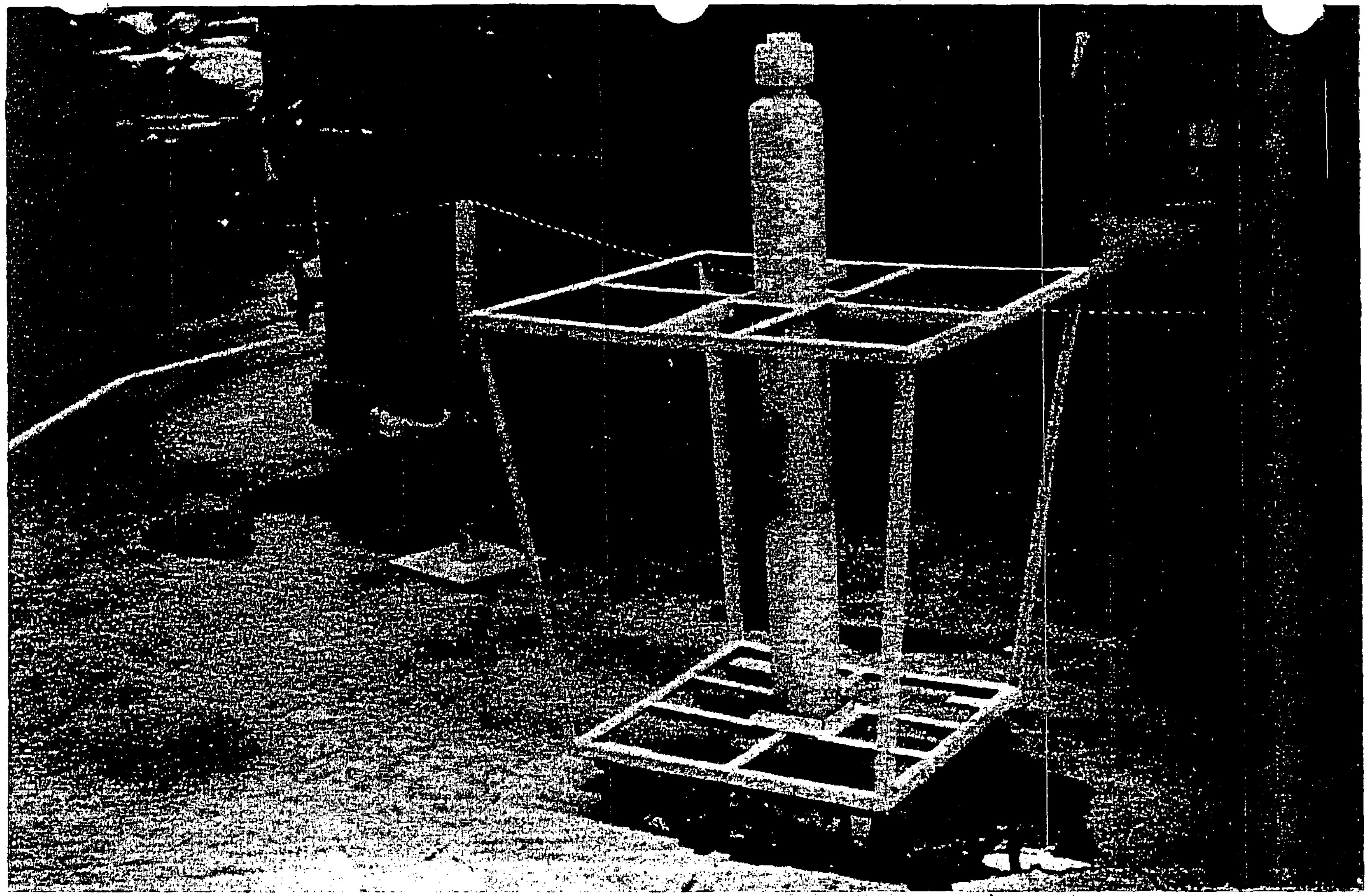
EXHIBIT G'

Pictures of the Plant, Taken on July 27, 1964

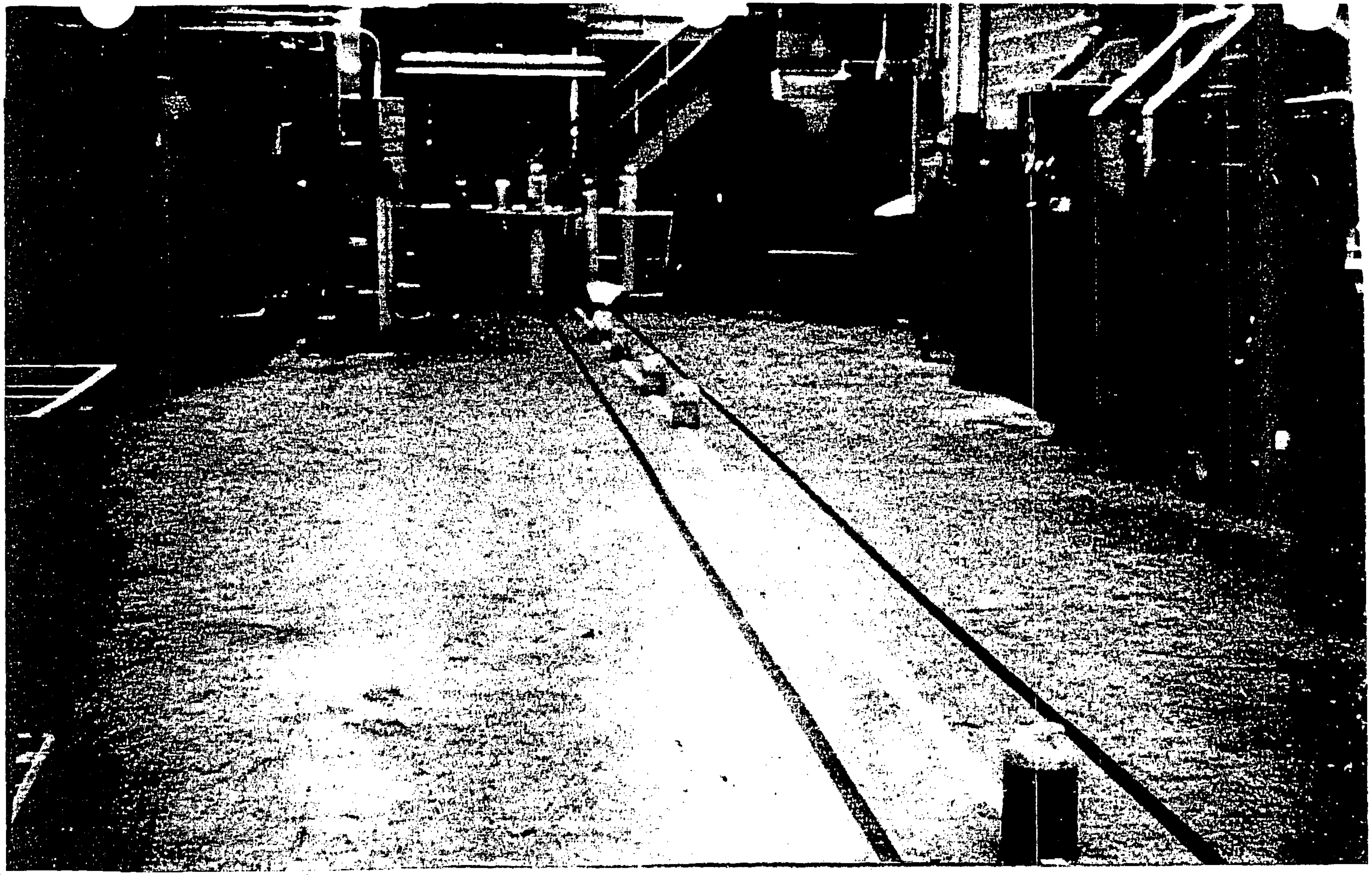
Entry to the process area was made on Monday, July 27, 1964 and a series of pictures was taken that describes and records the condition of the plant after the incident. The entry route was through the locker room, the shipping and receiving area, the storage area, through the doorway to the process area, south to the opening between the product storage wall and the process hood wall, east to the evaporator-precipitator area and north into the three levels of the tower room. The following pictures were taken by United Nuclear employees and were made available to the AEC as a record of the post incident conditions in the plant.

1. Bottle "X"
2. South Side of the Process Area
3. Close-up of a Gallon Jar
4. The Evaporator-Precipitator Storage Area
5. Bottle 11005
6. Tower Room Stairwell
7. Tag No. 1
8. Tag No. 1
9. Empty "Safe" Cart
10. First Floor of the Tower Room
11. Tag No. 2
12. Tag No. 2
13. First Floor of the Tower Room
14. Tag No. 3
15. Tag No. 3
16. The TCE and Organic Wash Columns
17. Second Floor of the Tower Room
18. Sodium Carbonate Make-Up Tank
19. Sodium Carbonate Make-Up Tank
20. Ceiling of Third Floor Tower Room
21. Solution on the Third Level Floor of the Tower Room
22. Solution on the Third Level Floor of the Tower Room
23. First Floor Process Area, Central Section
24. First Floor Process Area, North Section
25. Record Books

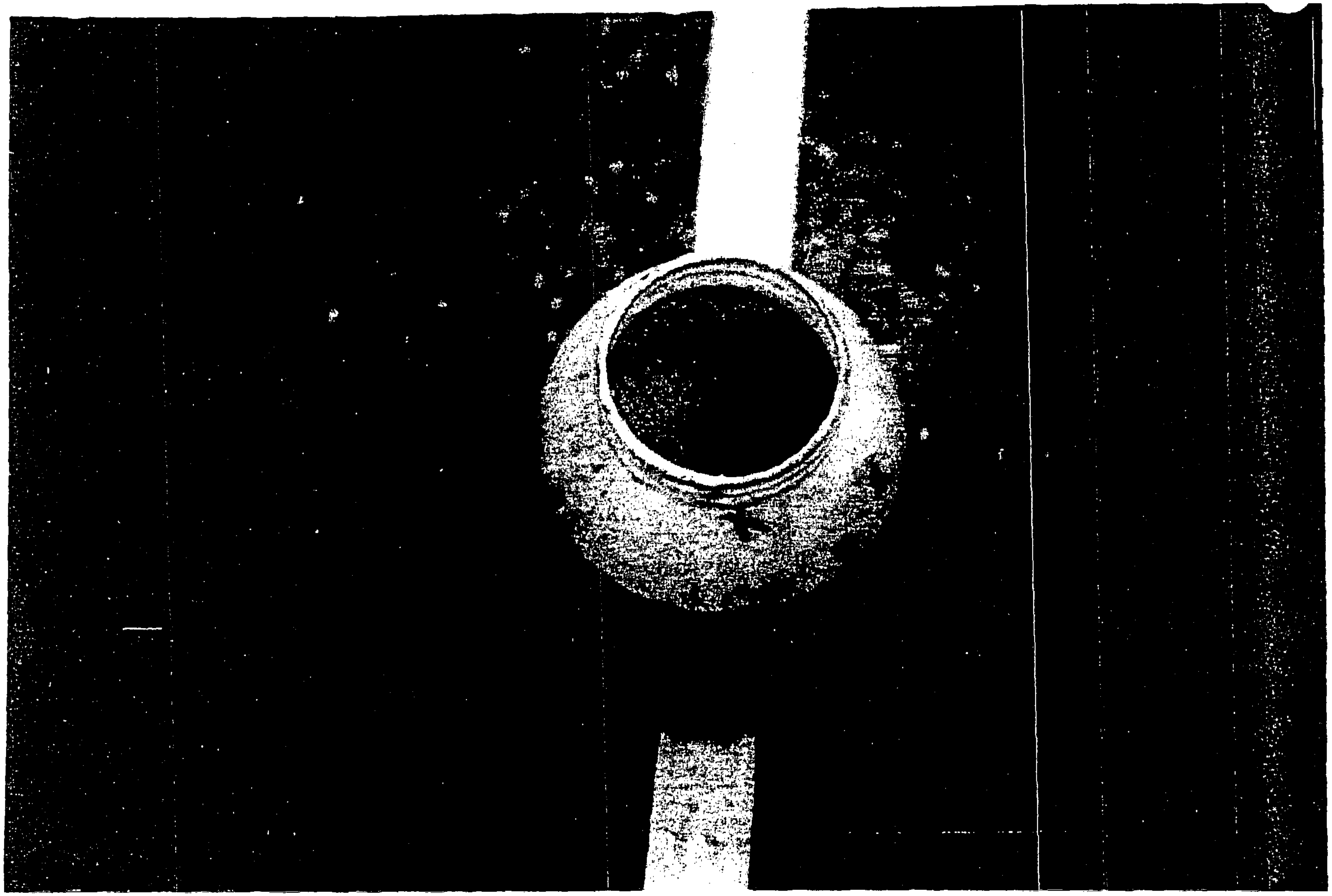
EXHIBIT "H"



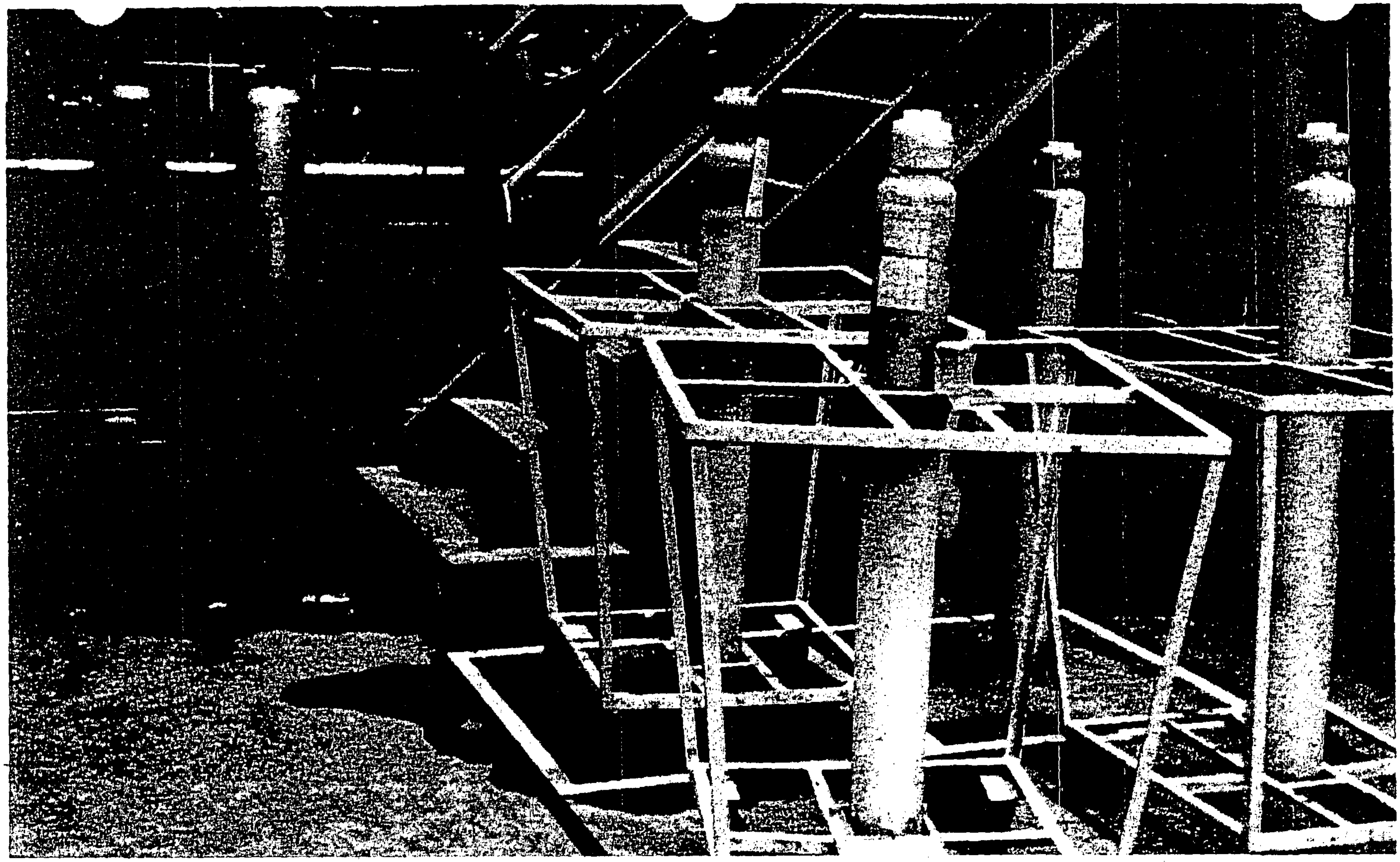
1. Bottle "X" - This first picture shows Bottle "X" in a "safe" cart, just southeast of hood 1-J-5B. A broken seam in the bottle has allowed solution to leak out onto the floor. The bottle still contains crystals of uranium nitrate that occupy about 1/3 of the total volume of the bottle.



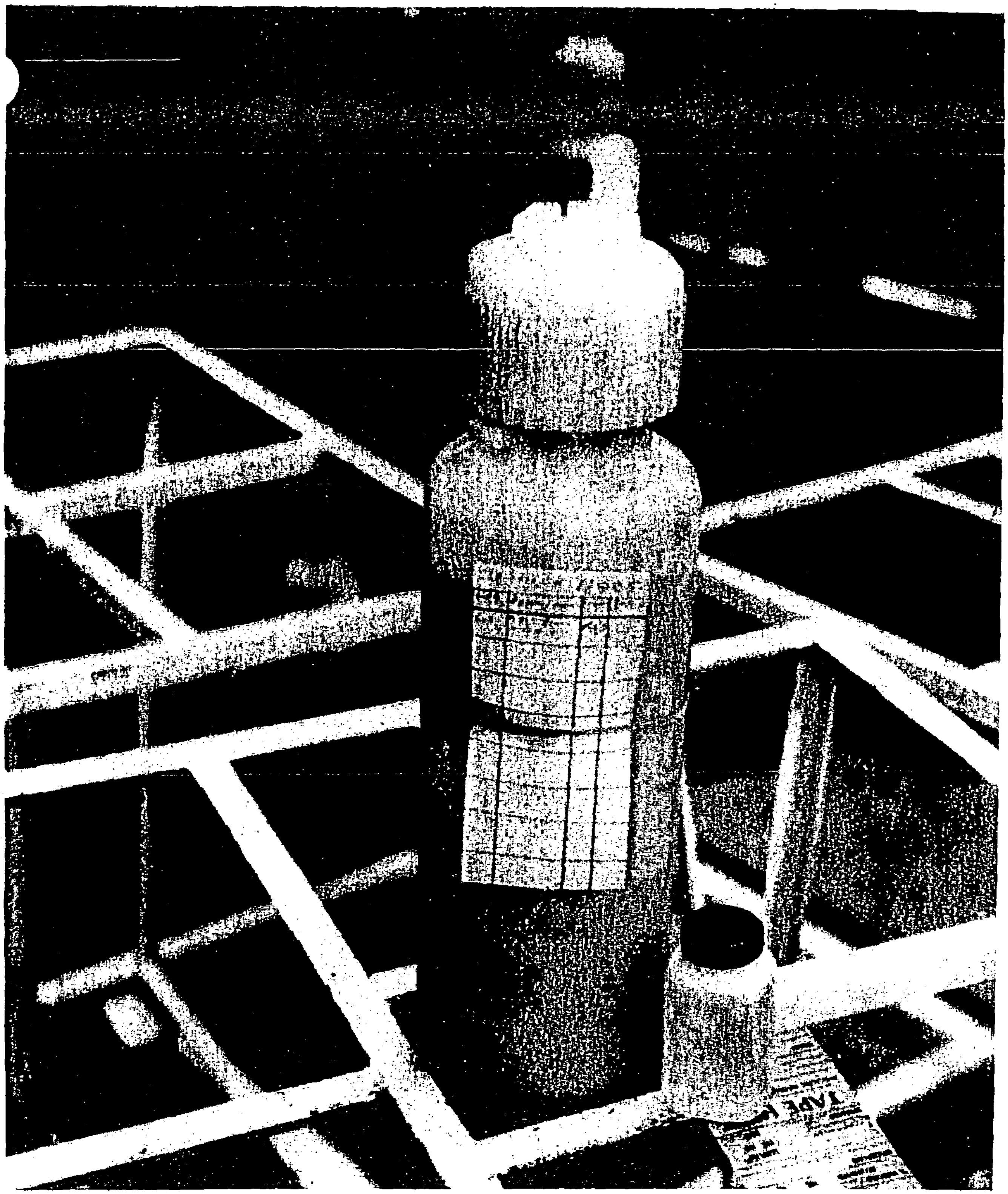
2. South Side of the Process Area - This second picture was taken facing east and shows the south side of the process area, between Bottle "X", which is in the cart shown at the left edge of the picture, and the evaporator-precipitator area. The lines on the floor designate the "safe" way down which "safe" carts containing the 11 liter bottles are to be transported. The first four one-gallon bottles that are spaced along the center line, contain both precipitate and solution from the nuclear incident. This material was drained from the organic wash column 1-C-9.



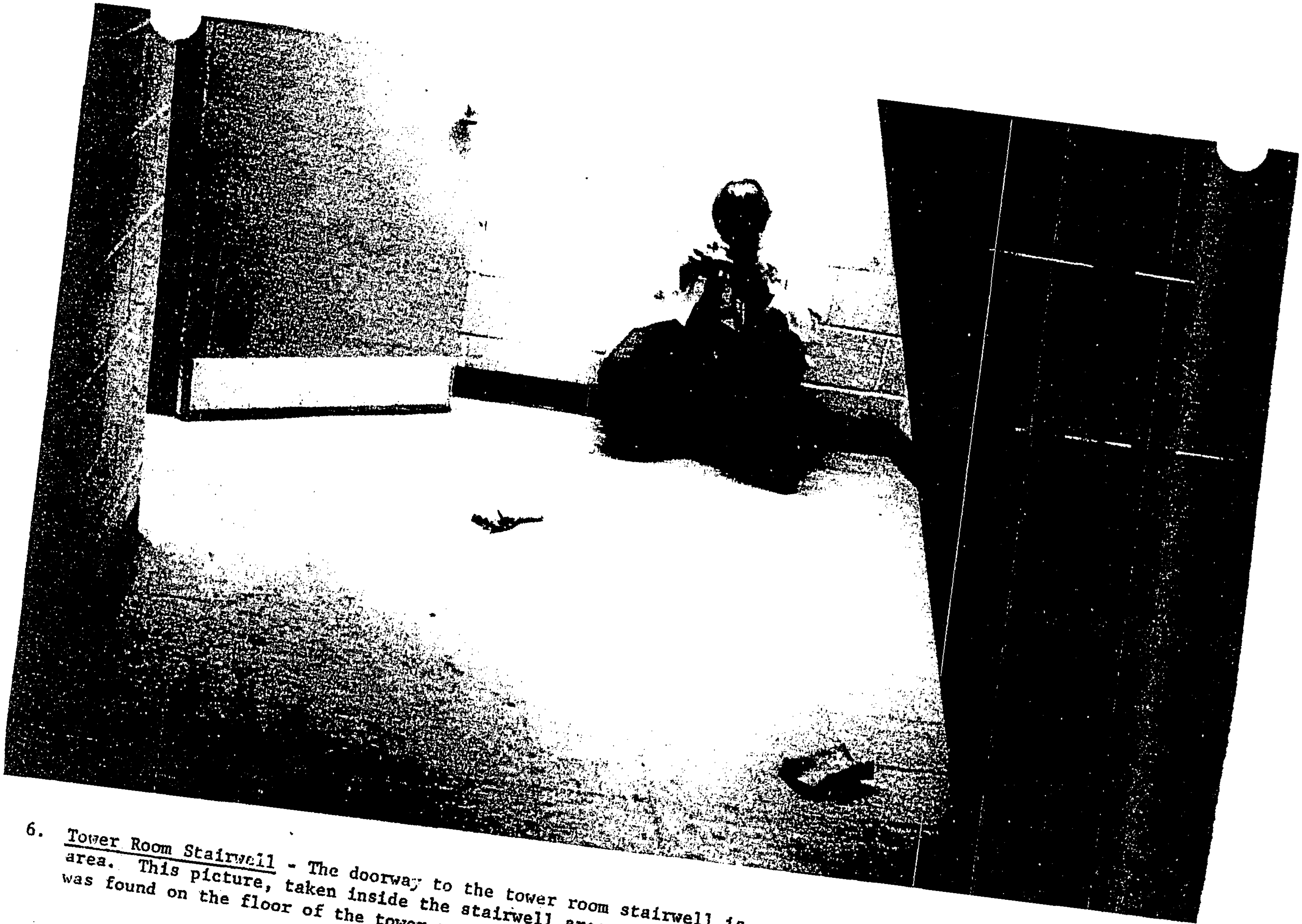
3. Close-Up of a Gallon Jar - This close-up shows one of the one gallon jars of material that was drained from the sodium carbonate make-up tank. This is one of the four bottles shown in picture 2.



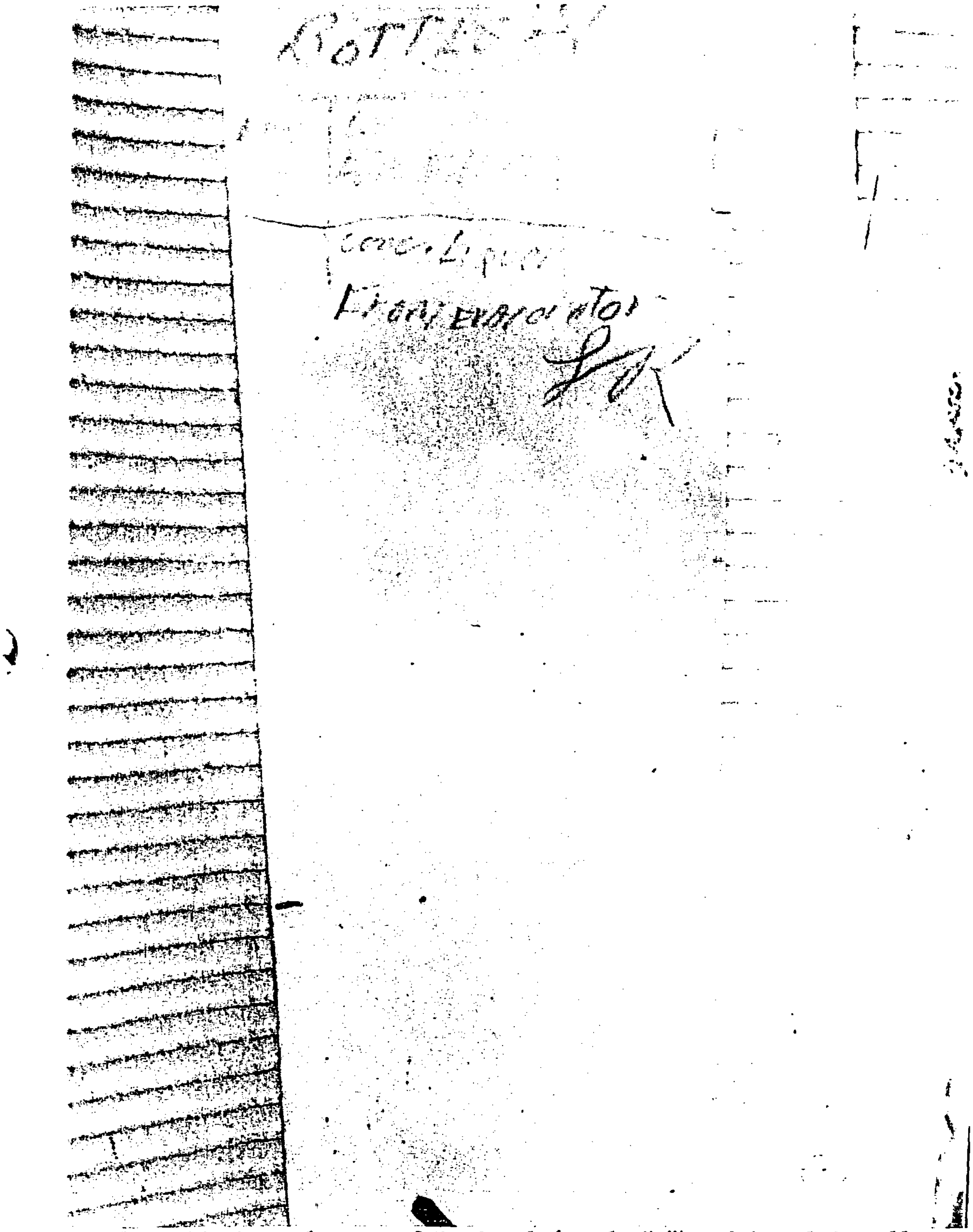
4. The Evaporator-Precipitator Storage Area - This picture shows four of the five 11 liter bottles that were stored in the evaporator-precipitator area. Three of the bottles are stored in safe carts, one is stored in the center of the 28" square area marked off on the floor, and one is stored on the center line of the "safe" way just west of the four 11 liter bottles. (The latter bottle is not shown by this picture.)



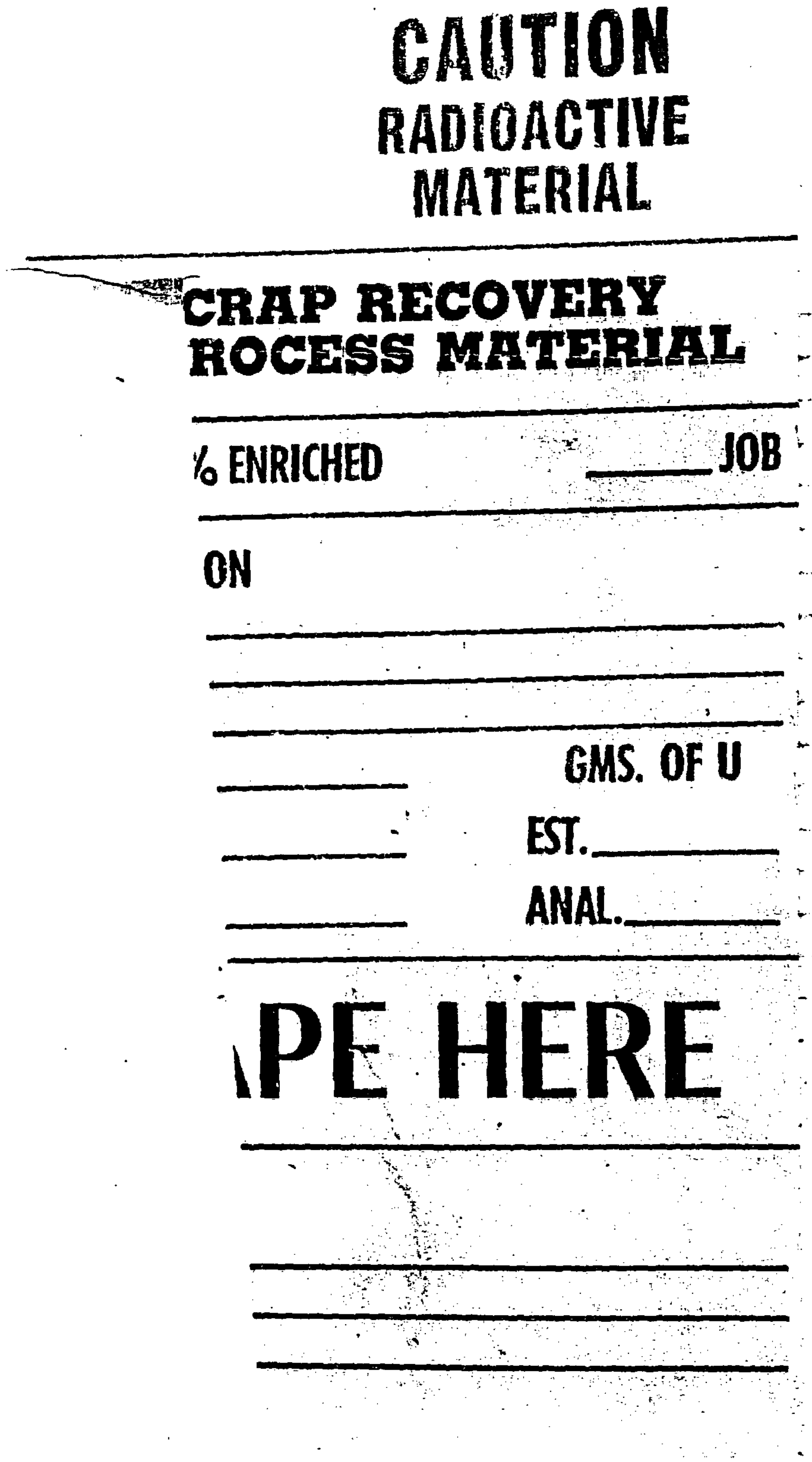
5. Bottle 11005 - This close-up shows the bottle in the "safe" cart nearest to the photographer in picture 4. It illustrates the method used for affixing the tag to the bottle, the type of tag used, the size of the sample bottle, and the way the sample tag is used.



6. Tower Room Stairwell - The doorway to the tower room stairwell is north of the evaporator-precipitator storage area. This picture, taken inside the stairwell area, shows Mr. Lindberg taking a picture of Tag No. 1 which was found on the floor of the tower room stairwell. Two rubber gloves were also found on the floor.



Tag No. 1 - This is a close-up of Tag No. 1 (Bottle "Y") and its plain yellow back which has penciled in column headings and a written description of the bottle contents. (A sample of each of the three tags found, was removed for activation analysis prior to taking the picture, hence the cut up appearance of the tags. When cutting off the sample, an attempt was made to avoid destruction of the writing on the tags.)


CAUTION
RADIOACTIVE
MATERIAL

CRAP RECOVERY
ROCESS MATERIAL

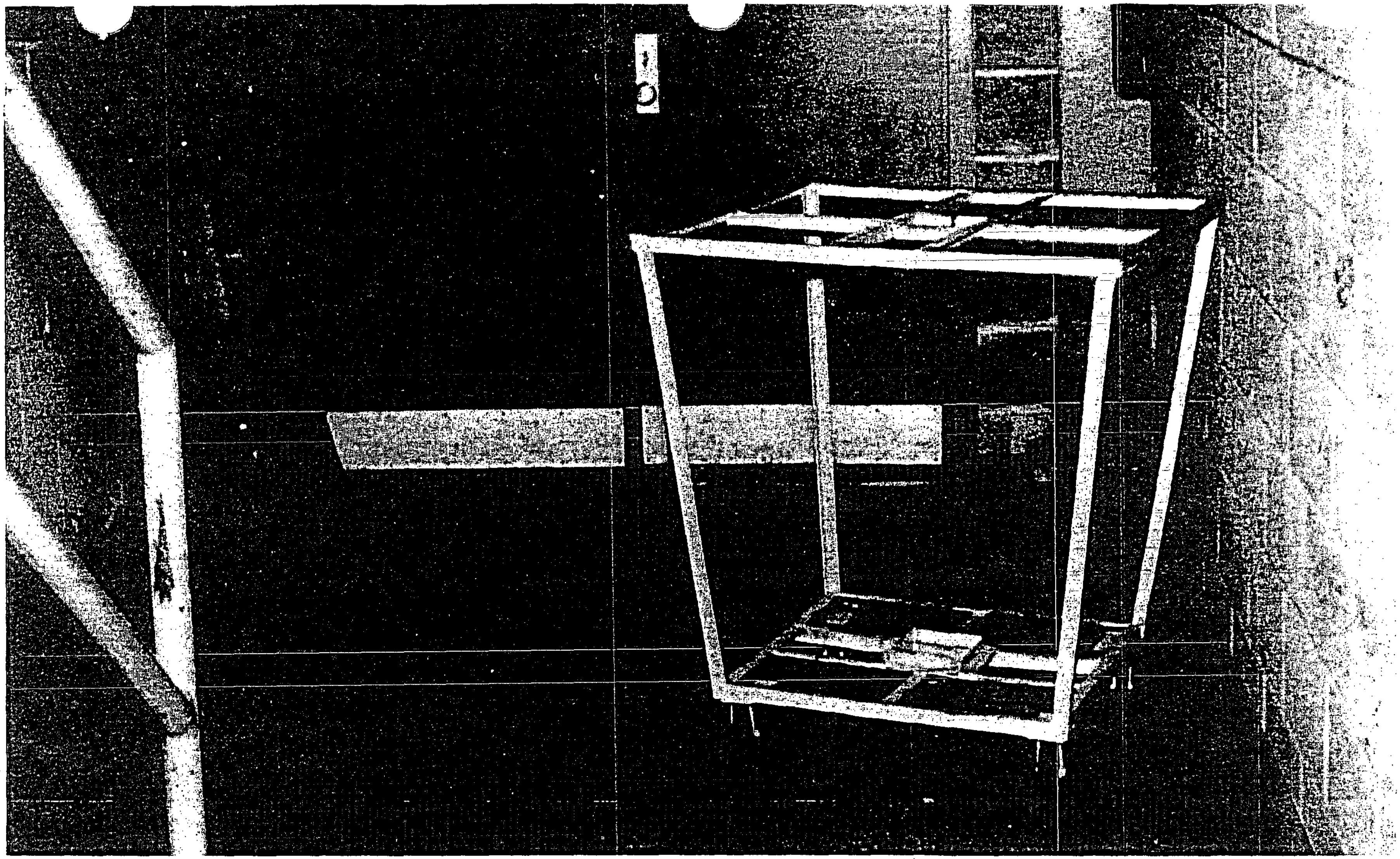
/o ENRICHED ______ JOB

ON

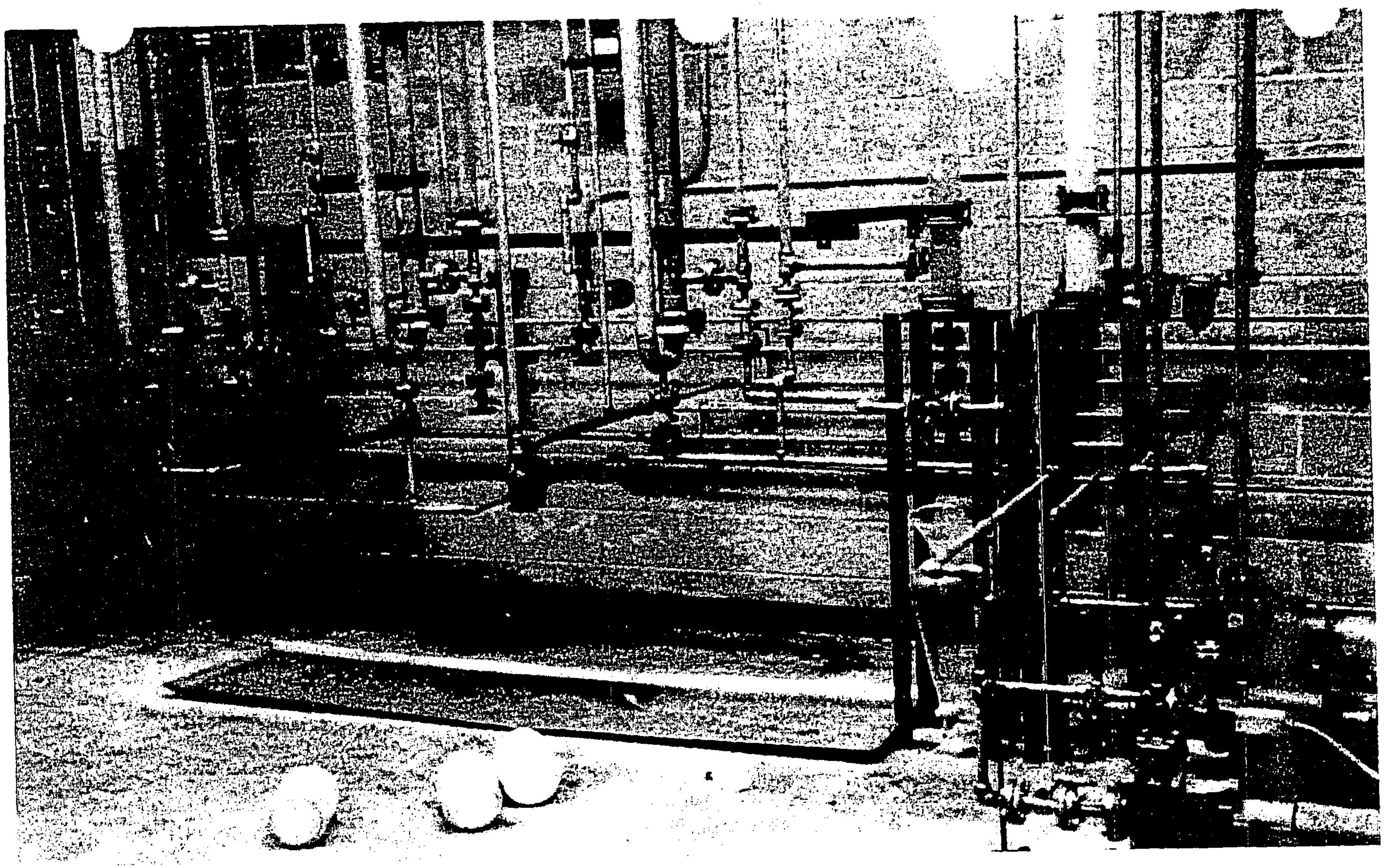
GMS. OF U
EST. ________
ANAL. ________

PE HERE

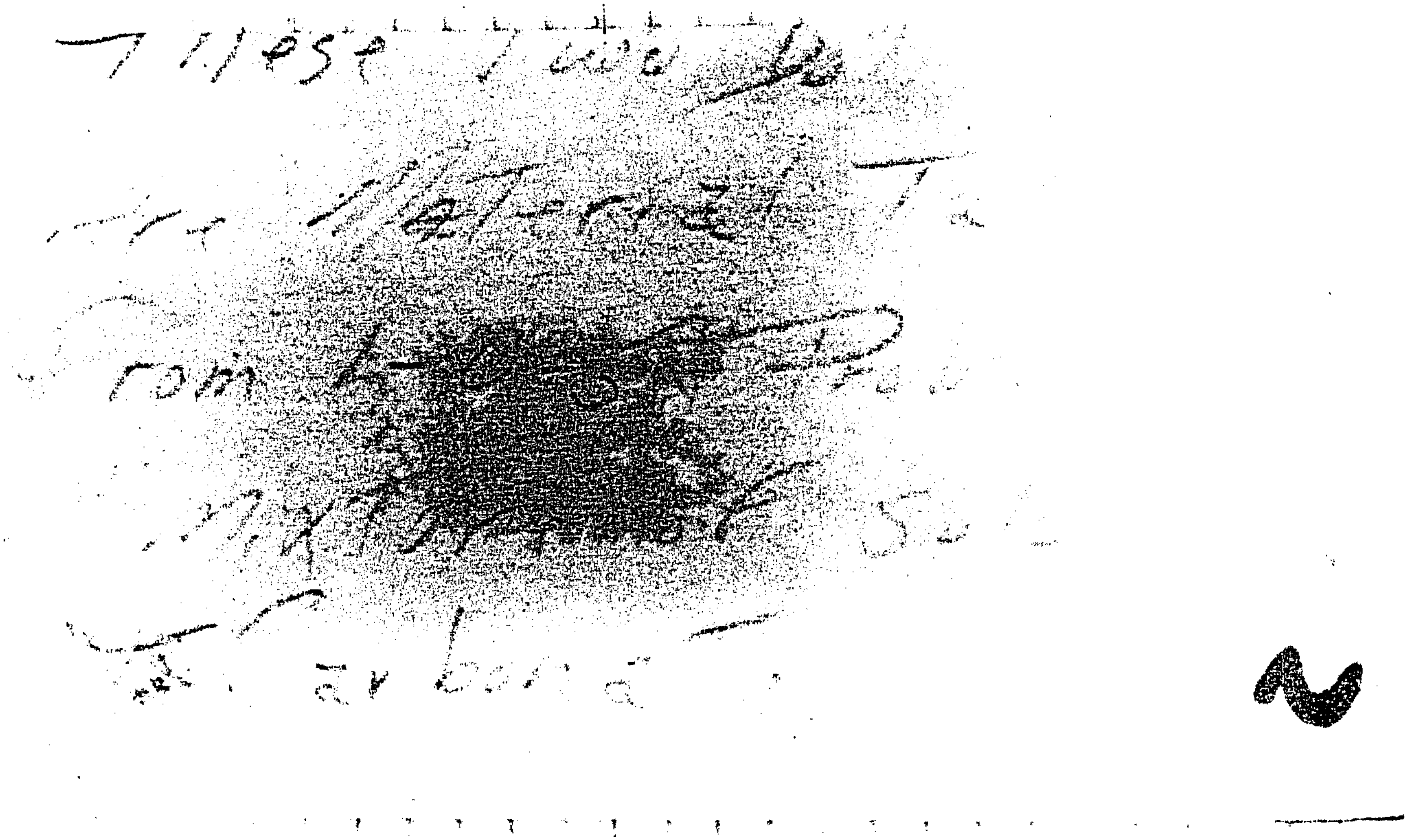
8. <u>Tag No. 1</u> - This picture shows the front of Tag no. 1 and the fact that no entries had been made on this side. The top one inch of the front side of the tag has a yellow background and the bottom portion has a red-orange background.



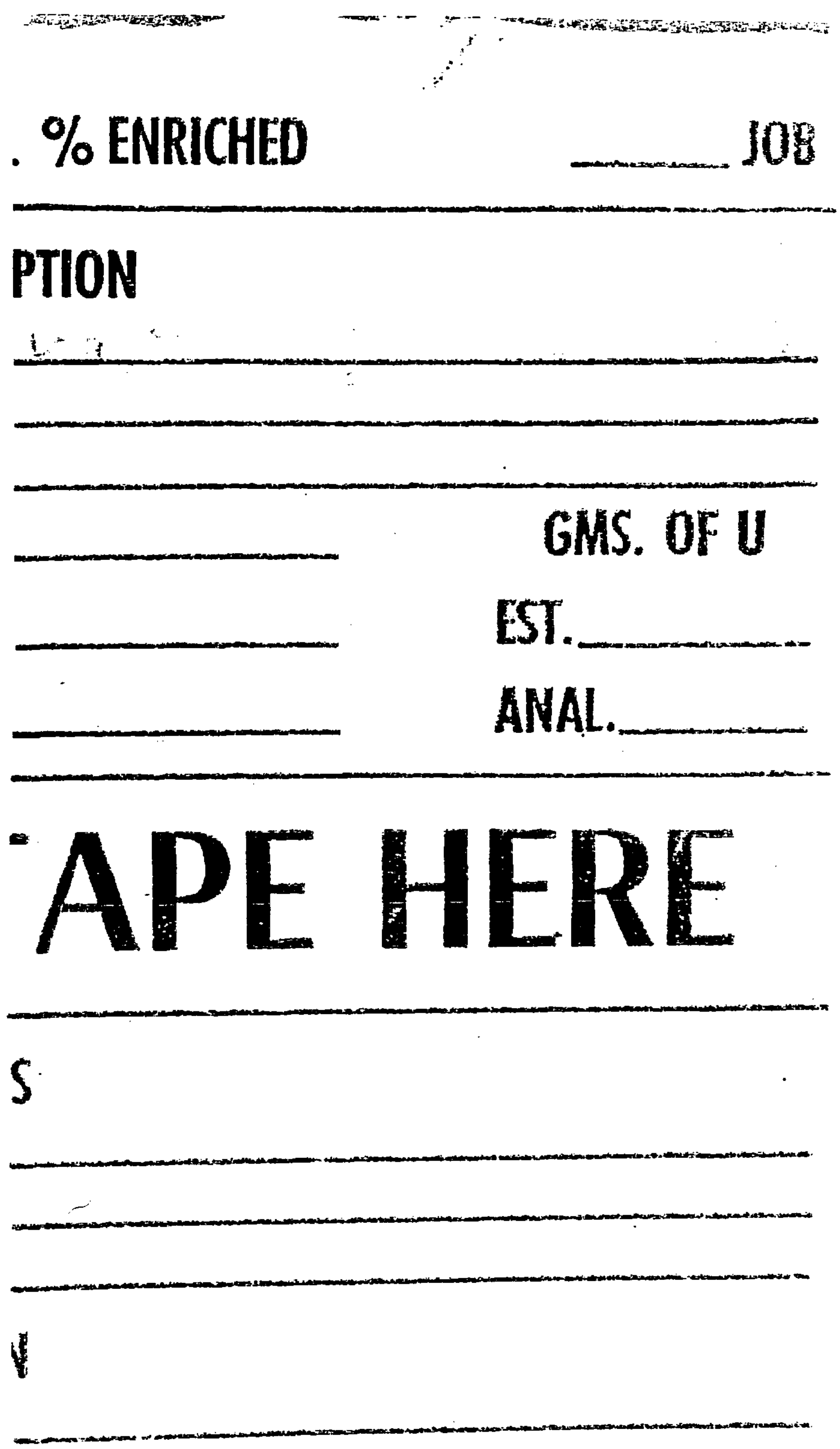
9. Empty "Safe" cart - This empty "safe" cart was found in the east portion of the first floor tower room stairwel[l] and is presumed to have contained the 11 liter bottle of uranium solution that was carried to the third floor of the tower room.



10. First Floor of the Tower Room - Looking north, three empty one-gallon bottles, a sponge, and a tag can be see on the first floor of the tower room. The tag is about 2' west of pump 1-P-32 and was designated Tag No. 2. Directly in line with the two liter separatory funnel, but above it, is the bottom of the TCE (Trichloroethan column, 1-C-10. Just to the right of the TCE column (east) is the organic wash column (1-C-9) which is still full of precipitate and solution that was involved in the nuclear incident.



11. Tag No. 2 - This is a close-up of the plain yellow back of tag no. 2 and shows the descriptive writing which covers essentially the whole tag area.


. % ENRICHED ______ JOB

PTION

GMS. OF U

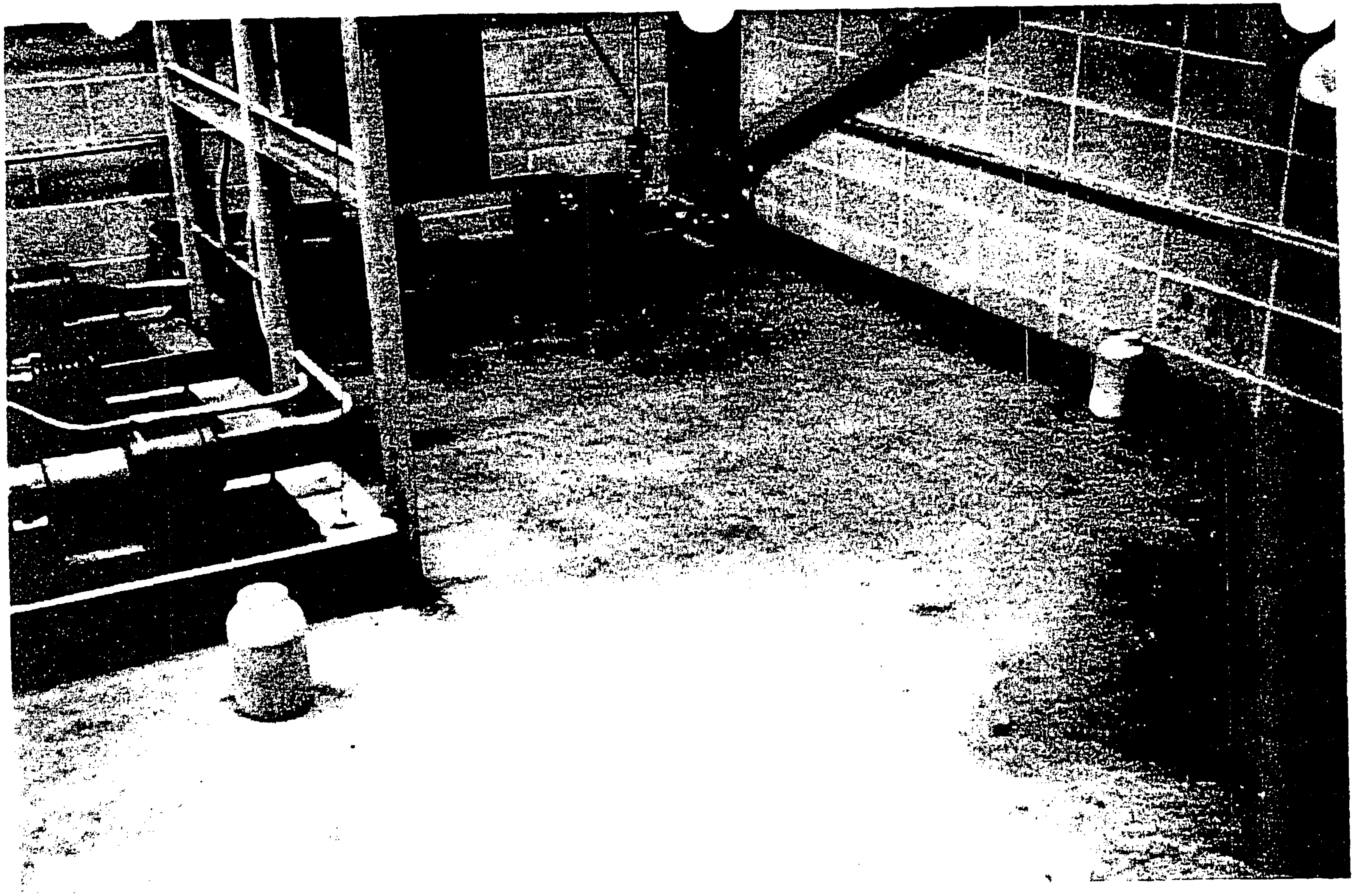
EST.

ANAL.

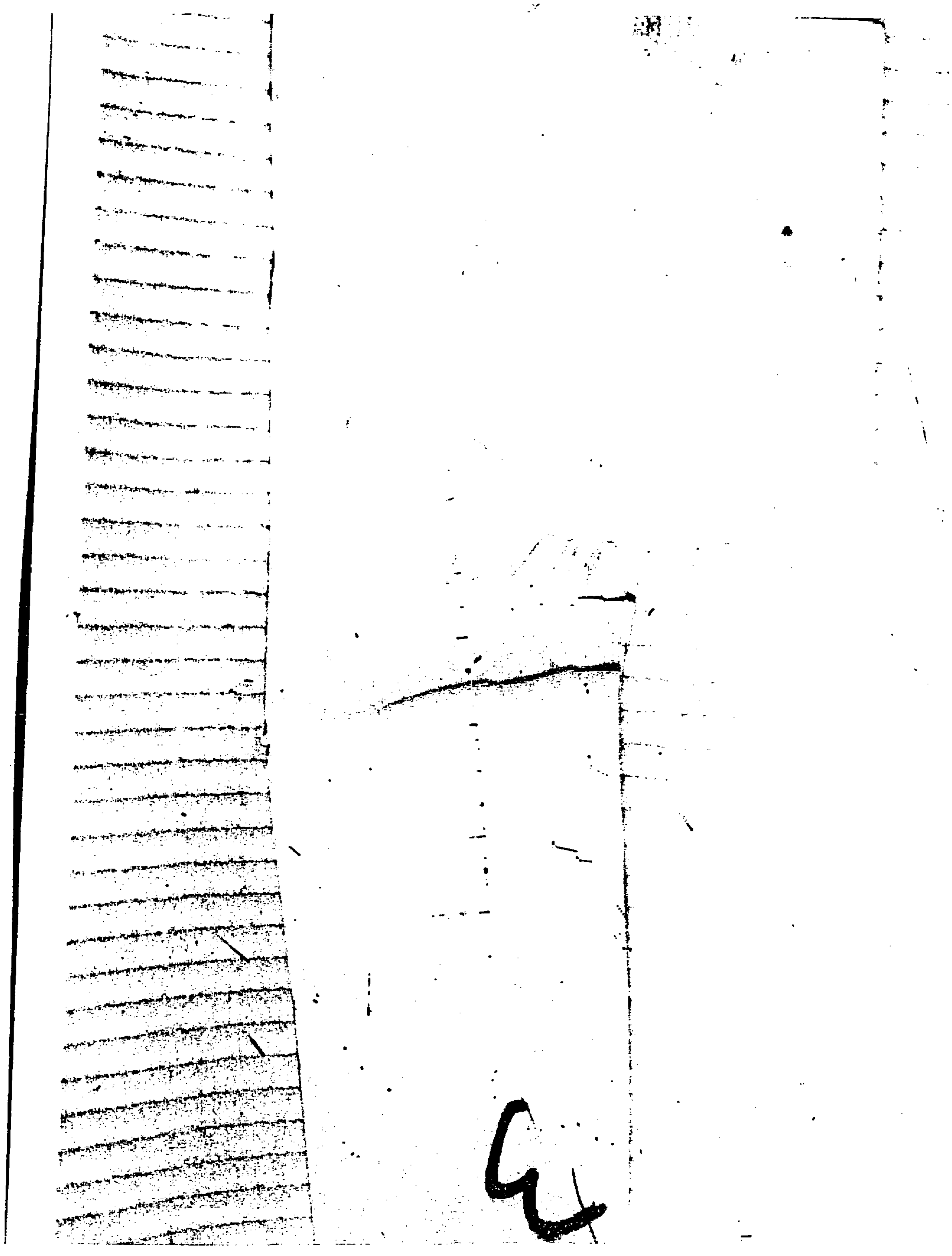
APE HERE

S

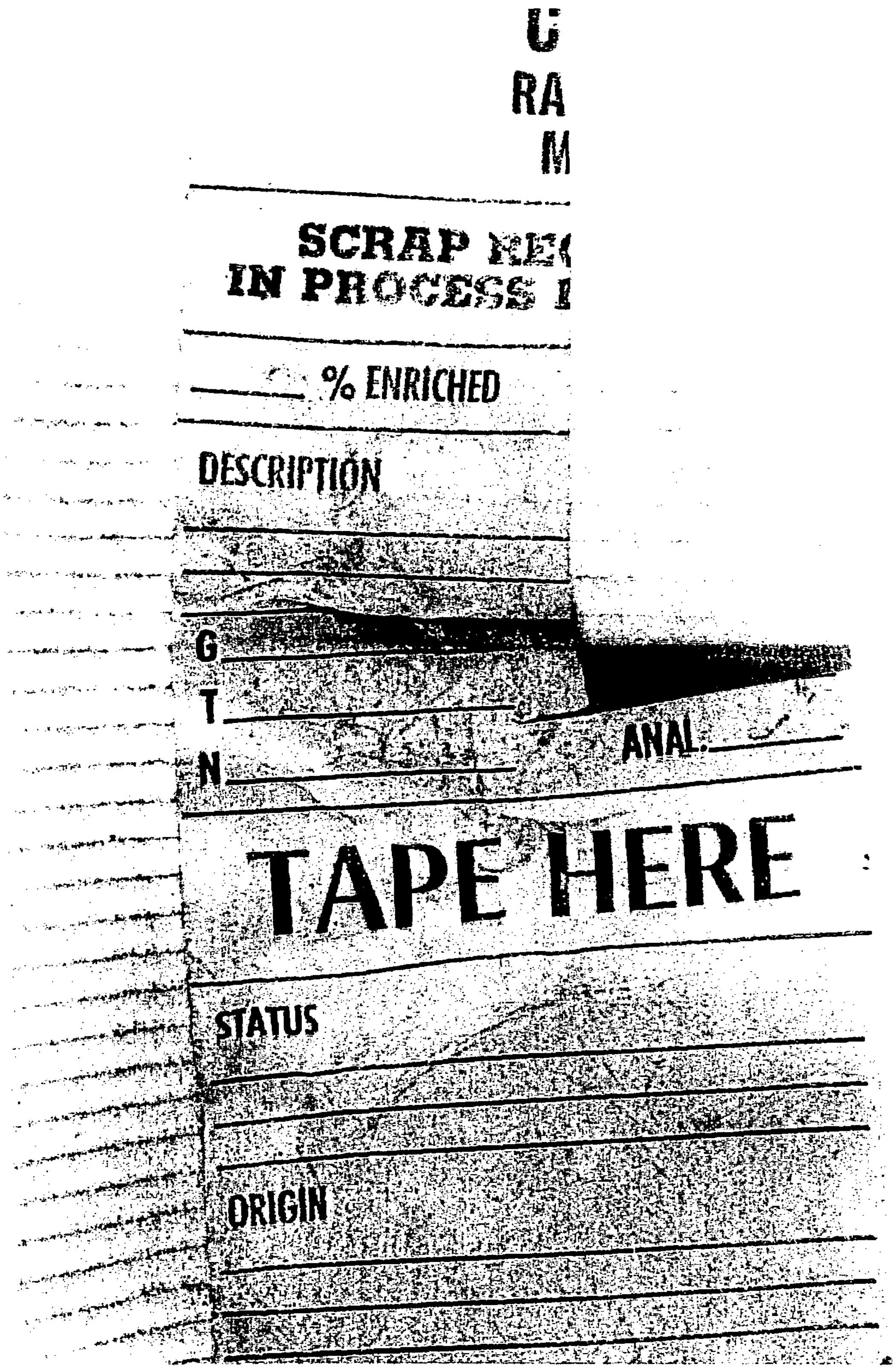
12. Tag No. 2 - This picture shows the front side of tag no. 2 and the entry that indicates the tag had previously been used on an evaporator sample.



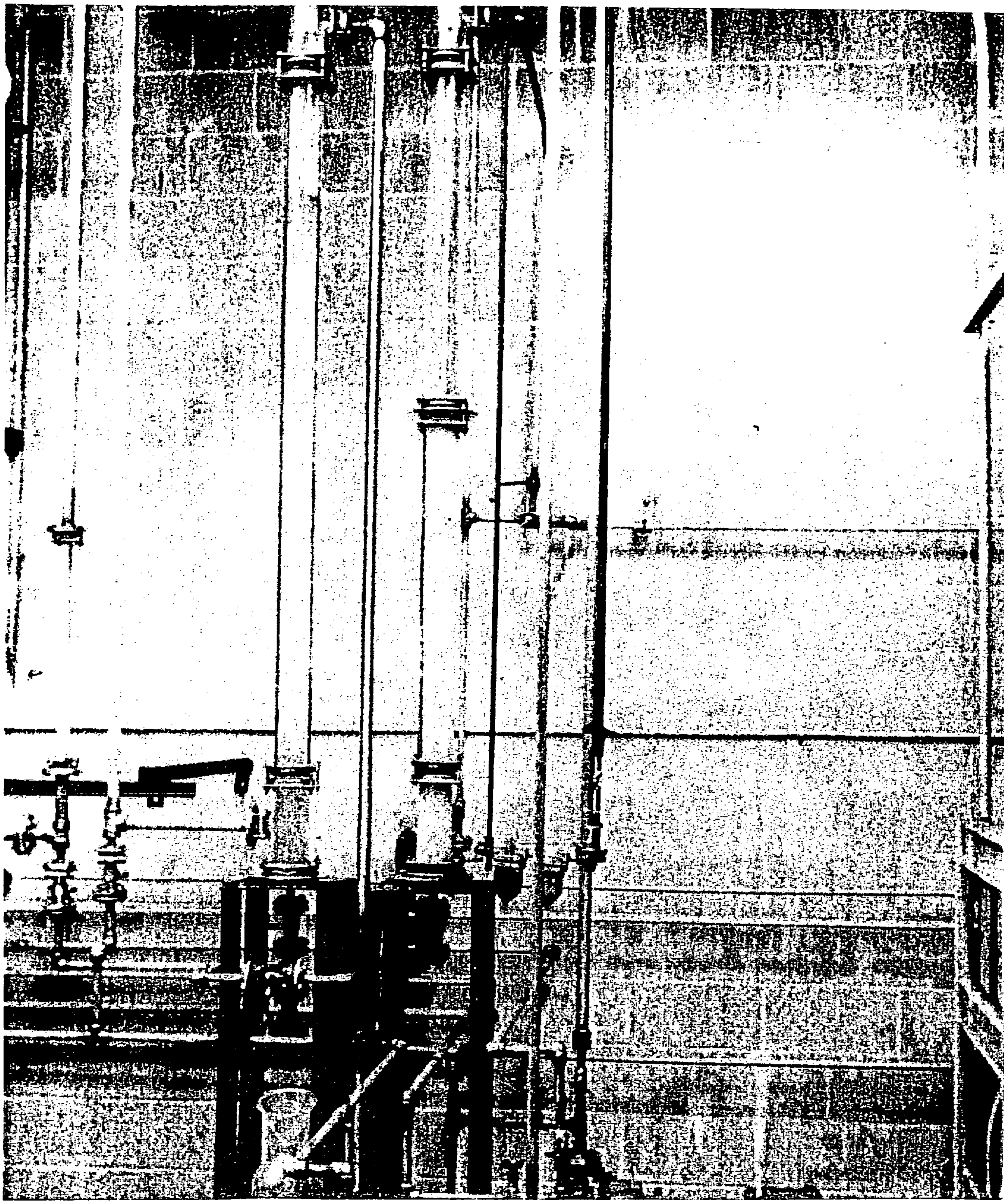
13. First Floor of the Tower Room - This shows the northeast portion of the first floor tower room. There is an open well above this area which goes to the top of the tower. Tag No. 3 was found on the floor, wetted with uranium solution that had splashed down the well from the third floor. The two one-gallon bottles contain solution that was drained from the 1-C-9 column before the incident material was drained from the sodium carbonate make-up tank (1-D-11) into the 1-C-9 column.



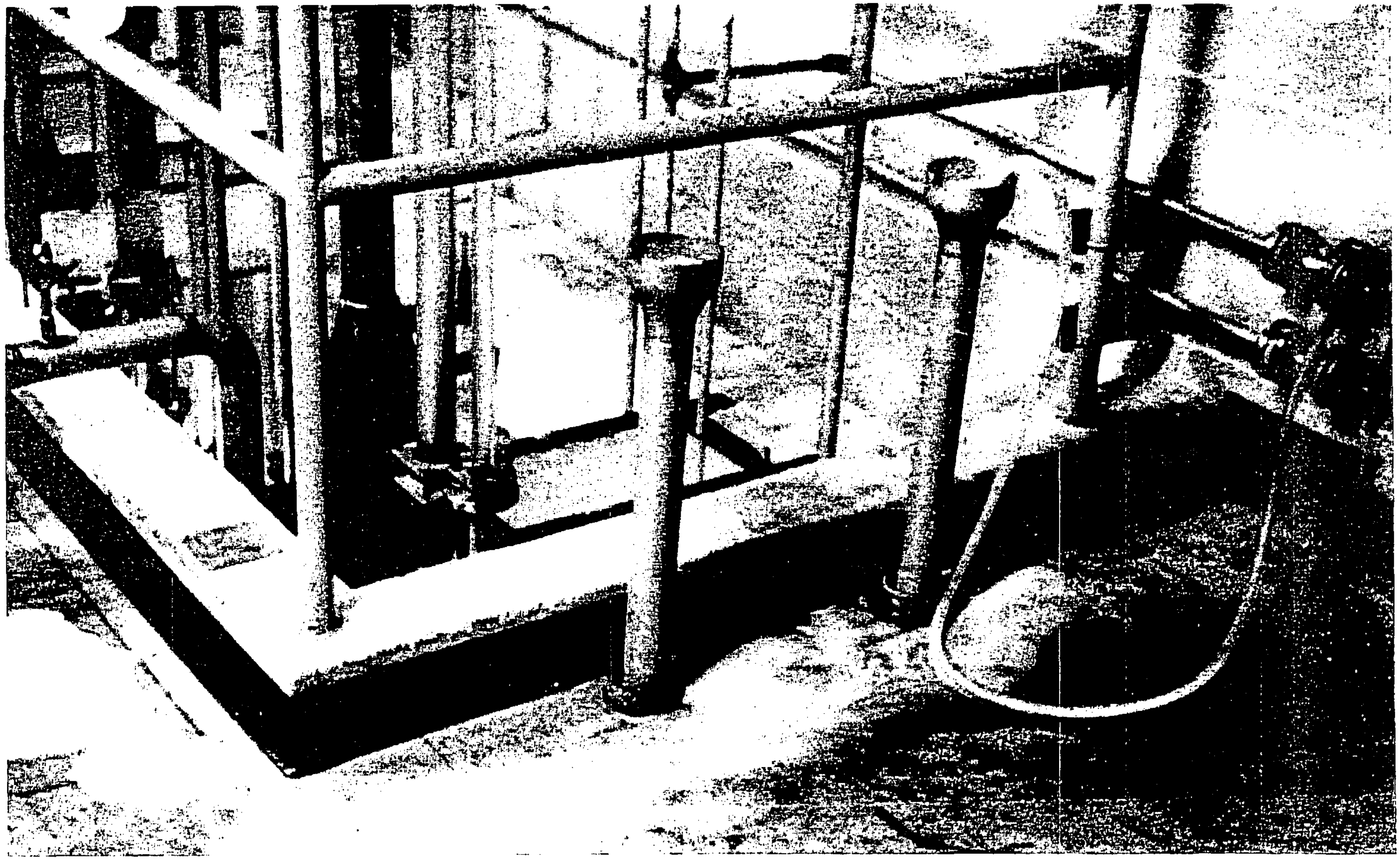
14. Tag No. 3 - This close-up shows the plain yellow back of tag no. 3 and the pencil writing on the tag.



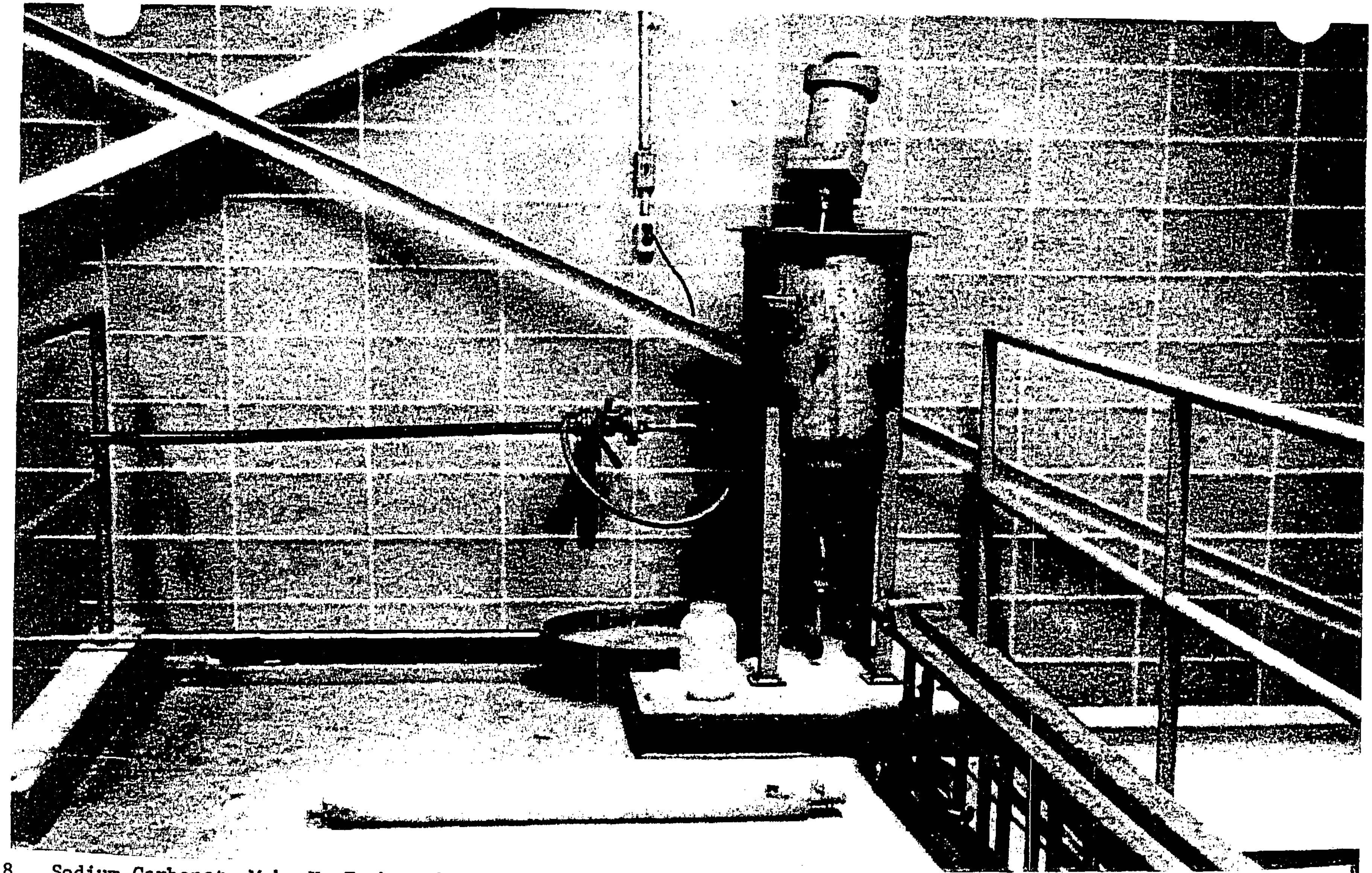
15. Tag No. 3 - This picture shows the front or red-orange background side of Tag No. 3. There is no writing on this side.



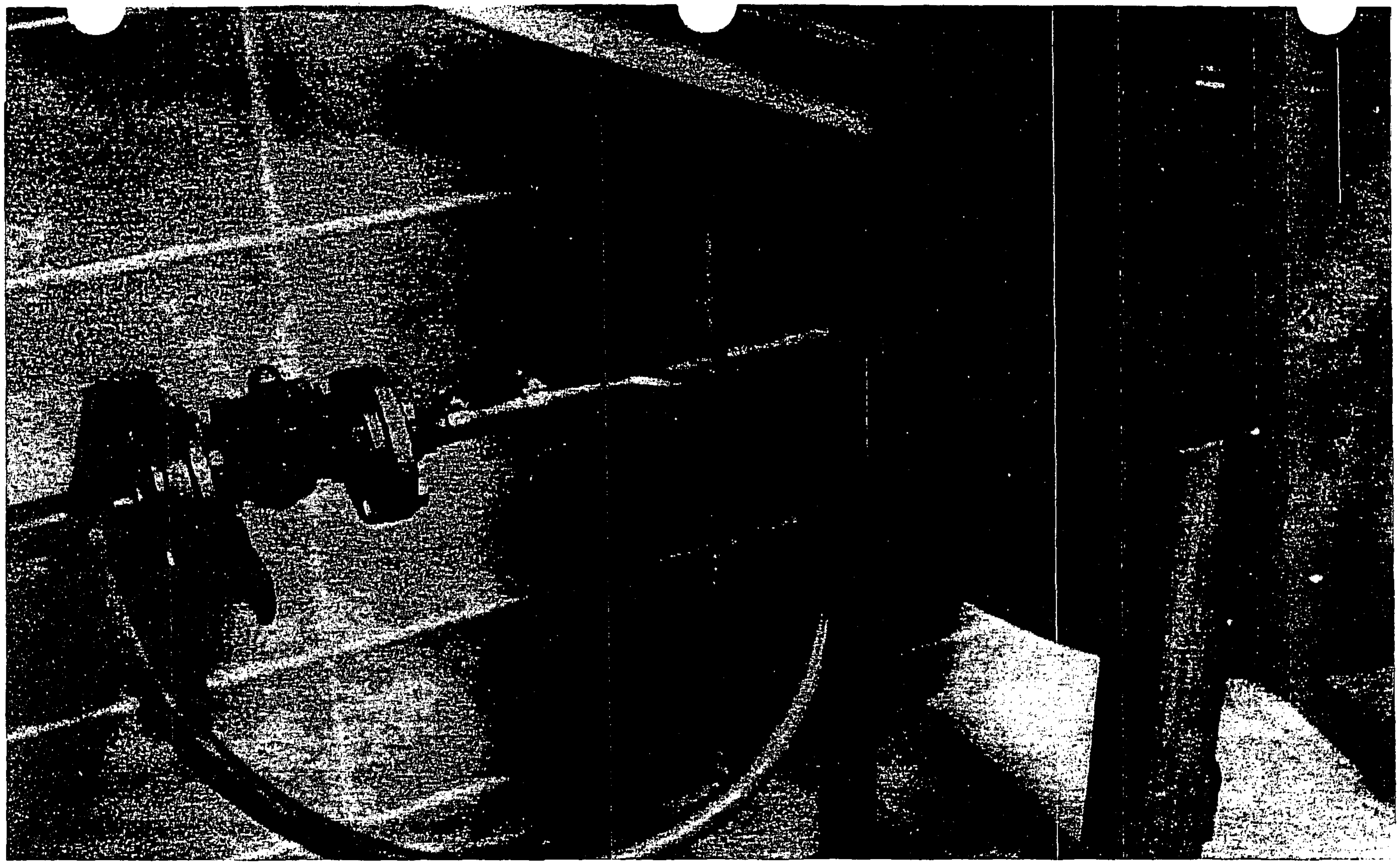
16. The TCE and Organic Wash Columns - This view of the columns shows the dirty TCE-aqueous interface of the TCE column (1-C-10) about a foot and a half from the overflow line, and the organic wash column (1-C-9) that is half full of precipitate. The organic wash column contains material involved in the nuclear incident.



17. Second Floor of the Tower Room - This picture taken at the second floor level of the tower room, looking north, shows the funnels for columns 1-C-10 and 1-C-9 with the tygon tube that is connected to the 1/2" pipeline from the third floor sodium carbonate make-up tank. There is a spill of uranium precipitate and solution on the floor, that occurred when the tubing flipped out of the funnel. The 1-C-9 (organic wash) column funnel is the one closest to the north wall and the 1-C-10 (TCE) column funnel is nearest to the photographer.

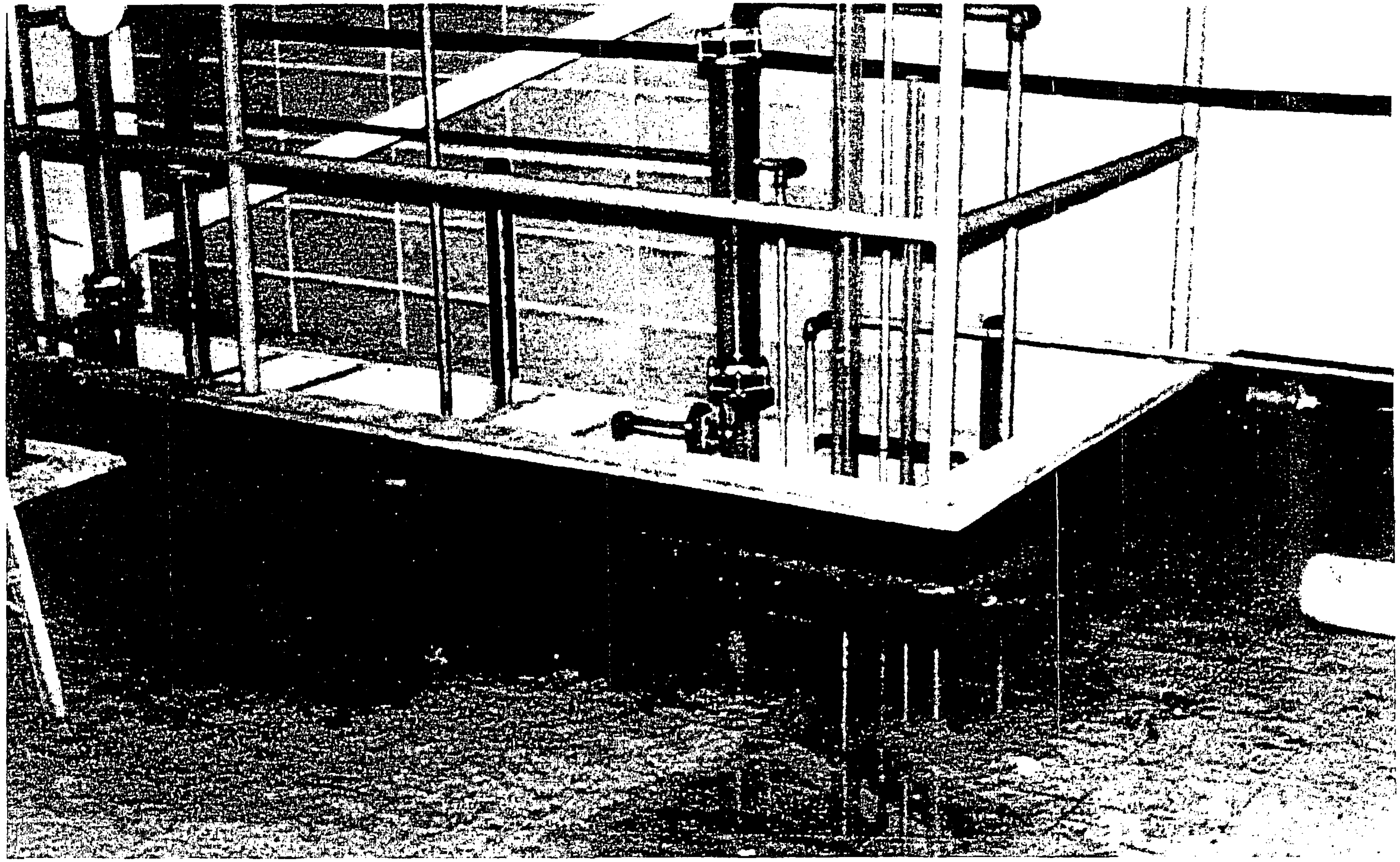


18. Sodium Carbonate Make-Up Tank - This picture, looking north, shows the sodium carbonate make-up tank (1-D-11) on the third floor of the tower room. This tank is the one where the nuclear incident occurred. The 11 liter bottle on the floor was originally found in the tank (about 2 hours after the incident occurred) with the bottom end facing west (to the left). The [illegible]tor was still running. Subsequently, the bottle was removed and the agitator turned off. The switch for [illegible]ator is just above the electrical outlet into which the agitator cord is plugged. Because of the pan, the one gallon bottle, the cap for the 11 liter bottle and the ladder, the only place that the operator could stand while pouring solution from the 11 liter bottle into the tank, is on the plat[illegible], directly in front of the tank.

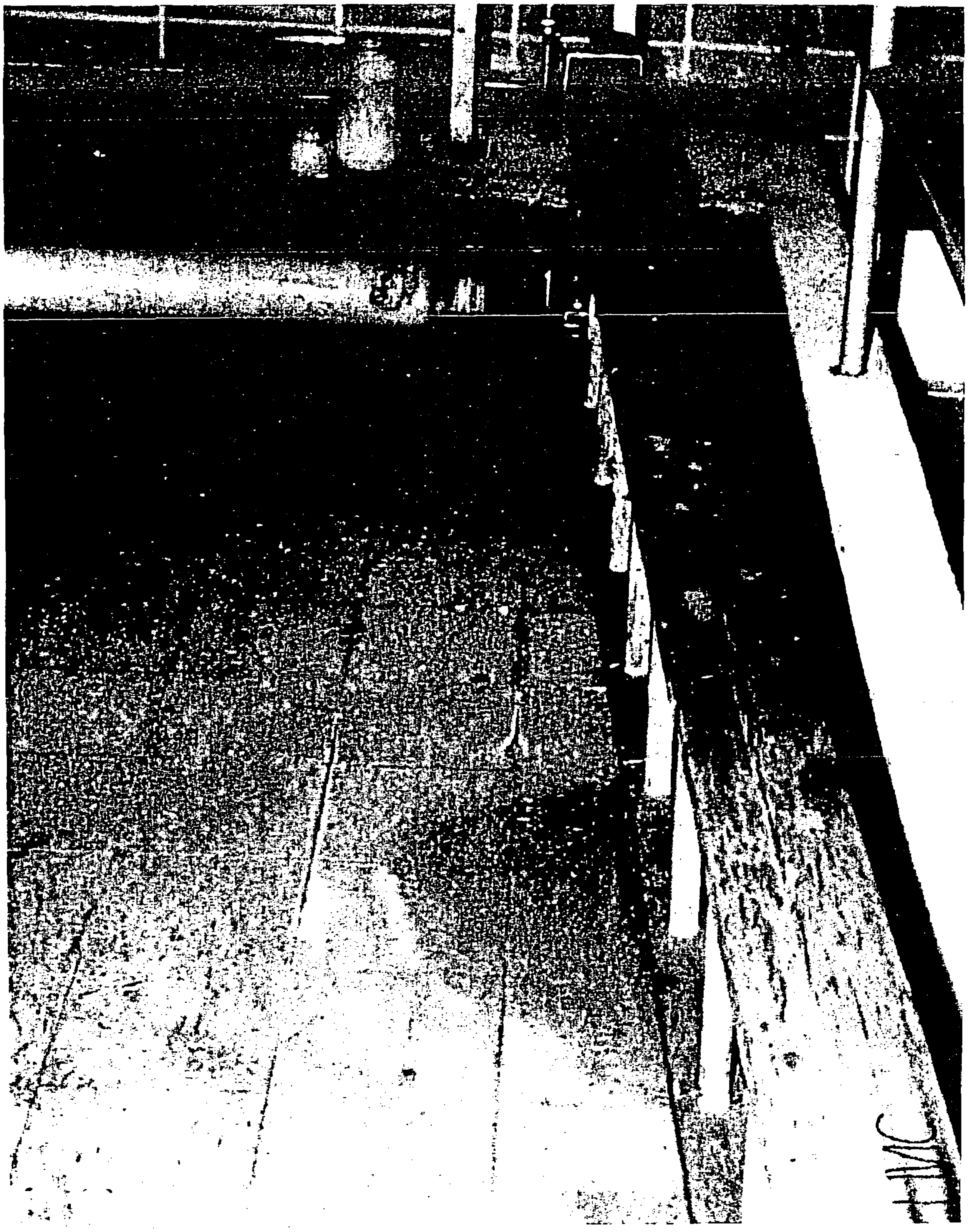


19. Sodium Carbonate Make-Up Tank - This close-up shows the sodium carbonate make-up tank (1-D-11) with the screwdriver in the angle iron tank support and the nearby hose clamp, both of which were later used for determining the fission yield of the nuclear excursion.

20. <u>Ceiling of Third Floor Tower Room</u> - This picture shows the fluorescent light fixture and ceiling of the third floor tower room. Uranium solution, plus some uranium precipitate, was expelled from the tank with sufficient force to splash it on the ceiling and light fixture. The ceiling is about 13-1/2' above the floor level.



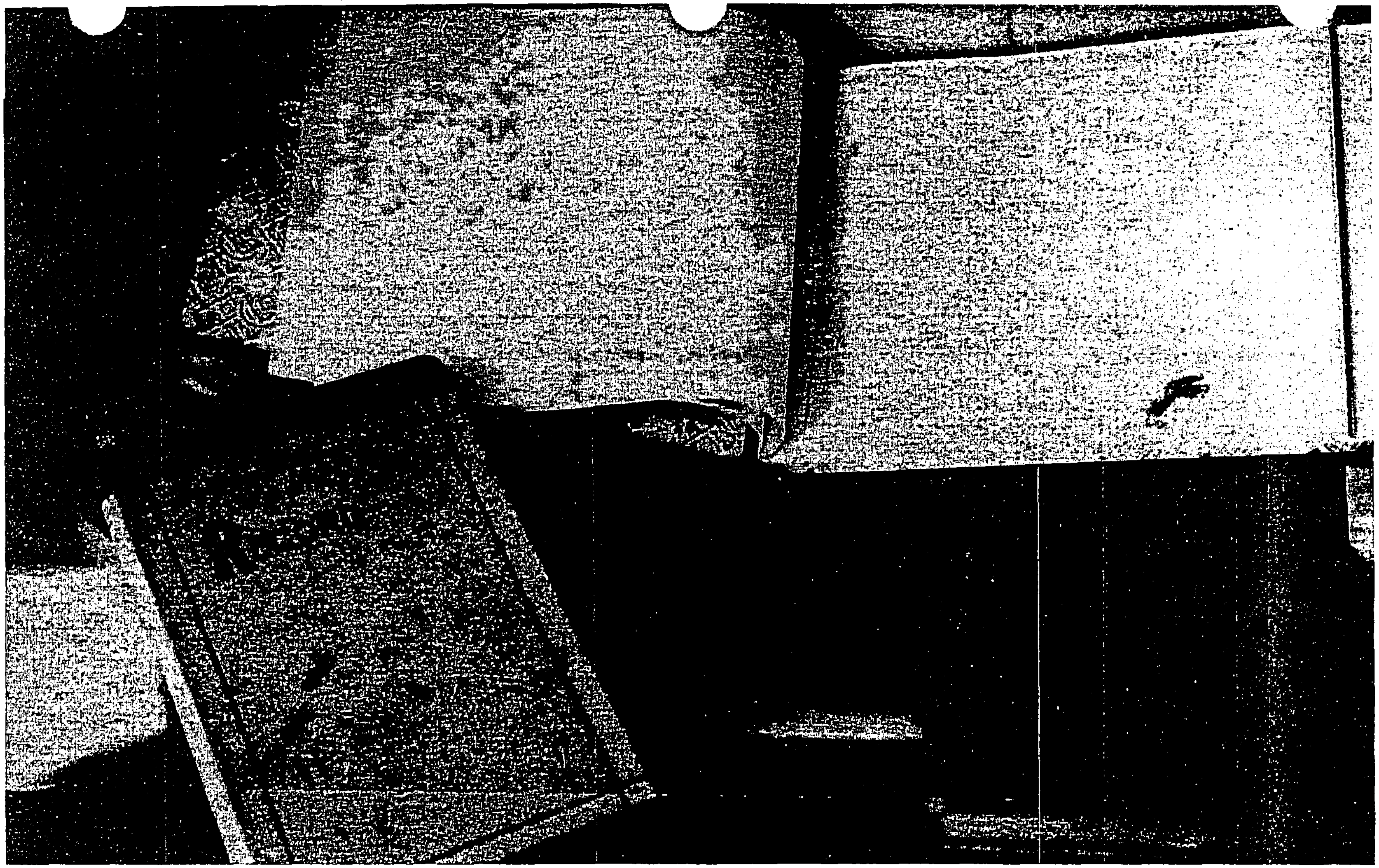
21. Solution on the Third Level Floor of the Tower Room - This picture taken on the third floor level of the tower room, shows part of the uranium solution that was expelled from the sodium carbonate tank. The solution had collected in a low spot of the tower room floor. The 11 liter bottle at the right edge of the picture is the same bottle shown in picture 18.



22. Solution on the Third Level Floor of the Tower Room - This picture shows the rest of the uranium solution (picture 21) that was found on the third level tower room floor. The 11 liter bottle at the top of the picture is the same bottle shown in picture 18.

23. First Floor Process Area, Central Section - This picture was taken after decontamination work had been started and shows the area between the stainless steel dissolver (right) and the process hoods (left). The one gallon bottles on the floor contain both concentrated (up to 40 g/l) and low concentration (less than 5 g/l), uranium solutions from the decontamination effort. The tall hoods at the far (east) end of the area do not contain any process equipment as yet.

24. First Floor Process Area, North Section - This picture was taken after decontamination work had been started and shows the area north of the process hoods. The large tank in the top center of the picture (along the north wall) is the extractor feed tank (1-D-41) and east of it is the incinerator. Behind the partially open sliding door is the pickle liquor receiving area and the waste neutralization tanks. The one gallon bottles on the floor contain solutions that are primarily low concentration (less than 5 g/l) uranium solutions from the decontamination effort.



25. Record Books - This picture shows the sample record book (Book No. 1) the Supervisor's Log, the Operator's Log (Book A) and the analytical log. These were the primary sources of information about process conditions bottle contents, and uranium solution concentrations.