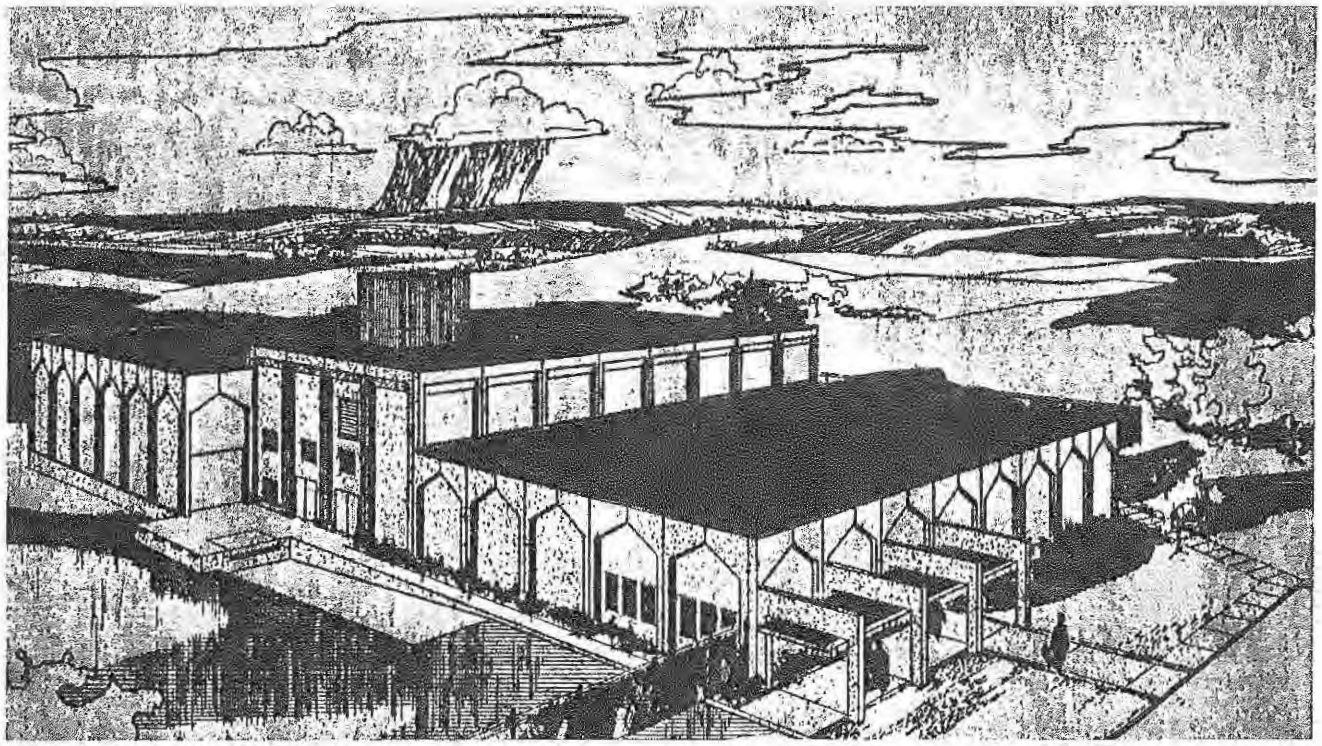


REPORT NO. 6

DECONTAMINATION AND DECOMMISSIONING OF THE KERR-McGEE CIMARRON PLUTONIUM FUEL PLANT

THIS FINAL REPORT NO. 6 IS PREPARED AND SUBMITTED AS A TASK I REQUIREMENT AND COMPLETES THE TASKS FOR CONTRACT DE-AC06-83RL 10382.

U. S. DEPARTMENT OF ENERGY
RICHLAND OPERATIONS OFFICE
P. O. BOX 550
RICHLAND, WASHINGTON 99352

REPORT NO. 6

DECONTAMINATION AND DECOMMISSIONING OF THE CIMARRON CORPORATION'S CIMARRON MIXED OXIDE FUEL PLANT.

THIS FINAL REPORT NO. 6 IS PREPARED AND SUBMITTED AS A TASK I REQUIREMENT AND COMPLETES THE TASKS FOR CONTRACT DE-AC06-83RL 10382.

to the

U. S. DEPARTMENT OF ENERGY
RICHLAND OPERATIONS OFFICE
P. O. BOX 550
RICHLAND, WASHINGTON 99352

Prepared by

CIMARRON CORPORATION
P. O.BOX 315
CRESCENT, OKLAHOMA 73028

Report No. 6

Decontamination and Decommissioning of the Kerr-McGee Cimarron

Plutonium Fuel Plant.

ERRATA SHEET

Page 51 Air Effluent Monitoring

The narrative states that the total gross alpha is measured in microcuries per milliter which is correct. The table listing is written as millicuries per milliter which is incorrect.

[signature]
12/20/88

CONTENTS

APPENDIX

ABSTRACT

This final report is a summary of the events that completes the decontamination and decommissioning of the Cimarron Corporation's Mixed Oxides Fuel Plant (formally Sequoyah Fuels Corporation and formerly Kerr-McGee Nuclear Corporation - all three wholly owned subsidiaries of the Kerr-McGee Corporation). Included are details dealing with tooling and procedures for performing the unique tasks of disassembly decontamination and/or disposal. That material which could not be economically decontaminated was volume reduced by disassembly and/or compacted for disposal. The contaminated waste cleaning solutions were processed through filtration and ion exchange for release or solidified with cement for L.S.A. waste disposal.

The L.S.A. waste was compacted, and stabilized as required in drums for burial in an approved burial facility. T.R.U. waste packaging and shipping was completed by the end of July 1987, this material was shipped to the Hanford, Washington site for disposal.

The personnel protection and monitoring measures and procedures are discussed along with the results of exposure data of operating personnel.

The shipping containers for both T.R.U. and L.S.A. waste are described.

The results of the decommissioning operations are reported in six reports which are titled as follows:

Report No. 1 - Design and use of Plasma Arc cutting equipment.

Report No. 2 - Technical recommendations in the design and operation of a plutonium fuel fabrication facility to facilitate decontamination and decommissioning.

Report No. 3 - Technique for liquid decontamination of equipment.

Report No. 4 - Nondestructive Assay (NDA) techniques and procedures.

Report No. 5 - Determination of the quantity and locations of the plutonium retained in the Cimarron Fuel Plant Systems.

Report No. 6 - Decontamination and decommissioning of the Kerr-McGee Cimarron Plutonium Fuel Plant.

The personnel protection and monitoring measures and procedures are contained and discussed along with the results of exposure data of operating personnel in this final Report No. 6.

All of the above six reports were prepared by Walter H. Spencer, Sr. Project Engineer Cimarron Facility.

ACKNOWLEDGMENTS

This series of reports documents work which reflects the collective efforts of the Cimarron Facility. Employees maintained the plant environment in the acceptable range of contamination levels during the disassembly and decommissioning of the plant production tooling and manufacturing equipment. This was a tireless monumental effort, and deserves much recognition for a difficult job well done.

Special recognition goes to Messrs. J. Kegin, Maintenance Supervisor, W. Rogers, Decon Supervisor, V. Richards, Decon Supervisor, and W. Rhodes Decon Supervisor, for their contributions to the fabrication of special tooling and instrumentation developed and used during the decommissioning operations.

Special recognition was earned by Mr. R. Fine, Health & Safety Supervisor, for procedures developed and for supervision of the Health Physics Department which was responsible for contamination control and safety of the decommissioning operators. Mr. C. Thompson, Health Physics Specialist, is recognized for the N.D.A. records and assay results that were compiled for the reports.

A special thank you goes to Mr. Wayne Norwood, Plant Manager, who contributed guidance and council in all phases of the decommissioning operations and to the text and proof reading of the reports.

A special thank you goes to Mr. Ron Adkisson, Director of Cimarron Operations, for his contributions to the outlines and editorial portions of these reports.

A very special thank you to Mrs. Ruth Jones and Mrs. LaVonna Smith Administrative Clerks, who typed countless pages of draft copy of these reports.

EXECUTIVE SUMMARY

Cimarron Corporation (formerly Kerr-McGee Nuclear Corporation and formerly Sequoyah Fuels Corporation) has essentially completed the decontamination and decommissioning of the Cimarron Mixed Oxide Fuel Fabrication Plant.) This plant contained the chemical process apparatus and manufacturing tooling and procedures to fabricate mixed oxide(PuO_2UO_2) fuel pins for the (ZPPR) Zero Power Plutonium Reactor and the (FFTF) Fast Flux Test Reactor programs. The plant also contained the necessary analytical and inspection capabilities for performing the required quality control functions.

The process started with plutonium nitrate feed solution provided by the Department of Energy(DOE) and uranyl nitrate solution provided by Kerr-McGee. The nitrate solutions were weighed and mixed in proportion, processed into powder, compacted into shape(right cylinders) and sintered into ceramic pellets. The pellets were ground to size, inspected and loaded into tubes and encapsulated by welding end plugs in the tubes which completed the pins. The completed pins were inspected for a multitude of attributes, the acceptable pins were supplied to others for (wire wrap) further fabrication and assembly into fuel elements or bundles for installation into the reactor. These campaigns were successfully completed.

INTRODUCTION

This report presents the results of decontamination and decommissioning program at the Cimarron Mixed Oxide Fuel Fabrication Plant. The primary purpose of this report is to describe the operations and provide information and procedures used to safely decommission a mixed oxide plant, and to provide pertinent information of interest to the Department of Energy which funded these reports.

Decontamination and decommissioning of the Cimarron Facility can be defined as the measures taken to terminate the facility's nuclear operations and decontaminate the building and grounds for other endeavors that are of interest to the Kerr McGee Corporation.

The Cimarron Facility is located 1/2 mile north of the Highway junction of 33/74 which is five miles south of Crescent, Oklahoma. The mixed oxide plant was in operation approximately five years, during that time the ZPPR and FFTF fuel pins were fabricated. Those contracts were successfully completed. When follow-on contracts were not obtained the plant was shut down in 1975. Currently the decontamination and decommissioning operations are nearing completion.

The Department of Energy(DOE) is interested in the technology of decontamination and decommissioning(D&D) of this and other plants. The D.O.E. plans to apply the technology developed during the D&D of this plant to other similar D.O.E. installations. There is limited information and experience available in mixed oxide fuel fabriation plant decommissioning. The Cimarron plant was unique because it had the added apparatus for coprecipitation of the nitrate solutions of Plutonium and Uranium. This required liquid handling equipment rather than the sophisticated dry mixing equipment required for powder blending. Powder blending is a complicated process for oxides of Plutonium and Uranium because the oxide particles are clinker shaped, they do not flow or mix well, plus they are abrasive. Inconsistent mixed powder produces hot spots in the fuel pins during operation due to non-homogeneity of the powder. The blending of batches of coprecipitated powder is not as difficult because each powder particle is a combination of the solutions which were mixed prior to the coprecipitation phase of the manufacturing process.

This is the last in a series of six reports which were prepared in accordance with terms and requirements of the United States Department of Energy Contract No. DE-AC06-85RL10382. This report deals with decontamination and decommissioning of the tooling, building,and site to acceptable levels of radioactivity in accordance with NRC requirements for unrestricted use of the decommissioned facility and property.

HISTORY

Kerr-McGee acquired uranium ore claims and mines in northeast Arizona in 1952, by 1963 Kerr-McGee held an AEC license for Special Nuclear Material. Early in 1970 the company had completed the construction of a Mixed Oxide Fuel Fabrication plant, installed the processing equipment and assembled a trained staff of operating personnel for manufacturing mixed oxide U/Pu fuel for power reactors. The AEC authorized the operation of the plant in April 1970.

The plant is located on a 1,000 acre site overlooking the Cimarron River which is the north boundry. The entrance to the plant is on Highway 74 one-half mile north of Highway Junction 33/74 five miles south of Crescent, Oklahoma. A current map illustrating the property lines and building locations.(Vicinity map) is attached. (Figure 1)

The Mixed Oxide plant is constructed of precast, prestressed concrete exterior walls and roof panels. A concrete floor was poured in place after the precast panels were erected. The roof construction is mopped on asphalt with build up felt roofing insulation plus gravel cover. The building panels are of sandwich construction with insulation cast in place. The walls are erected on grade beams supported on drilled and belled piers. All exterior and interior joints in the precast structure are felted and caulked to make the building air tight.

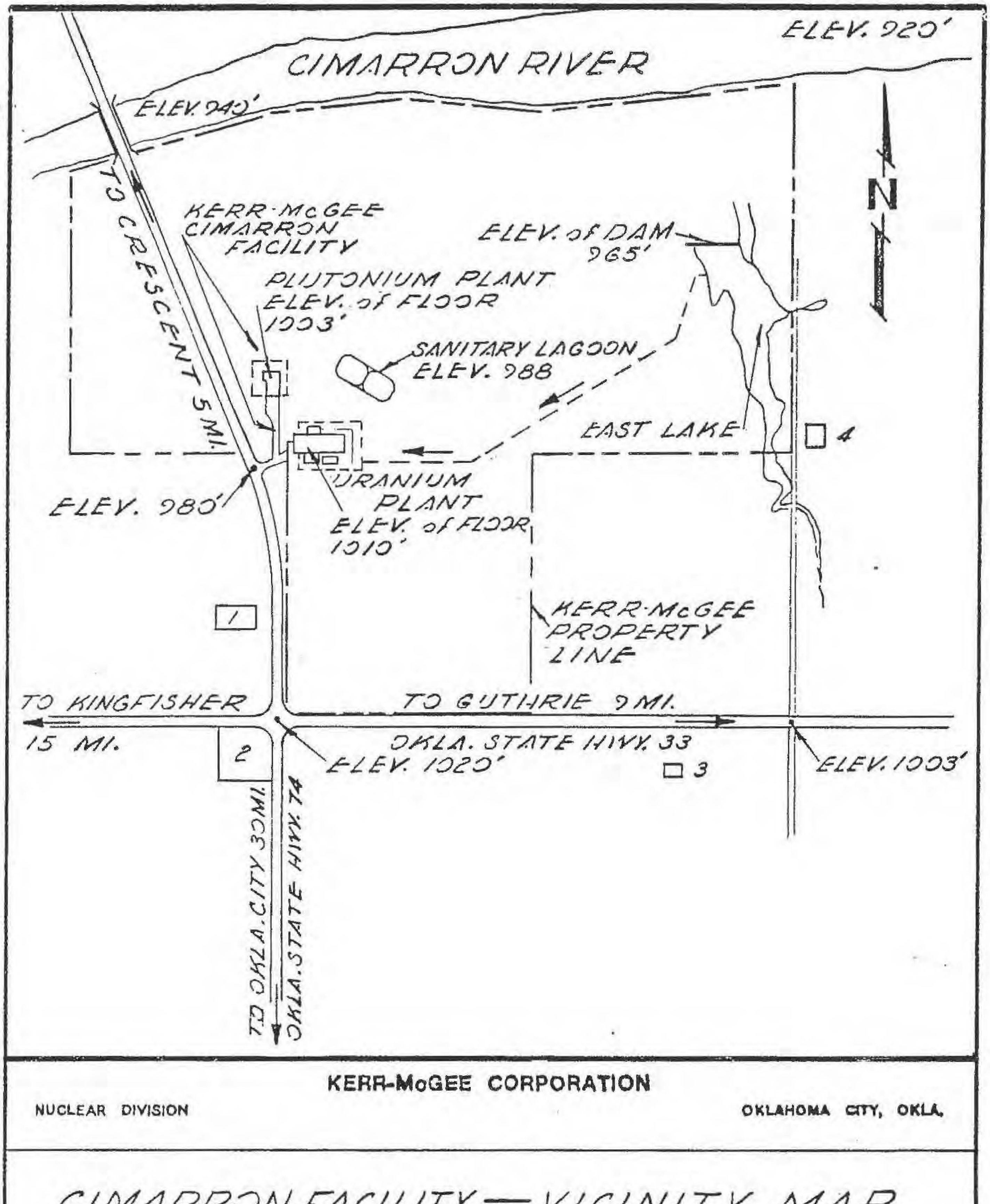

ELEV. 920'
CIMARRON RIVER
ELEV. 940'
TO CRESCENT 5 MI.
KERR-McGEE CIMARRON FACILITY
ELEV. of DAM 965'
PLUTONIUM PLANT ELEV. of FLOOR 1003'
SANITARY LAGOON ELEV. 988
EAST LAKE
4
URANIUM PLANT ELEV. of FLOOR 1010'
ELEV. 980'
1
KERR-McGEE PROPERTY LINE
TO KINGFISHER 15 MI.
TO GUTHRIE 9 MI.
OKLA. STATE HWY. 33
2
ELEV. 1020'
3
ELEV. 1003'
TO OKLA. CITY 30 MI.
OKLA. STATE HWY. 74
KERR-McGEE CORPORATION
NUCLEAR DIVISION
OKLAHOMA CITY, OKLA.
CIMARRON FACILITY — VICINITY MAP

FIGURE 1

The walls and ceiling in the production and laboratory rooms were painted to improve the surface finish for easier cleaning. The floor in all areas except the office and lunch room were coated with a ceramic granular aggregate contained in an inorganic ceramic covering and then painted with an Amercoat paint system. The building and floor plan are illustrated in exploded view of Figure 2.

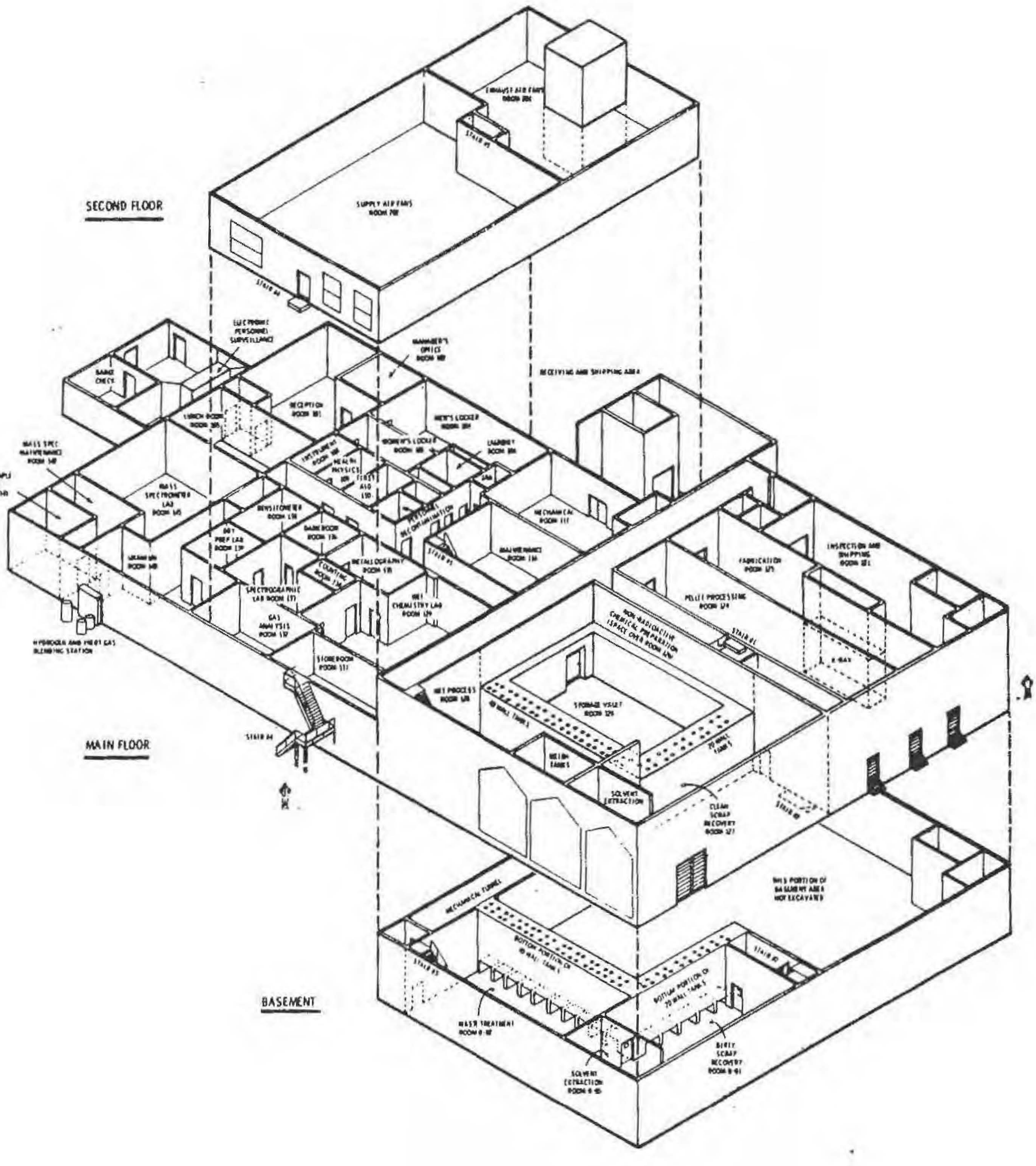


FIGURE 2

PROCESS DESCRIPTION

Block outline, figure 3 illustrates the production system sequentially so that the logic of the operations can be visually understood, however there are some subtle features that are better understood by description: For example, it was discovered that weighed and blended solution performed much better through the coprecipation and filtration process when the solution was allowed to age in the wall storage tanks a day or more. It was also discovered that uniform powder was required to control pellet density and size. Powder from several batches mixed with powder reprocessed from clean scrap operations usually had different pressing characteristics due to variations in particle size and other attributes, as a result it was necessary to add the operations of pressing this powder into biscuits or slugs and then granulate these green powder slugs into a more uniform powder particle size for production press feed stock. It was also developed that processing the slugging press pellets through a warm calciner $100^{o}C \pm 10^{o}$ with dry nitrogen purge gas was beneficial in driving off any moisture that may have accumulated in the green powder slugs. Virgin powder batches did not always require these added operations.

The completed pellets were batch loaded in molybdenum boats for sintering in a (cracked amonia) hydrogen-nitrogen reducing atmosphere.

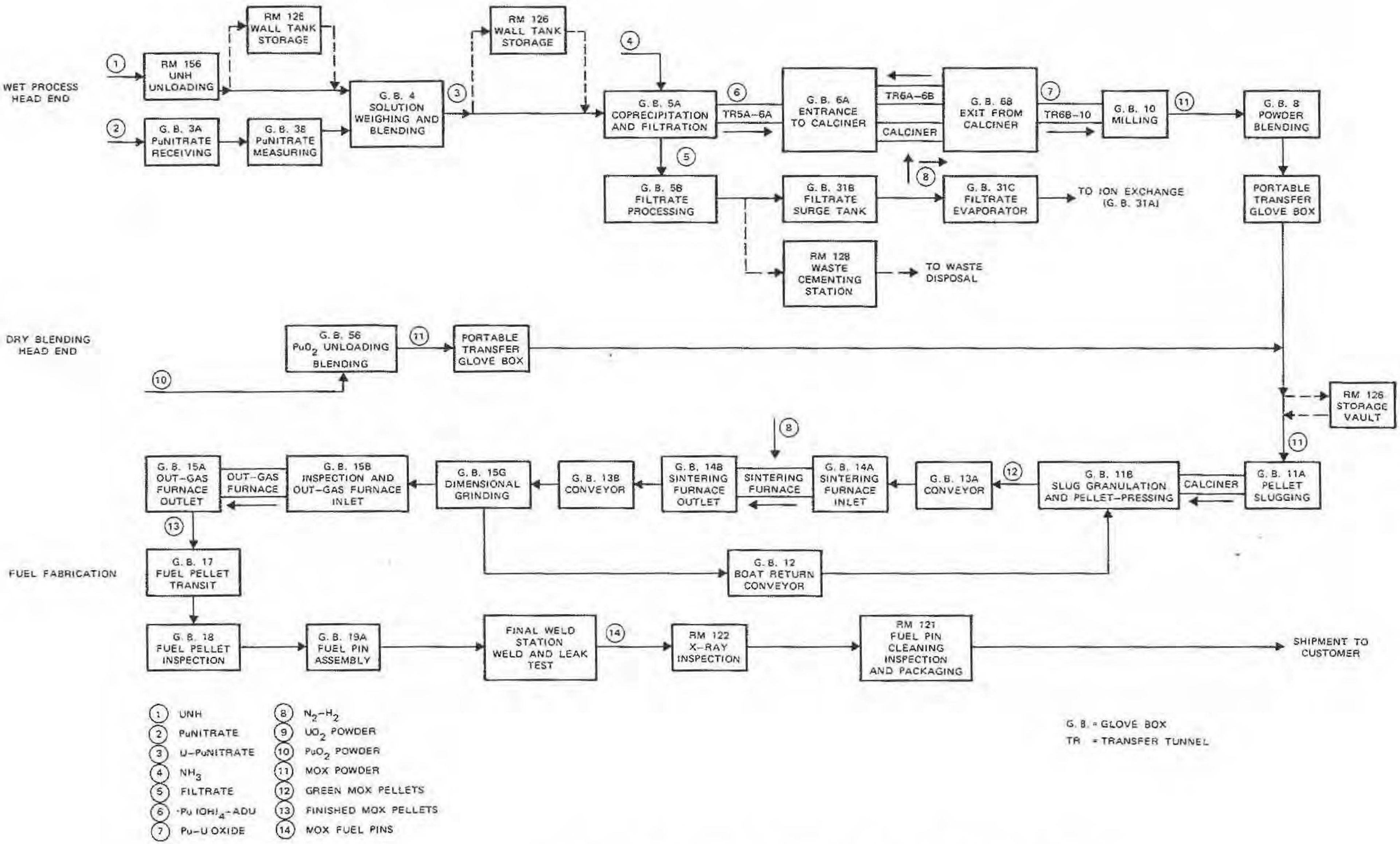


FIGURE 3

Glove Box Flow Diagram, Mainline Mixed Oxide Fabrication Process

The sintered pellets were ground to diameter on a centerless grinder (no coolant) utilizing diamond grinding wheels. The pellets were inspected using a roller micrometer and other dimensional inspection equipment. The pellet outgas operation was a batch type operation. The retort was loaded with baskets of pellets, evacuated to approximately 5 x 10^{-5} torr heated to above 100^{0}C and held until the vacuum stabilized. Final inspection consisted of dimensions, weight and visual inspection for cracks, chips, and other discontinuities. The satisfactory pellets were laid out in a V trough to measure stack lengths.

Pellet loading in the fuel tube was a unique operation, the tube had one end plug welded as a sub assembly and inspected in accordance with all applicable specfications. The open end of the sub assembly was fitted with a plastic loading bushing (used only once) which protected the end of the tube from contamination from the pellets. The tube with the sacrifical bushing was inserted into a sphincter seal in the end of the loading glovebox. The pellet stack and other hardware in the V trough were slid into the tube, when the loaded tube was withdrawn from the sphincter seal, the contaminated plastic loading bushing stayed inside the glovebox. The loaded fuel tube was surveyed for contamination and decontaminated if necessary. A plastic end cap with a very small hole through the center of the cap was placed over the end of the loaded pin to retain the contents until the pin was ready to be "welded".

The welding was performed in a glovebox equipped with a high speed oil diffusion vacuum pumping system and an orbit arc welding head driven by a programmed transistorized welding power supply. The fuel pin to be welded was assembled in a fixture in the vertical position.

The plastic end plug was discarded after evacuation in the weld box and the end plug to be welded was installed. A horizontal electrode traveled around the periphery of the assembly which was fixtured to maintain alignment during the welding operation. The sequence of events for the welding operation were:

A. Loaded pins to be welded were placed in a gatling gun magazine from the fuel loading operation.

B. The filled gatling gun was placed in a weld box canister.

C. The weld box canister was positioned and attached to the bottom of the weld box.

D. The box and canister unit were evacuated and pumped down. (Approximately 5×10^{-6}) torr.

E. The weld box system was back filled with helium.

F. A destructive weld sample was made and inspected.

G. Fuel pins were welded complete one at a time in the orbit arc welding system.

H. A destructive weld sample was made after each hour of production.

I. When all pins were welded complete, the canister was removed from the weld box. Welded pins were inspected, cleaned, surveyed and advanced to the next operation.

Before production welding started, destructive weld samples were welded. Additional samples were made each hour of operation and at the end of each batch. These samples were sectioned and etched for macro examination of a cross section of the weld fusion zone. Visual appearance and x-ray examination do not always reveal defective welding. Sectioning and etching the polished cross section and examining the etched surface with a metallograph allows dimensional inspection of the fusion zone. When the fusion zone dimensions start to change, corrective action was initiated before defective product was produced. Welding an acceptable sample each hour of operation verifies the welds produced during that time frame. The welds made during the last hour before a defective test weld was made would be the only welds suspect of substandard quality. Suspected pins would be destructively tested and examined in reverse to the sequence of welding one by one until the last acceptable production weld made was found and examined. This would verify past production welds. Production welding would not resume until corrective action had been implemented and satisfactory test welds had been made to verify the results.

Statistical control of the dimensions of the fusion zone in the welding process eliminated the need to destructively test large numbers of production pins to verify specification welding. Inspection of the completed pins included the following:

A. X-ray of full length pin to reveal placement of internal components, cracks in welds (if any).

B. Autoradiography of fuel column to verify homogenity of pellets.

C. Dimensional inspection of all attributes.

D. Concentracity.

E. Visual inspection for scratches and discoloration.

F. Profilometer inspection for surface finish.

G. Helium leak testing of the pins for leaks.

The complete manufacturing operations of the fuel pins were under the survelance of the customers inspectors at all times. However, final acceptance of the finished pins was dependent upon the successful completion of receiving inspection at the customer facility.

PROCEDURES AND EQUIPMENT USED IN THE DECONTAMINATION AND DECOMMISSIONING OPERATIONS

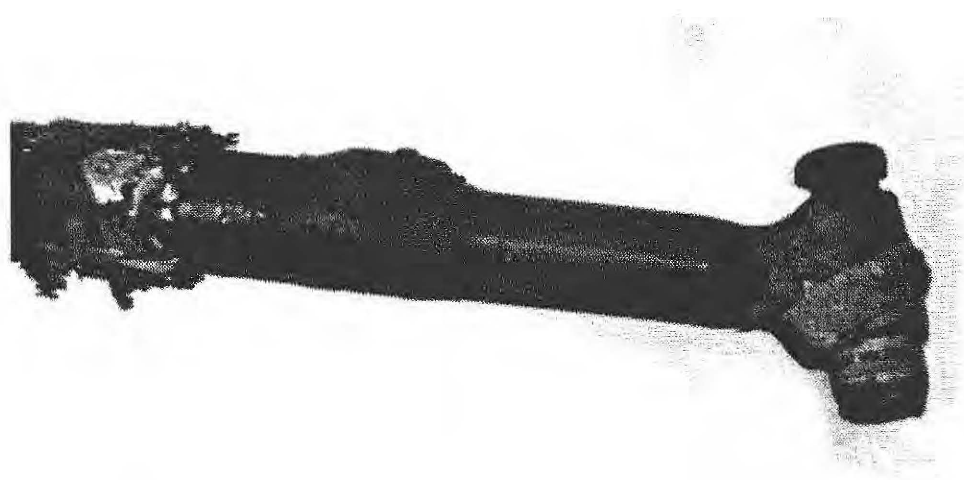
The procedures and tooling used in the Decommissioning operations were developed as required in advance of need so that sufficient tool tryout could be performed prior to actual commitment to contaminated operations. This proved to be beneficial in several ways; first it gave operations experience in the use and operation of special tooling and/or procedures. Second, it gave us an opportunity to modify or change as required any tooling or procedure that would improve or expedite the operation. The third thing which was most beneficial was it required advance planning which called attention to details that may have been overlooked if advance planning had not been implemented. Examples of the tooling that was developed and used is described as follows:

Tigair reciprocating hacksaw

This hand held power tool utilizes conventional hacksaw blades, and is used to cut framing, piping, sheet metal, and almost anything that allows access only from one side. This versatile air operated tool proved to be a real work horse with a multitude of applications.

Plasma Arc Cutting Torch

The plasma arc torch was originally developed for cutting non-ferrous metals using inert gases(Argon-Helium, etc.). In order to expand the applications of the process, modifications to the equipment were made and parameters for various gases were developed. The developed equipment can produce plasma flame temperatures estimated to be 10,000°C to 14,000°C. This broadens the list of metals that can be cut and accelerates the cutting speed. The quality of the cut of some materials may not be suitable for some production applications, but the long list of materials that can be cut and the fast cutting speeds(example: cutting speed for 3/8" stainless 20" per min.) makes this a good tool for decommissioning.



The plasma arc torch, when used inside a well ventilated glovebox can reduce sections of gloveboxes, tooling and machines to small pieces suitable for small piece assay (14" high cylindrical shaped packages at good production rates.

A plasma arc cutting torch was installed in one conventional glovebox for the cut up of tooling and equipment that had been sectioned into pieces that could be manipulated by hand for cutup. Another operation was a plasma arc torch installed in a large cutup box equipped with a crane, where smaller gloveboxes could be maneuvered over and lowered into the cutup box for slabbing off sections and cutting the sections into pieces for packaging and assay. The slabbing off operation started at the bottom of the item being cut up and the item was lowered as the cut up operation advanced upward until the item being cut up was consumed. The taping of the edges of the cut up pieces and the bag out operations were performed in one end of the big cutup box as the sectioned off pieces cooled to handling temperature.

Another plasma arc torch was fitted to a modified pipe beveling machine for sectioning the pipe and tankage in the solvent extraction glovebox operation. This glovebox and apparatus had contained tributyl phosphate and dodacane solvents. The atmosphere in the S.X. glovebox was inerted with nitrogen gas and the apparatus was cut down and sectioned using nitrogen gas plasma and nitrogen cover gas. The details of the operation are explained in D.O.E. Report No. 1.

Wach's Portable Powered Saw

A portable hydraulic operated power hacksaw was modified to fit and operate inside a small wheel mounted glovebox for removing and sectioning the verticle storage tanks which were suspended in the wall of the vault and scrap recovery rooms. The glovebox was positioned over the tank to be removed. A jacking device was placed in the floor cubicle in the basement under the tank to be cut up. A 30 ton jacking system was used to make the first lift because some of the tanks had been driven into the steel lined sleeves in the concrete during plant construction 19 years ago. Acid fumes from production operations had caused rusting and corrosion and tightening of the tanks in the wall. After the initial lift was made and the tank being removed was reasonably free to move in the hole, a yoke type jacking device with pipe wrench type jaws, was used at the top of the hole to lift the tank up through the bottom of the cut up box. A collar type clamping device was used for safety to secure the position of the tank at all times. Each tank was cut in approximately 25 sections and the average cutting time per section was about 16 minutes. All 60 tanks were cut up safely without any major contamination problems. Special plastic caps were obtained to cover each cut end of the pipe sections to prevent the burrs on the pipe ends from snagging and cutting gloves and/or fingers. The plastic pipe ends proved to be more economical than tape for this operation due to savings in time and the reduction in tape usage.

Use of Zip Strip, Clear Coat and Other Strippable Coatings

Zip Strip

Zip Strip is a product of the Star Bronze Company. It is a jelly-like material, that when applied to a painted or finished surface with a brush or roller and allowed to soak for 20 to 30 minutes, the finish becomes soft, it crinkles up and becomes strippable with a putty knife or scraper.

During the years the plant was in operation when painted surfaces showed signs of wear and stain from shop soil, they would be re-painted, as a result those areas of least wear developed a build up of paint layers. Decommissioning operations required the removal of these layers of built up paint which may have contained traces of contamination. In the early months of decommissioning Zip Strip was used to remove much of this paint, however when some of the chemicals contained in Zip Strip appeared on the E.P.A. list of hazardous materials we were required to stop the use of Zip Strip and were required to develop other methods of removing paint and paint type coatings. We are currently using mechanical(abrasive) methods for paint removal such as: sandblasting, vacu-blasting, using steel shot and various machines that use a rotating drum which contain carbide flails that impact and abrade the surface being decontaminated and prepared for survey. When the decontamination survey has been completed the abraded surface is usually suitable for the reapplication of paint or other suitable coatings.

Clear Coat

Clear coat is a trade name of the Oakite Corporation. This clear paint type coating was used to cover and contain contamination on the inside and other surfaces of gloveboxes during sectioning for cut up and packaging for disposal. In order to contain and not spread contamination to the atmosphere in the production areas, the inside of a cleaned glovebox to be sectioned is spray painted with Clear Coat, usually 2 or 3 applications. Drying time between coats varies due to how thick it is applied, but it usually dries in several hours in a well ventilated glovebox. This coating will adhere to the glovebox surfaces and retain any contamination that may be present. Sectioning a glovebox opens joints and exposes cross sections of the glovebox which requires another application of Clear Coat, consequently each time a portion of a glovebox was cut away the disturbed area would be given another application of Clear Coat.

When these large sections were being further cut up inside a cut up box for packaging, the clear coat would be scraped off in the area of the plasma arc cutting path to reduce smoke. Excessive smoke impares vision inside the cut up box and will clog the H.E.P.A. filters, to reduce this problem we installed inexpensive furnace filters as pre-filters to increase the production time between H.E.P.A. filter changes.

Tent Design and Ventilation

The sectioning of gloveboxes is performed inside a temporary plastic tent which is constructed around the glovebox to be dismantled. The tent is connected to a negative ventilation system which causes the air flow to be from the room to the tent to the suction of the ventilation system. This assures a negative on the tent atmosphere and should a contamination leak occur it would still be confined to the tent. The glovebox being sectioned is maintained on negative atmosphere as long as practical also. The tent and glovebox arrangement is illustrated in Figure 7, Report No. 1.

Disassembly and Dismantling of a Glovebox

A typical sequence of operations for dismantling a standard glovebox is as follows:

1. The area supervisor completes a Special Work Permit. See Figure 4 Form KM 2420-B. This form requires written response to the following:

   Location
   Job Description
   Job Safety Analysis
   Radiation Conditions
   Protection Equipment Required
   Any special instruction
   Signatures of all people involved in the job.

   This is to assure that everyone involved reads and understands the tasks that must be done to complete the job.

   The gloveboxes in the wet end of the process were permeated with nitric acid which has long dried up and traces of nitric crystals are present in various joints and crevices.(the gloveboxes have been out of service and on negative ventilation since the plant ceased operations in 1976)

2. The inside of these gloveboxes are steam cleaned with a strong alkaline solution consisting of(Turco Power Steam Cleaner No. 121256) and water. This solution, after use

DISTRIBUTION:
White — Job Site
Canary — Health Physics File

№ 0506

SPECIAL WORK PERMIT KM-2420 B

DATE

LOCATION			
JOB DESCRIPTION			
JOB SAFETY ANALYSIS	After considering the basic job steps, complete A and B by selecting appropriate item(s) from back of sheet.		
	A. Industrial Safety		
	B. Types of Accidents which may occur		
	C. Recommended Safeguards (How can above accidents be prevented?)		
RADIATION CONDITIONS			

SURFACE CONTAMINATION

AIRBORNE CONTAMINATION POTENTIAL

EXTERNAL EXPOSURE POTENTIAL

Nuclear Criticality Safety Limits and Controls Considered? ☐ Yes ☐ No ☐ N/A

RADIATION MONITORING REQUIREMENTS

☐ H.P. Present at all times
☐ H.P. Present as needed
☐ Self Monitoring
☐ Continuous air monitor
☐ Lapel Sampler
☐ Extra Fixed Samplers
☐ Film Badge
☐ Gamma Pencil

is processed through filters and ionization columns to recover the radioactive material and to make the waste water suitable for release. When the waste water has been processed and meets release limits it is piped to a hypalon lined evaporation pond.

3. The gloveboxes in the dry end of the process are scrubbed on the inside with wipes saturated with 1, 1, 1 Trichloroethane. The contaminated wipes and accumulated material were collected and arranged on the floor of the glovebox to dry. The flow through ventilation in the glovebox will dry the wipes in a short time. The dried wipes are packaged and bagged out for survey in the TRU waste counter and placed in a drum for disposal.

4. When all high level smearable contamination is removed, the inside of the glovebox is clear coated. A glove or window may be removed to allow access for this painting operation.

5. When the glovebox is ready for removal to Box 4 for cut up, or if it is to be sectioned in place a tent is erected over the work area for containment. Incoming ventilation is established in the tent to prevent room contamination and an air monitoring alarm system is installed to continuously sample the atmosphere to warn the operator should airborne contamination occur.

6. When all contaminated surfaces have been clear coated, the windows and gloves are removed, all newly exposed surfaces are clear coated to prevent airborne contamination.

7. Operators outfitted with supplied air and two suits of clothing, (outer set disposable paper) perform the dismantling and cut up operations, tape all edges of the sectioned pieces and bag each piece in plastic for bag out.

8. The bag out operation consists of a bag port in the side of the tent. A wrapped and plastic covered piece ready for bag out is placed in the bag attached to the bag port in the side of the tent. The bag attached to the bag port containing the wrapped piece is gathered and twisted closed (horse-tailed), the horsetail section is wrapped with tape to keep it closed. The horsetail is sectioned leaving half with the bag port and half with the bag. The cut end on both halves is carefully taped to prevent contamination spread. The sectioned piece in the bag is now ready for transfer to a cut up box for further size reduction or if suitably small to the T.R.U. waste assay counter and disposal in T.R.U. waste drums A new bag is attached to the bag port over the horse tail section left from the previous bag. The remnant horse tail is then removed and is contained in the new bag which is ready to receive another piece of hardware.

9. The operators leave the cut up tent through an anti-room attached to the tent entrance. The first layer of paper disposable clothing is removed. The second layer of clothing is surveyed and if contamination free, the operator steps out into the room. If spot contamination or a small area of contamination is revealed the contaminated area may be cleaned by touching the spot with the stickey side of a piece of tape to remove the contamination from the operators garment. It may also be necessary to remove the second layer of clothing.

10. Tent Disposal

The tent is fabricated out of a roll of plastic sheet. (clear .004-.006" thick)

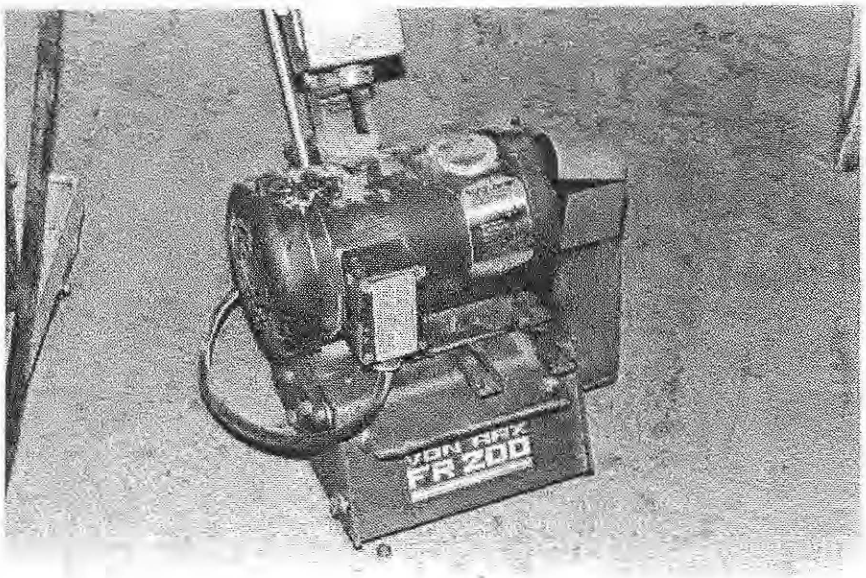
The frame work that supports the structure is on the outside of the plastic sheeting which prevents the frame from becoming contaminated. This simplifies the task of disassembly which is to detach the plastic from the frame, collapse the tent with filtered negative air pressure, and fold the plastic carefully toward the center of the tent and when the package is as small as practical it is placed in a drum for assay and disposal. The size of the tent may require sectioning the plastic into more than one container for disposal. When a section of the tent if more soiled or contaminated than another, such as the floor, that section may be spray coated with clearcoat and packaged separately to meet packaging requirements.

Building Surface Decontamination

The building surfaces such as walls and ceilings were shot blasted with a vacu-blast machine which was modified for this service. The modification consisted of an additional cyclone and filter which was added to the discharge air stream before it exhausted into building ventilation discharge air system.

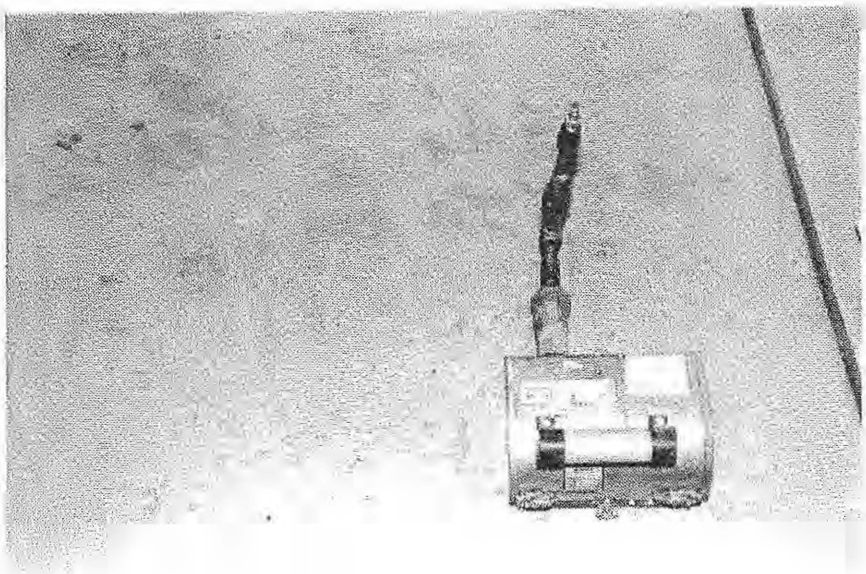
Decontamination of the production and laboratory floor presented an unusual problem because the floor coating was an epoxy material which was applied by pouring a quantity on the floor and allowing it to flow out level. Due to the irregularities in the floor, the coating varied in thickness,(as much as 1/2"), the resilience of the material virtually eliminated the effectiveness of vacu-blasting which merely impacted the surface. Several removal methods were tried such as grinding, which loaded up the grinding wheel to the point where it would quit cutting. Removal by heat was not a practical approach because experimental work revealed that the material would off-gas when heated and the off-gas was combustable. Scabbling with impacting pistons was reasonably successful, but very slow. The method which gave us the best results was a machine which used a rotating drum with milling cutter type flails which contained tungsten carbide blades. The scarifier action of this machine would appear to mow the floor covering away, along with a skin layer of concrete. An auxiliary vacuum system with a H.E.P.A. filter box and exhaust tube to the building ventilation discharge system completes the arrangement.

This machine has a working width of 8", weighs about 100 lbs., uses a 3 H.P. motor and scarifies 400 sq.ft. per hr.



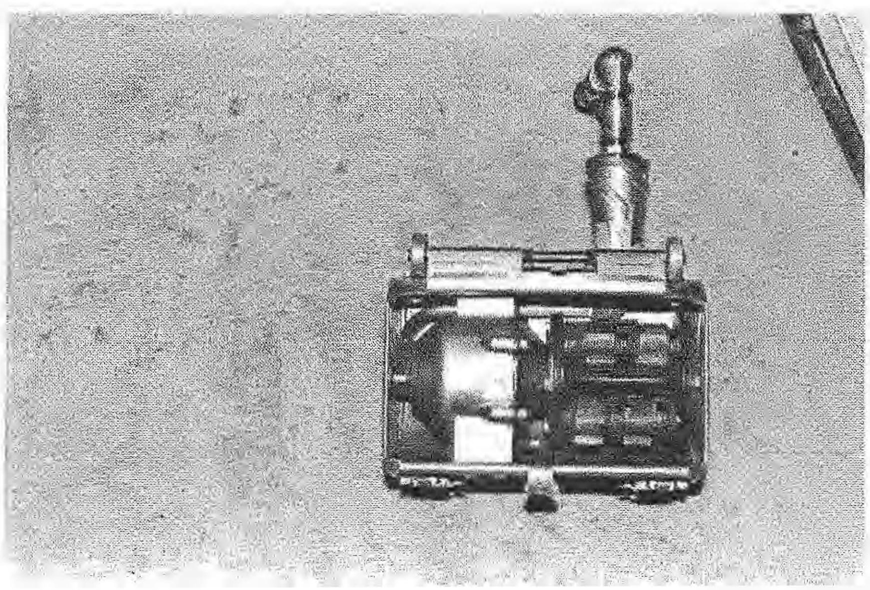
Electric version of
Floor Scabbler

Pneumatic version and conversion of hand held machine to a walk behind floor machine.



Top view hand held machine

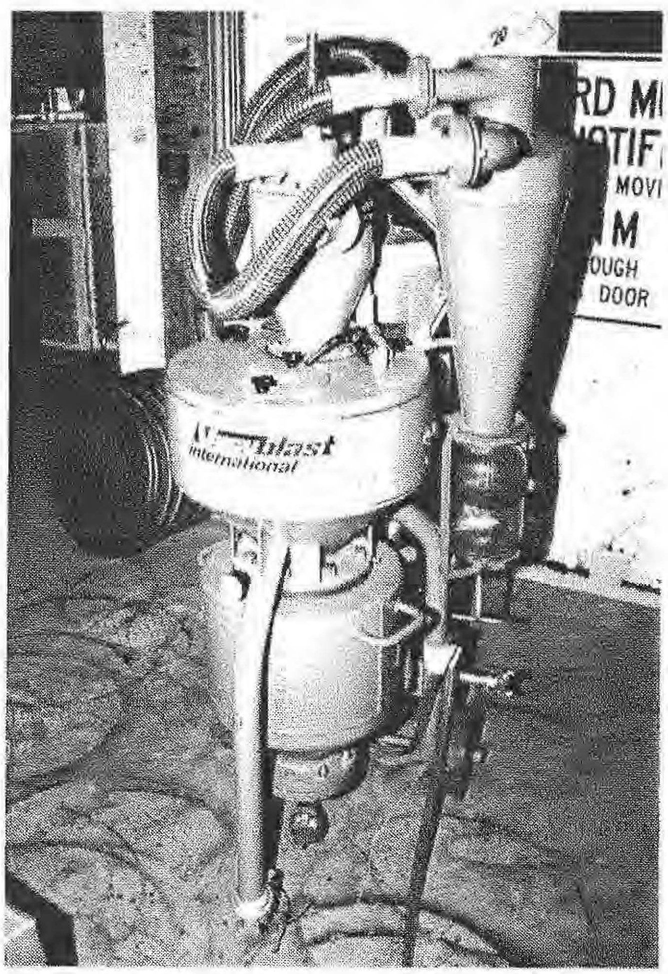
Bottom view hand held machine showing air motor and drum with special milling cutters

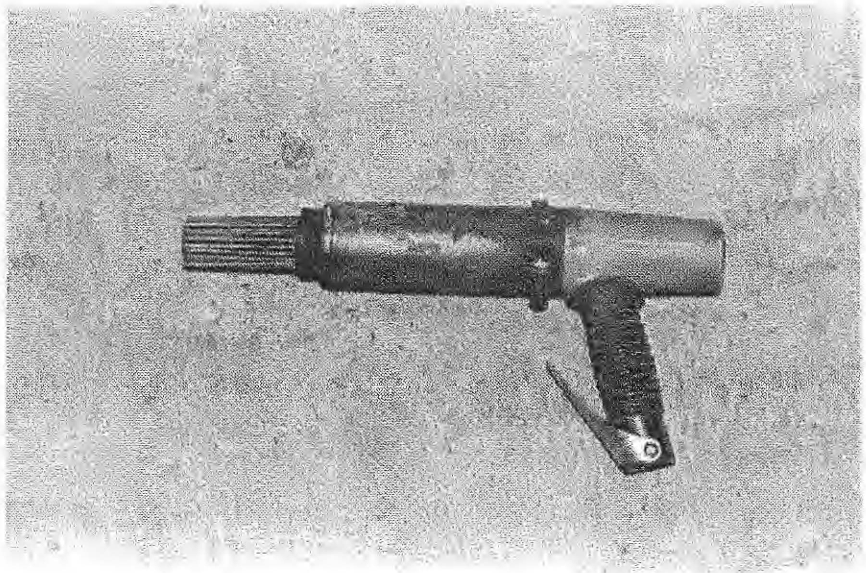


Photos also show floor surface produced by this equipment.

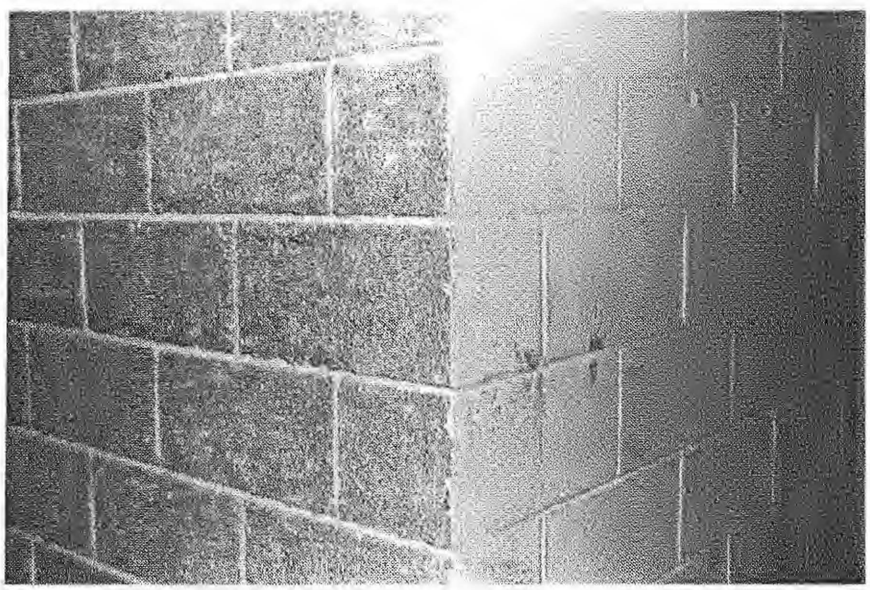
Building Surface Decontamination

The vacu-blast machine is a sand or shot blasting machine that has a nozzle arrangement for vacuuming up the spent shot and debri from the blasting operation as it occurs. The machine separates the debri from the shot, cleans the shot and returns it to the feed hopper. The dust and paint flakes are collected in a cyclone dust collector and filter system. The final filter for the discharge air is a H.E.P.A. filter. This machine will prepare about 14 sq. ft. per hour of wall or ceiling. Cimarron has 4 units in service



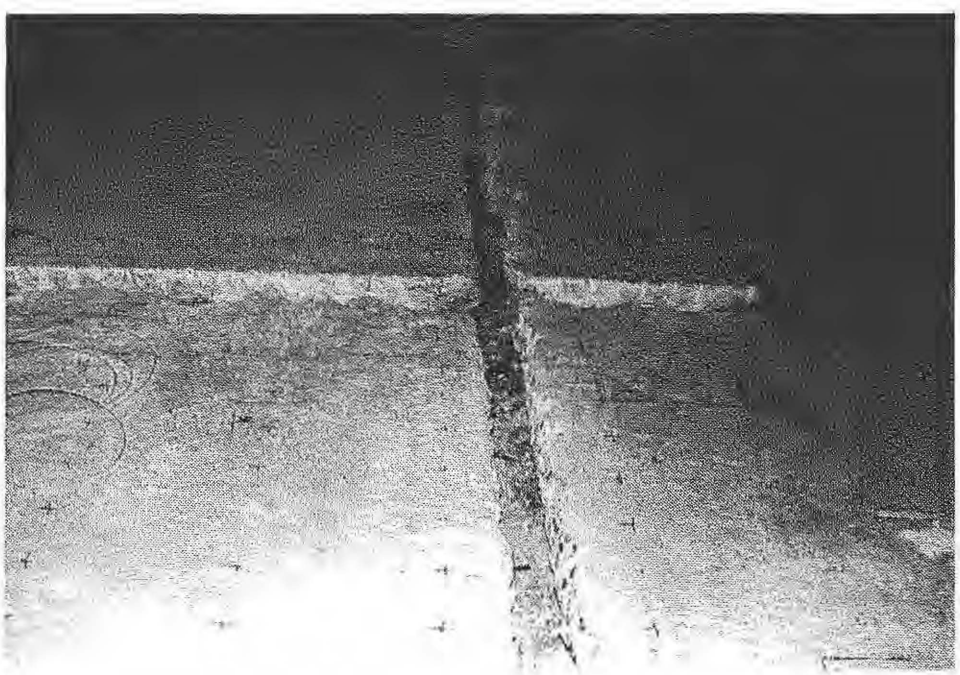


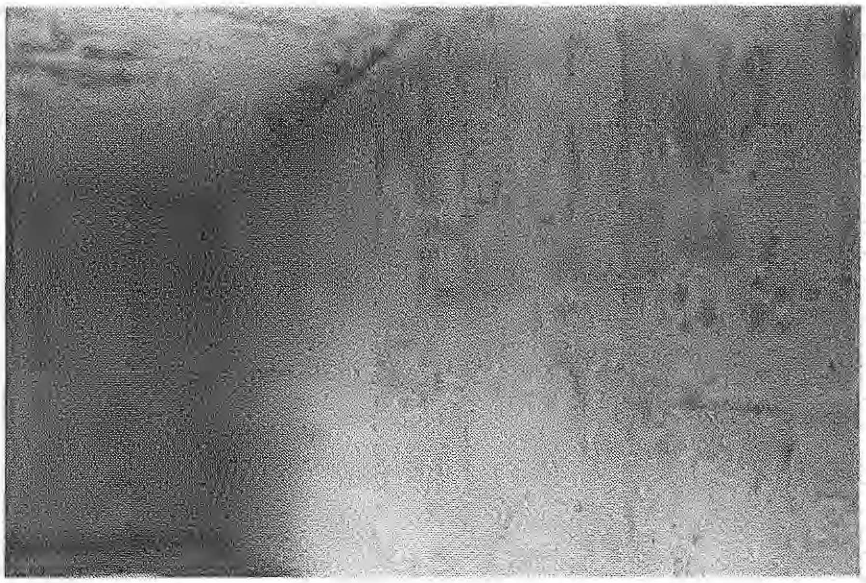
Needle scaler used in corners and other areas which were inaccessible for drum type machine.



.Photo shows shot blasted wall surfaces before and after.

The results of removing contamination from the walls, floor, and cubicles are illustrateds in the following photographs.





vault wall

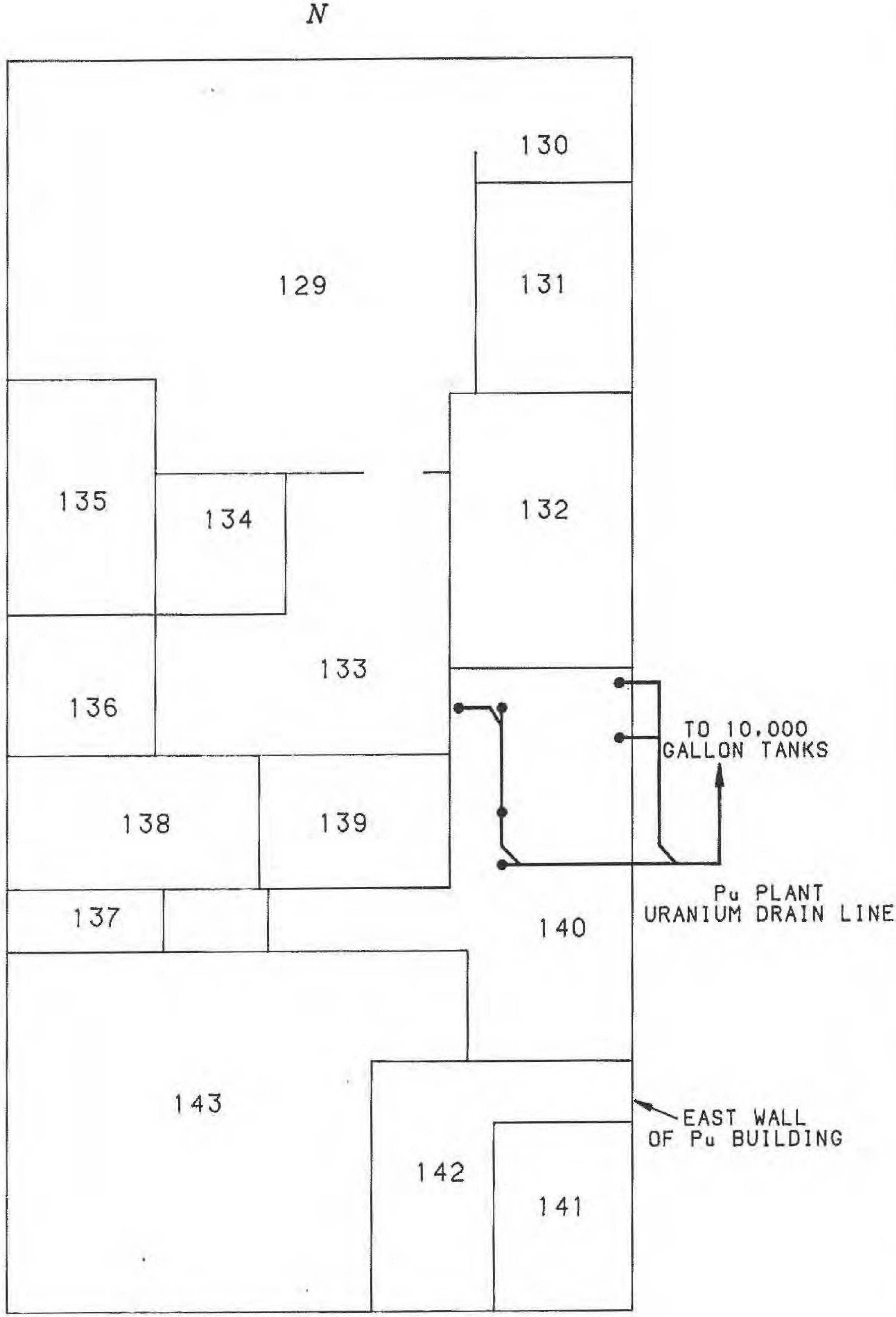
floor exhaust air filter box

Pu Plant Laboratory Drain System

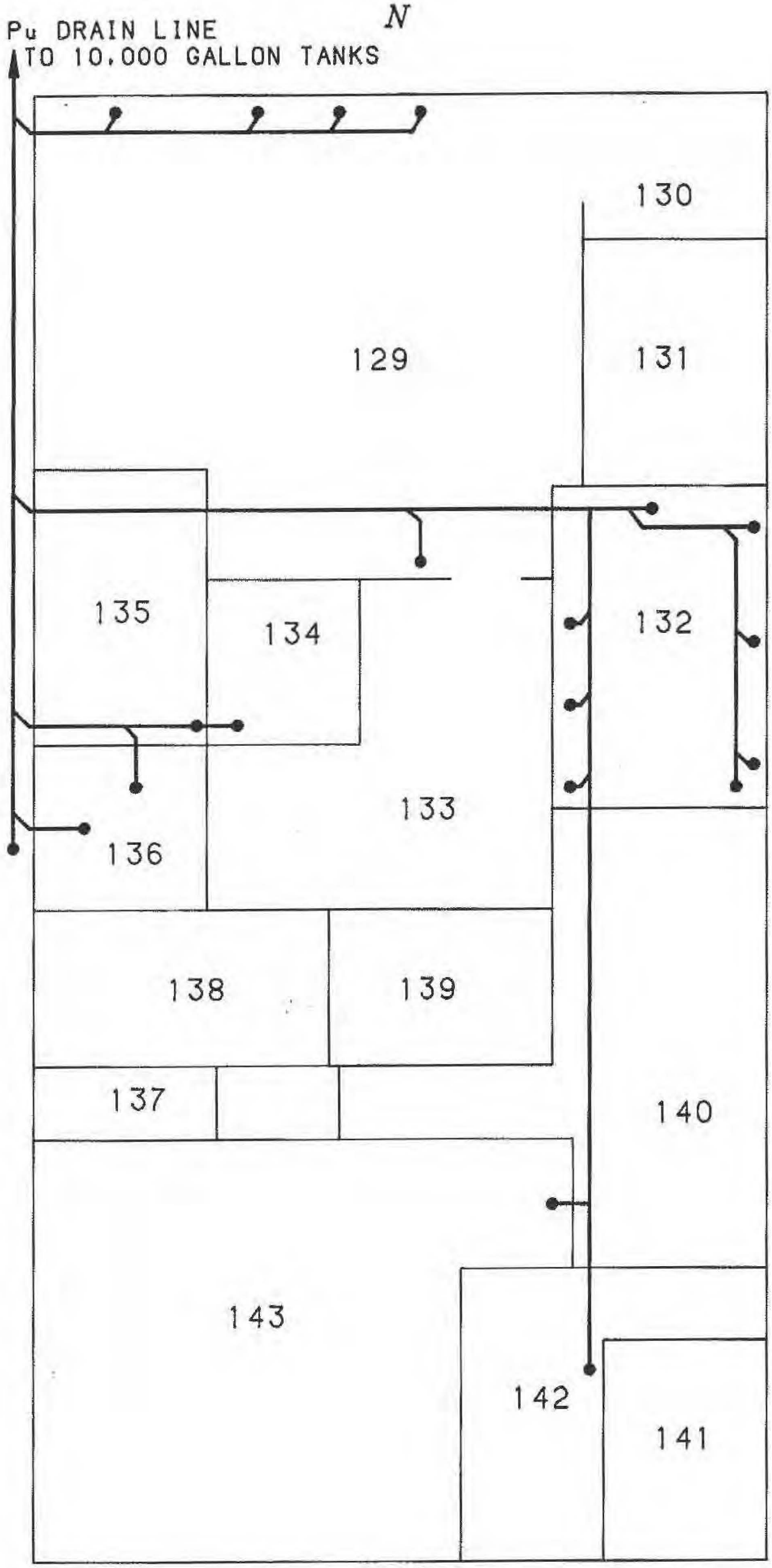
The laboratory drain system consisted of two separate drain systems. The uranium laboratory room drain system was located in Room 140 and exited the building through the east wall and terminated in the 10,000 gallon collection tanks. This system consisted of approximately fifty two feet of two inch durcon pipe under the floor of Room 140. The Plutonium laboratory rooms drain system serviced most of the laboratory area and exited through the buildings north wall and terminated in the 10,000 gallon collection tanks. This system consisted of approximately 335 feet of two inch durcon pipe.

Since the uranium drainage system was contaminated to approximately 500 dpm/100 cm^2 smearable and was concentrated in one room we decided that it would be easier to remove this small system (Figure #1). This was accomplished by using a concrete saw to cut around the up risers, breaking out the concrete, and digging up the pipe. We performed a release survey on all concrete that was removed. All dirt was drummed as it was removed. All joints were inspected for leakage and surveyed for detectable contamination. After the pipe was removed each hole was surveyed with an Eberline PRM-5 with PG-2 gamma probe and soil samples were taken. Since no contamination problems were detected the dirt was then returned to the hole.

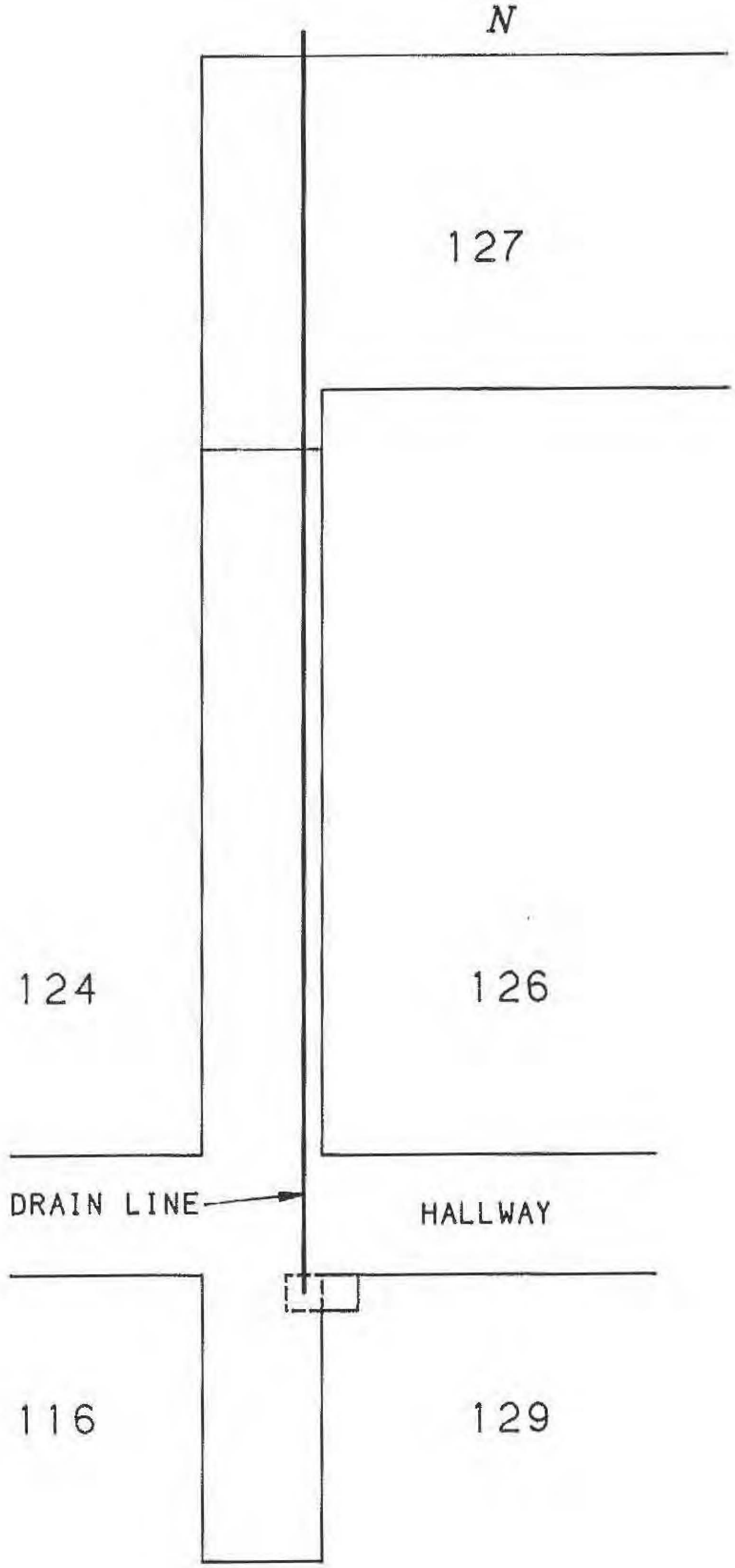
Our initial plan was to clean and survey the Pu drain system (figure #2 and #2A). To accomplish this, we saw the need to acquire some special detectors and to prove that this system was leak proof. We initially removed a portion of this system outside of the building between the building and the 10,000 gallon tanks and installed a sight glass riser on the pipe at the lower level outside of the building (Figure #3). We proceeded to fill the entire system under the building with water to the floor level and marked the water level in the sight glass riser.



Pu LABORATORY AREA
FIGURE #1



Pu LABORATORY AREA
FIGURE #2



Pu DRAIN LINE

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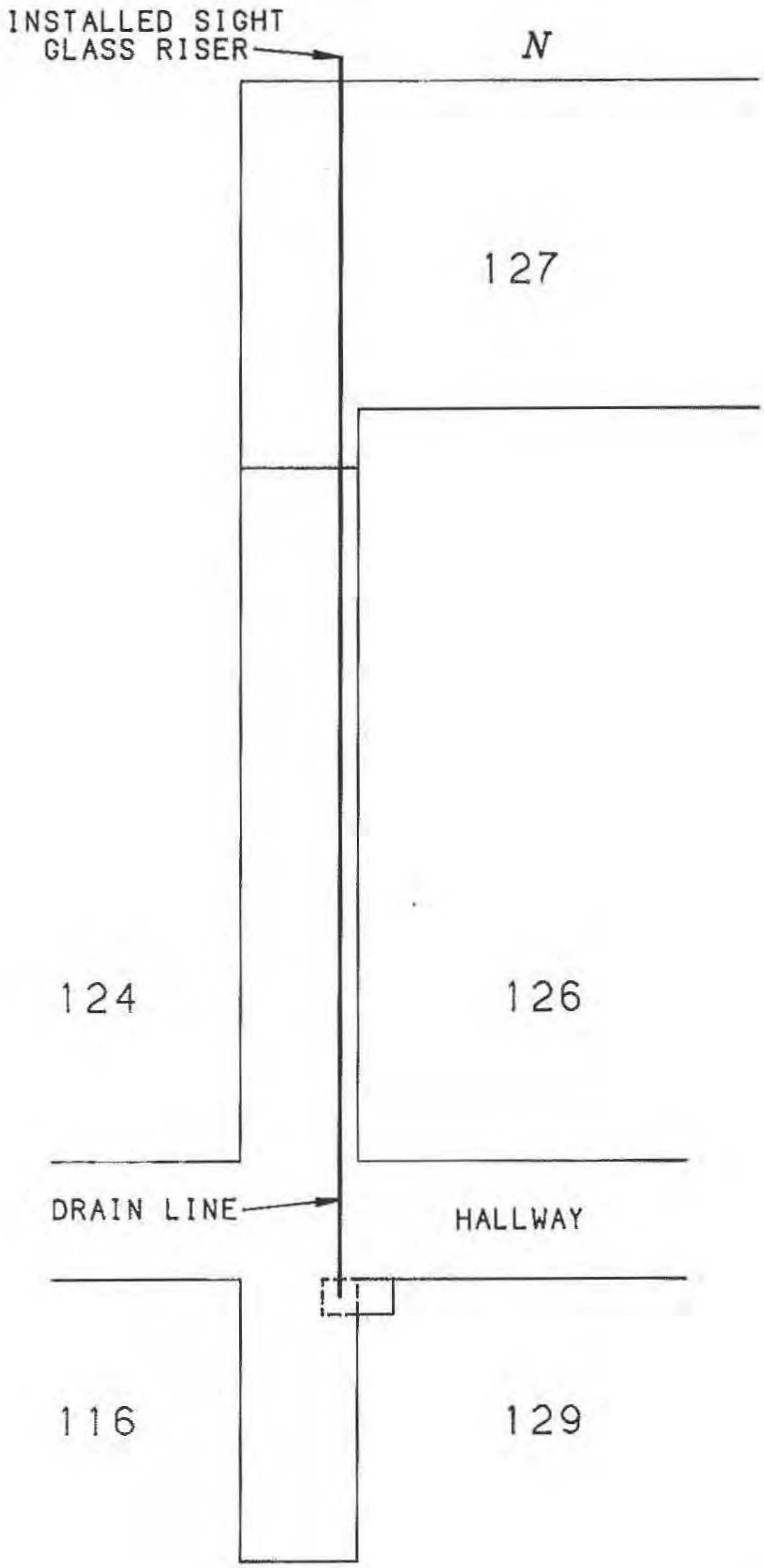
FIGURE #2A

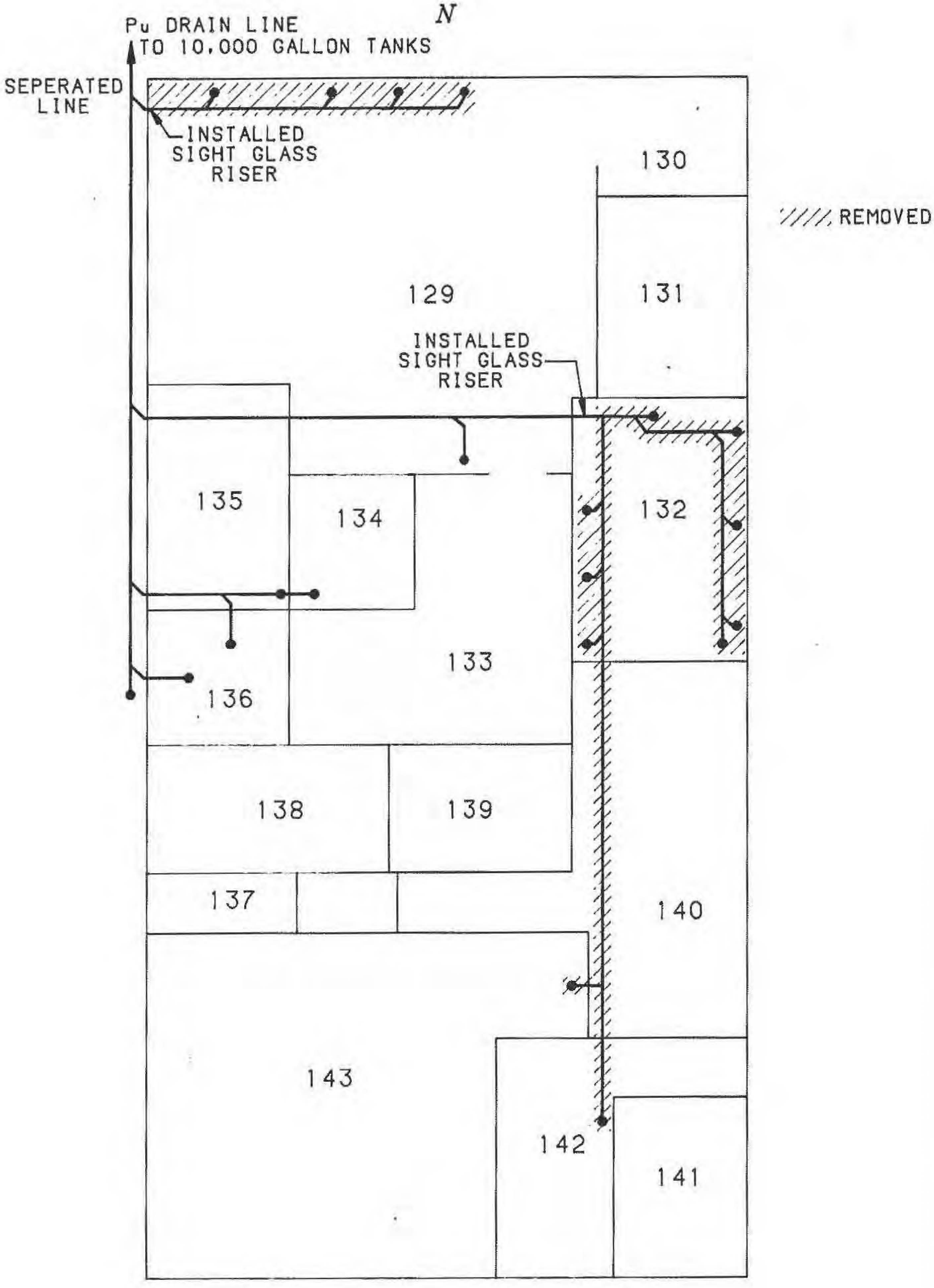


Pu DRAIN LINE

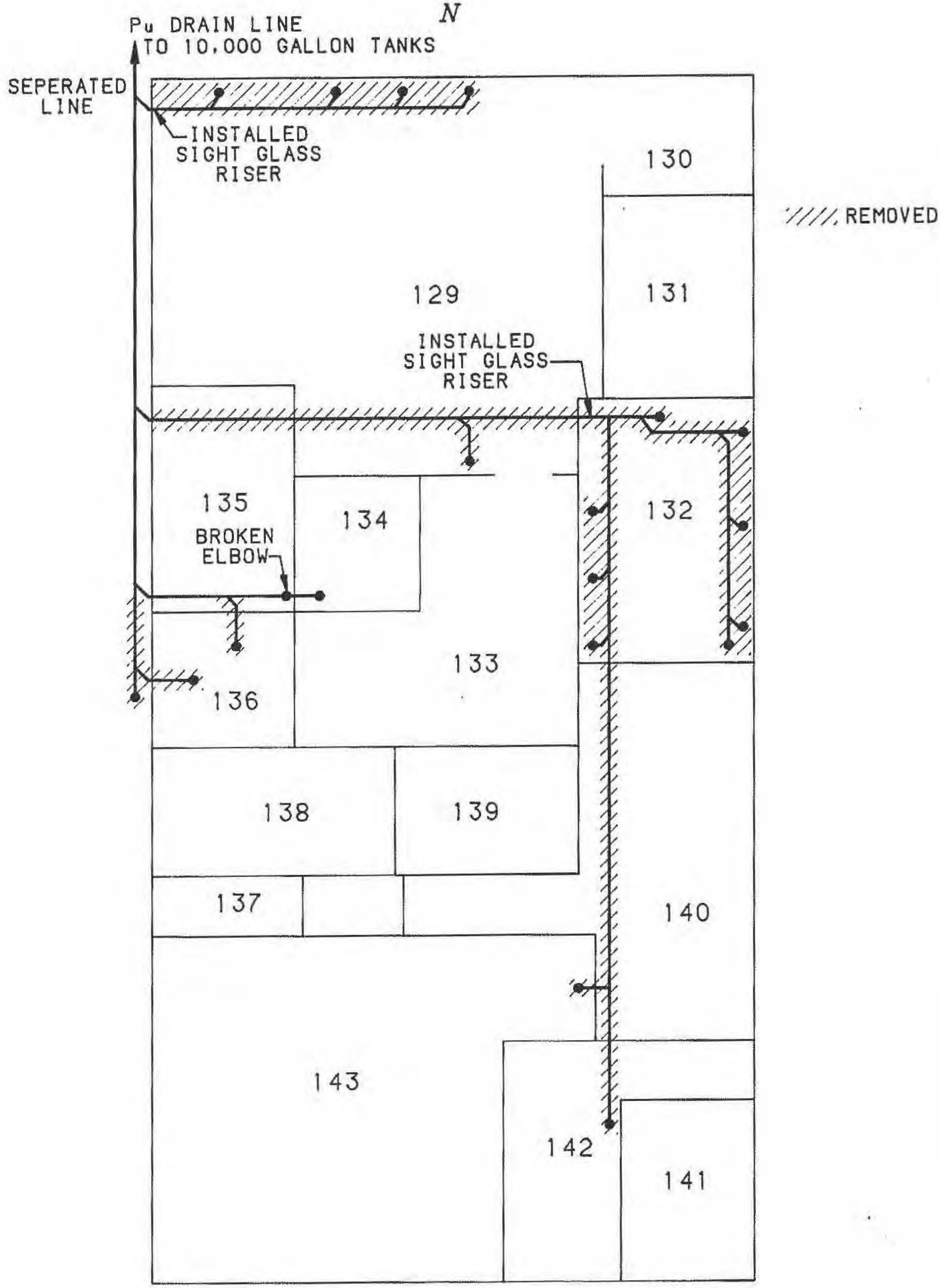
FIGURE #3

The results of our initial leak test indicated a leak rate of approximately 0.5 gallons of water per minute in this remaining system. In an attempt to locate this leak we decided to remove the line from under rooms 141, 142, 143, 140, and 132 since we already had access under the floor in room 140. We also decided to cut a hole in the northwest corner of room 129 and to separate the drain line there for our next leak test (figure #4).

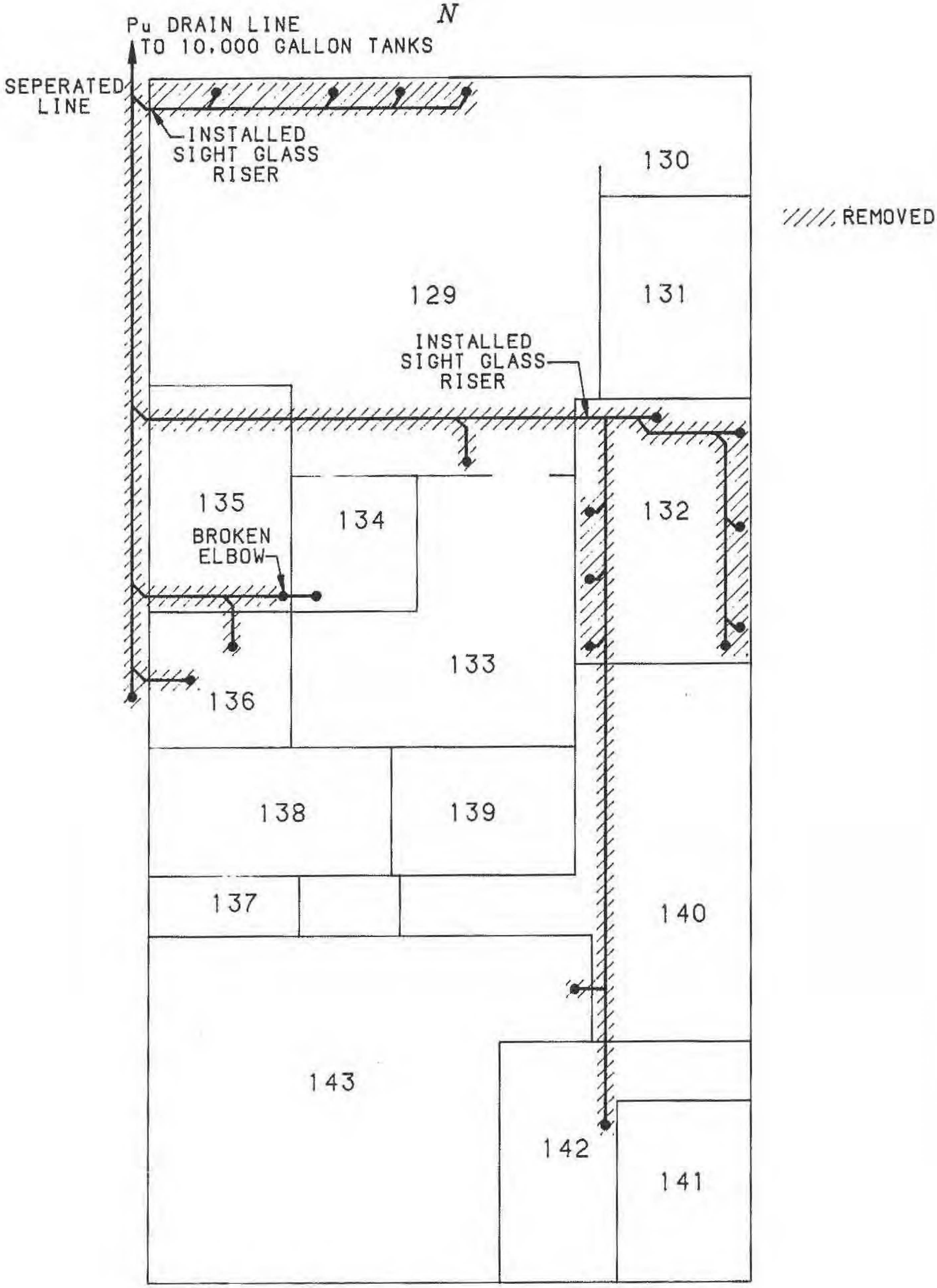
Our second leak test consisted of the remaining drain system in the laboratory area only. We installed two standpipes, one in the northwest corner of room 129, and the other in room 132 northwest corner (Figure #4). After filling this portion of the drain system with water, we still indicated a leak rate of approximately 0.5 gallons per minute. Because of the results of this leak test we continued to remove Pu drain line until we found a wet area in room 135. This wet dirt was drummed separately and labeled as possibly contaminated dirt (Figure #5.) As we continued to remove dirt at this location we found an elbow at approximately 6 feet below floor level with the back of the elbow broken out. Since there was only approximately 35 feet of this drain system left in the laboratory area, we decided to complete removal of this system from the laboratory area (Figure #6). Our third leak test consisted of the drain line from the northwest corner of room 129 to the north wall of the Pu bulding (Figure #7). After this portion of the system was filled with water and left 24 hours it indicated no leakage from this part of the system. This is a straight run of approximately 82 feet of two inch durcon pipe that runs through the exhaust ventilation tunnel and under the production hall thru room 127 (Figure #7). Initial smearable results indicated approximatley 1000 dpm/100 cm^2 smearable in this pipe. We used a rotating steel brush with a water flush to clean this pipe to less than 20 dpm/100 cm^2 smearable.



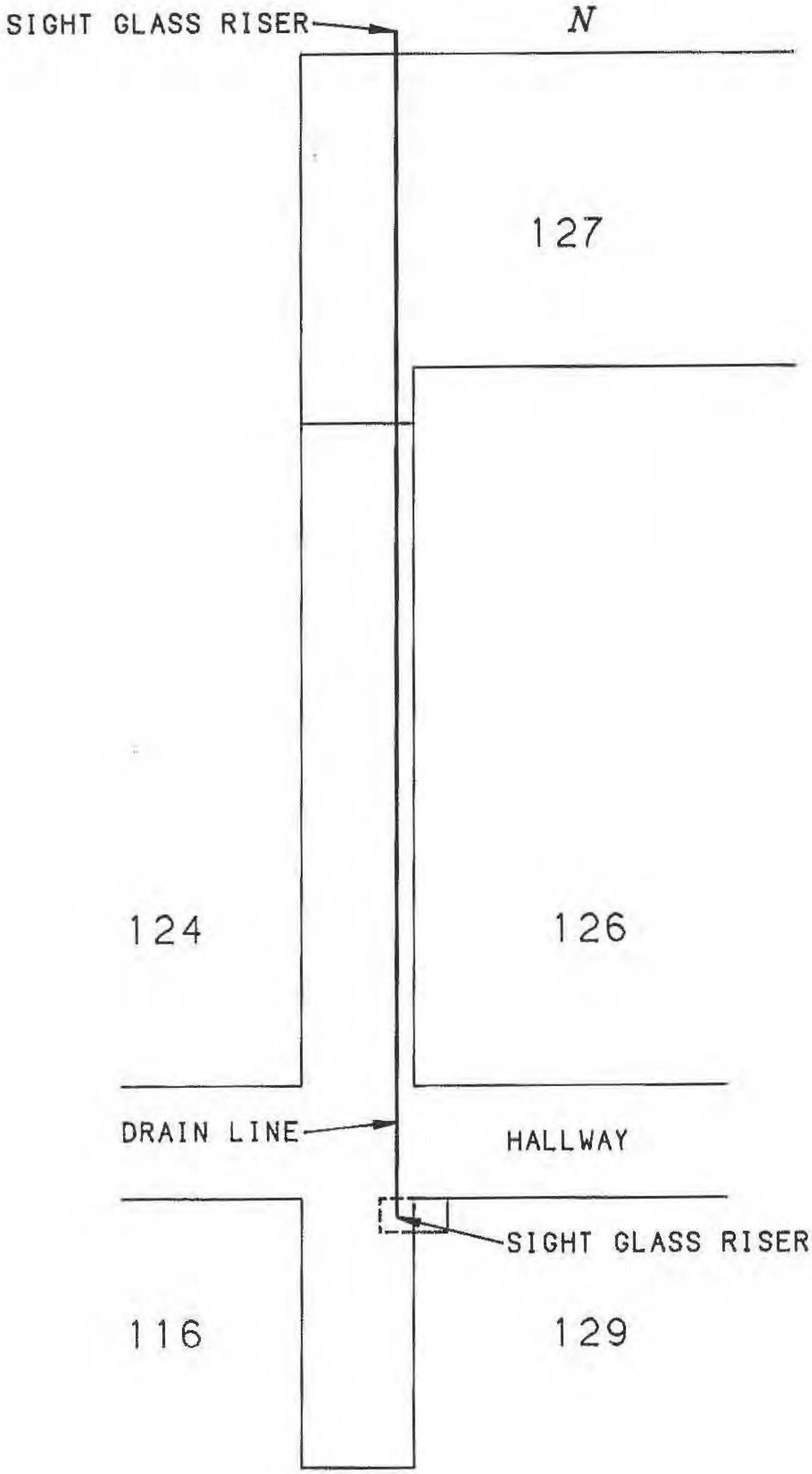
Pu LABORATORY AREA
FIGURE #4



Pu LABORATORY AREA
FIGURE #5



Pu LABORATORY AREA
FIGURE #6



Pu DRAIN LINE

FIGURE #7

We built a cylindercial gas proportional alpha detector to pull through this line for our direct survey. Our initial survey indicated approximately 50% of our readings were still above 100 dpm/100 cm^2 and a maximium of 408 dpm/100 cm^2 After recleaning the pipe with a brush hone our results were all less than 100 dpm/100 cm^2 direct and less than 20 dpm/100 cm^2 smearable.

W. A. Rogers

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Housekeeping and Safety

Spreading contamination by careless operations would make the task of decontamination more difficult, increase the potential for personnel exposure, and generate excessive waste which requires expensive disposal costs. During the decommissioning operations, any disarray or contamination spread caused by disassembly and cut up operations were cleaned up by the decommissioning crew as they occurred.

The Plutonium Plant housekeeping plan included a list of regular tasks performed by the utilities group of people. These tasks included routine mopping of the hallway corridors and service areas as well as shiftwise surveillance of the building's negative air system requiring attention to fans, filters and flow control damper actuators.

In addition to routine contamination surveys by the Health Physics Technicians, a monthly inspection(see Figure 5) was performed by the Health Physics Supervisor on a surprise schedule. This method was used to help maintain orderly working areas. An important part of this inspection was to look for safety hazards or unsafe work practices which might result in an injury.

DATE: ____________________

MONTHLY WALKTHROUGH HOUSEKEEPING AND SAFETY INSPECTION

(Write deficiencies detected and specify area in space provided below each item to be checked.)

I. General Orderliness (unnecessary clutter)

A. Floors and Aisleways:

B. Work Areas - Table, Power Tools

C. Scrap or Trash (should have been removed)

II. Safety

A. Clear Access To Fire Extinguishers

B. Clear Access To Emergency Exits

C. Clear Access To Electrical Switch Boxes

D. Containers Labeled

III. Health Physics

A. Survey Instruments Readily Available At Work Locations

B. Respirators Properly Stored

IV. Comments or Additional Items

FIGURE 6