AIIM

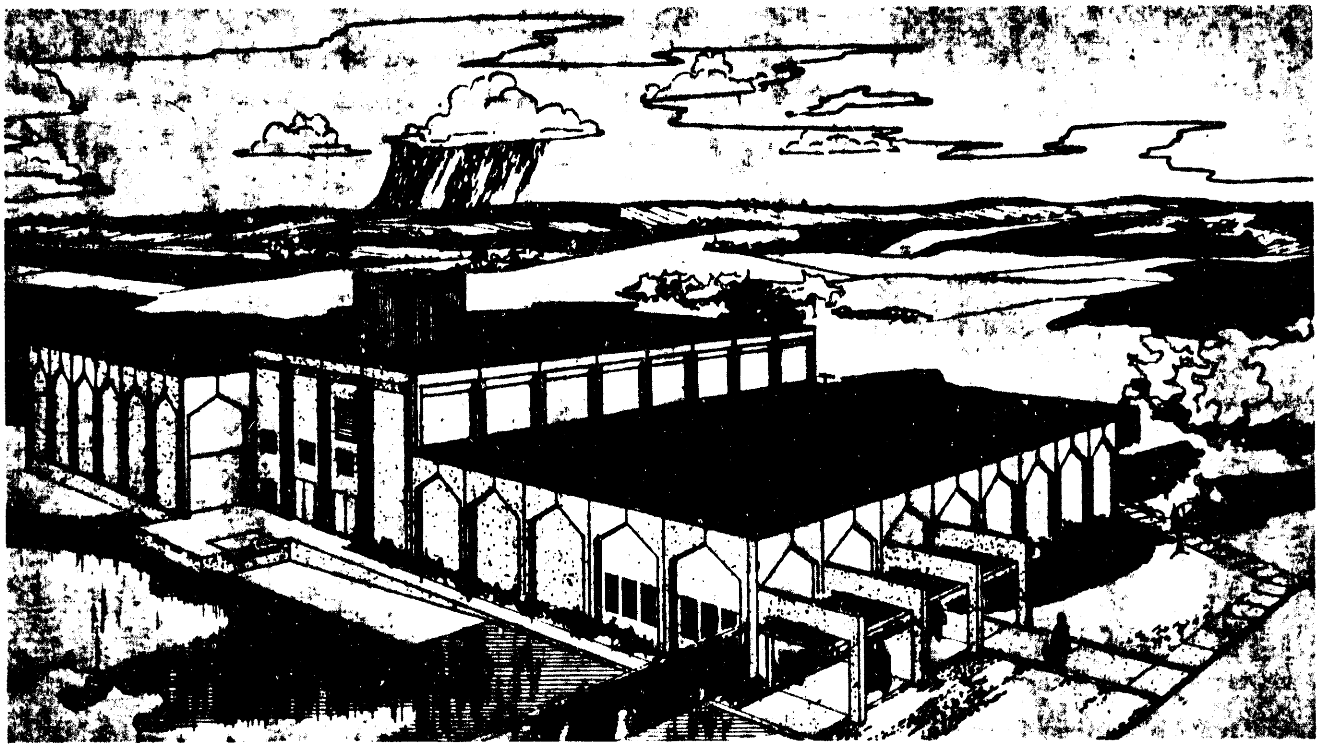
Association for Information and Image Management
1100 Wayne Avenue, Suite 1100
Silver Spring, Maryland 20910
301/587-8202

Centimeter

Inches

MANUFACTURED TO AIIM STANDARDS
BY APPLIED IMAGE, INC.

1 of 2



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 Kerr-McGee Cimarron Plutonium Fuel Plant.

ERRATA SHEET

Page 51 Air Effluent Monitoring

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

12/20/88

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

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.

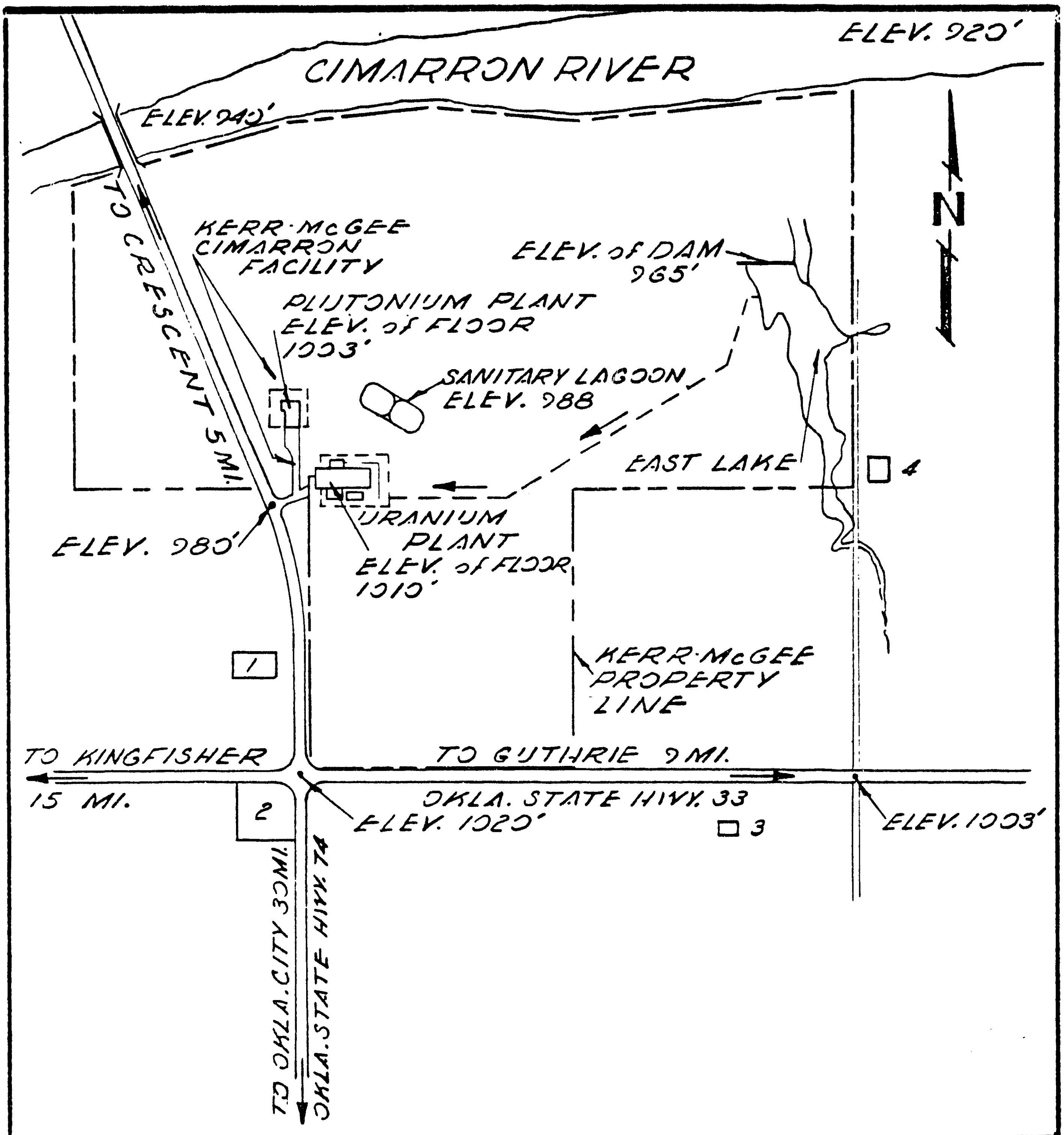
HISTORY

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.

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.



KERR-McGEE CORPORATION

NUCLEAR DIVISION — OKLAHOMA CITY, OKLA.

CIMARRON FACILITY — VICINITY MAP

FIGURE 1

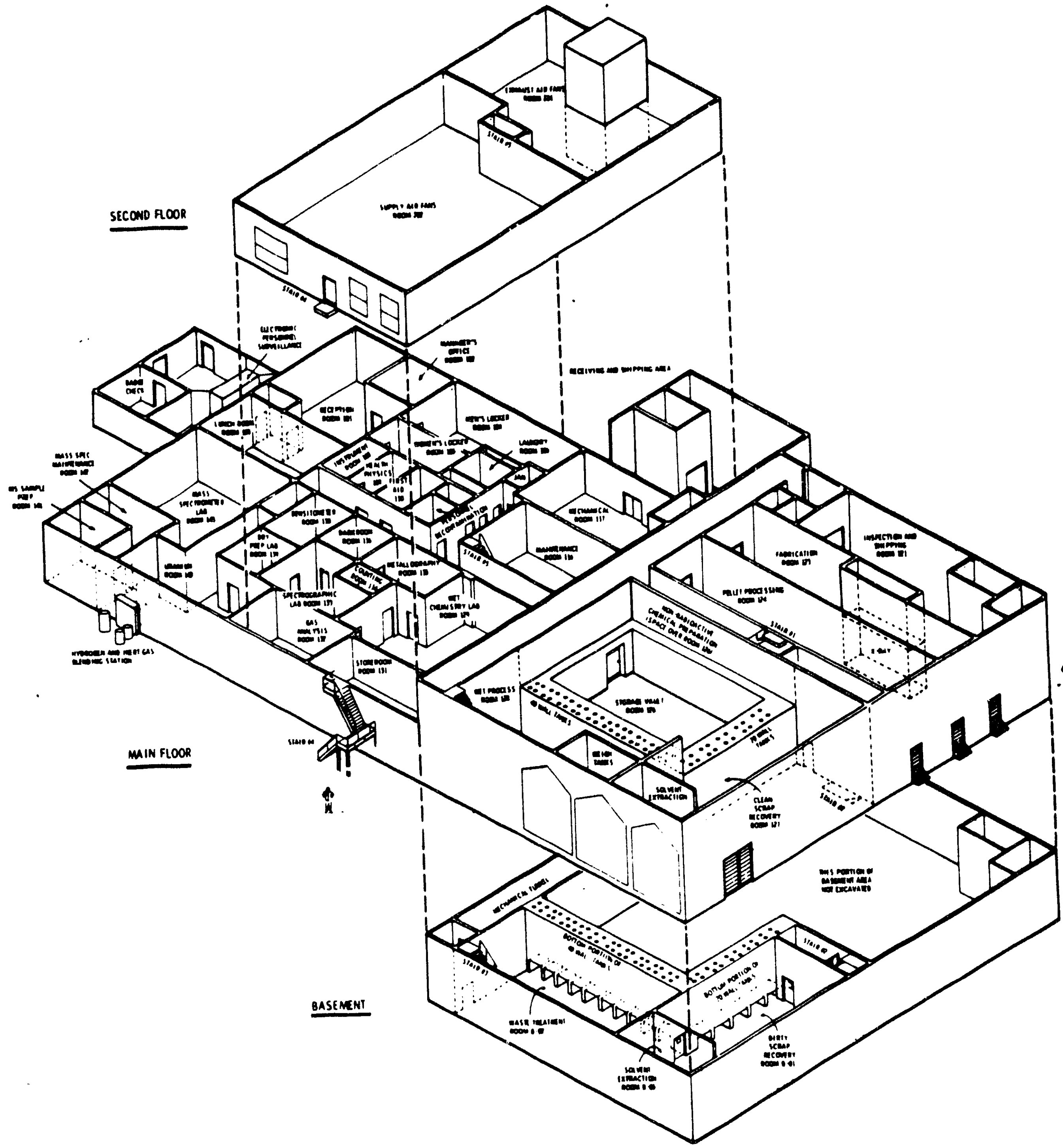
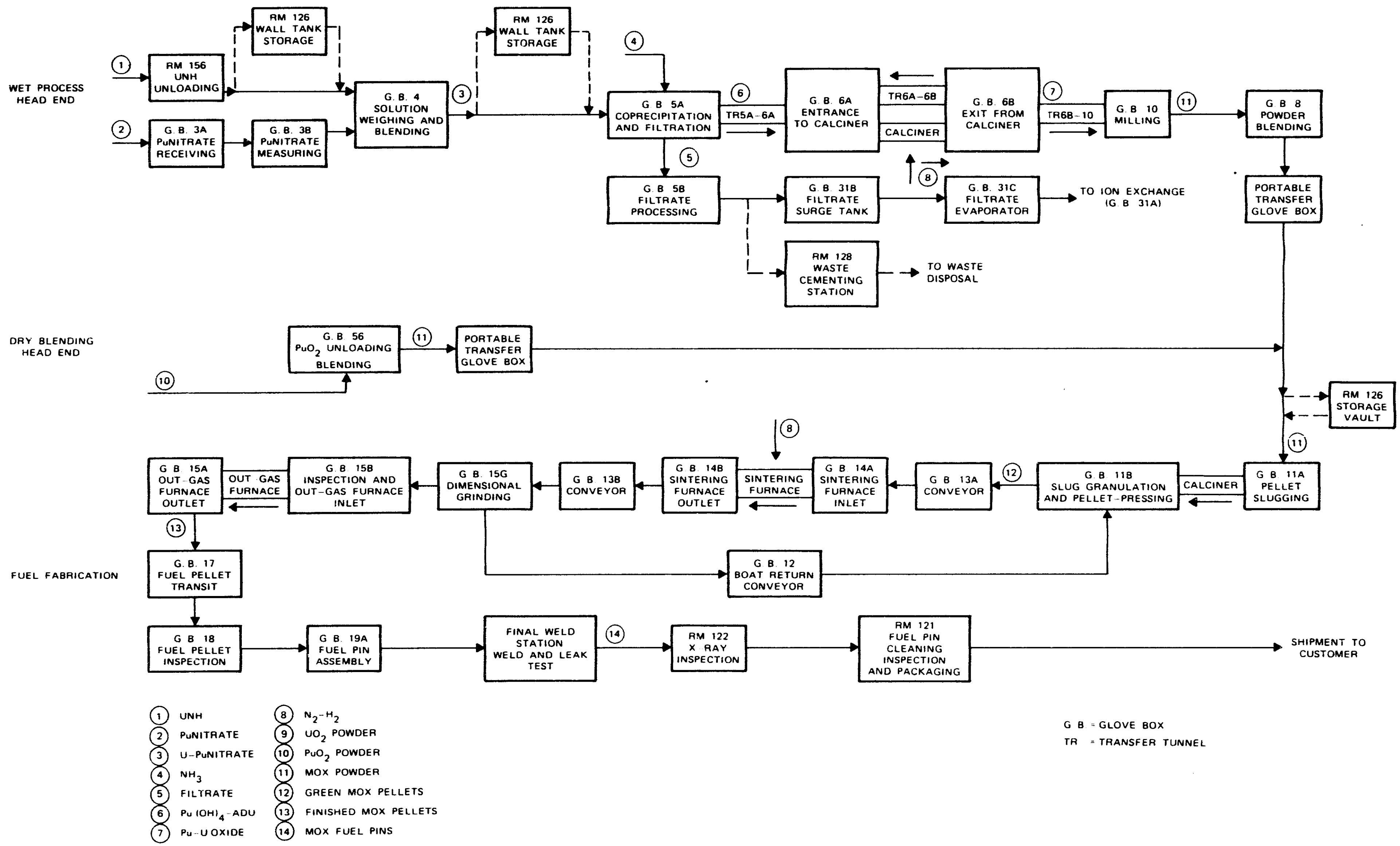


FIGURE 2

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°C ± 10° 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.



Glove Box Flow Diagram, Mainline Mixed Oxide Fabrication Process

FIGURE 3

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.

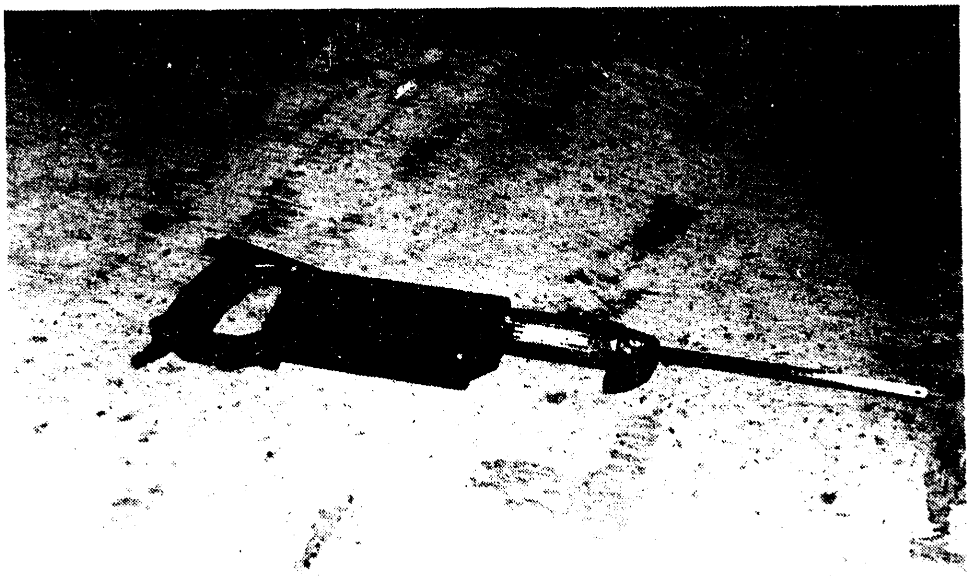
The complete manufacturing operations of the fuel pins were under the survelance of the customers inspectors at all times. However, final acceptance of the finished pins was dependent upon the successful completion of receiving inspection at the customer facility.

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

№ 0506

SPECIAL WORK PERMIT KM 2420 B

DISTRIBUTION
White — Job Site
Canary — Health Physics File

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

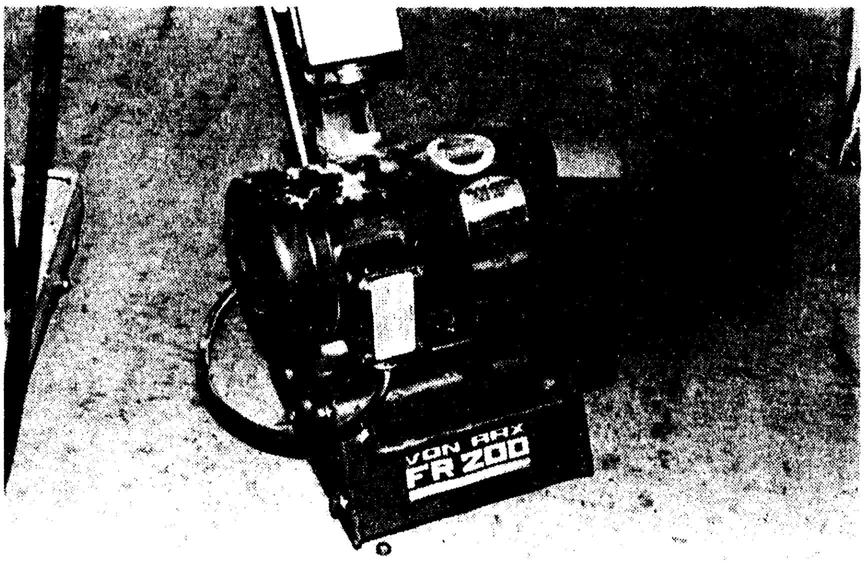
The tent is fabricated out of a roll of plastic sheet. (clear .004-.006" thick)

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

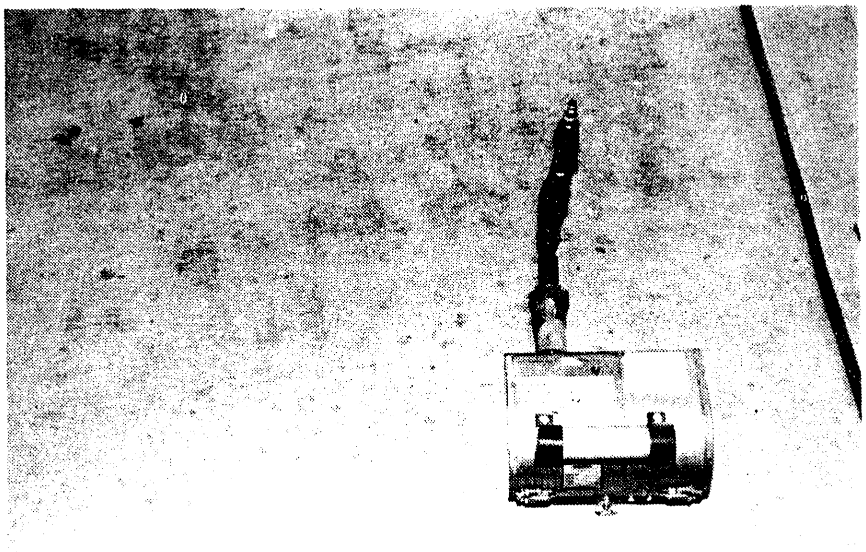
The building surfaces such as walls and ceilings were shot blasted with a vacu-blast machine which was modified for this service. The modification consisted of an additional cyclone and filter which was added to the discharge air stream before it exhausted into building ventilation discharge air system.

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.



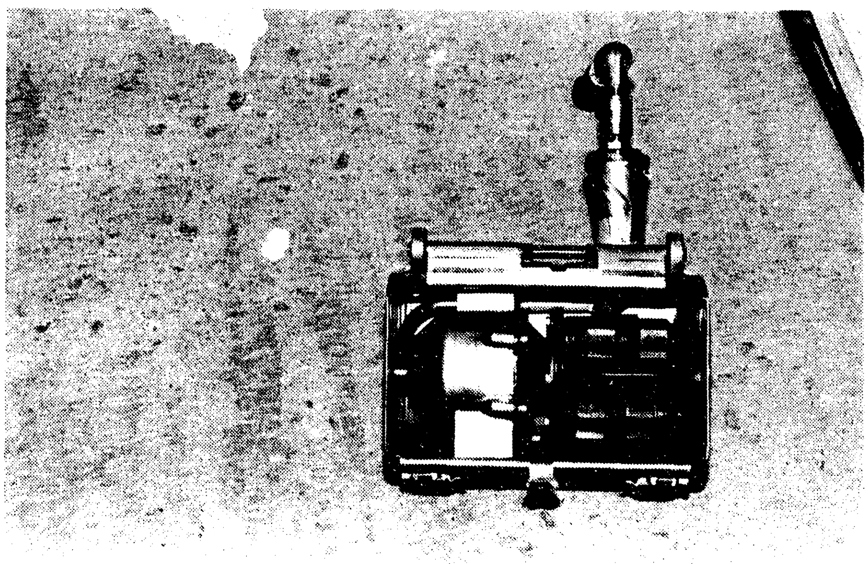
Electric version of
Floor Scabbler

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



Top view hand held machine

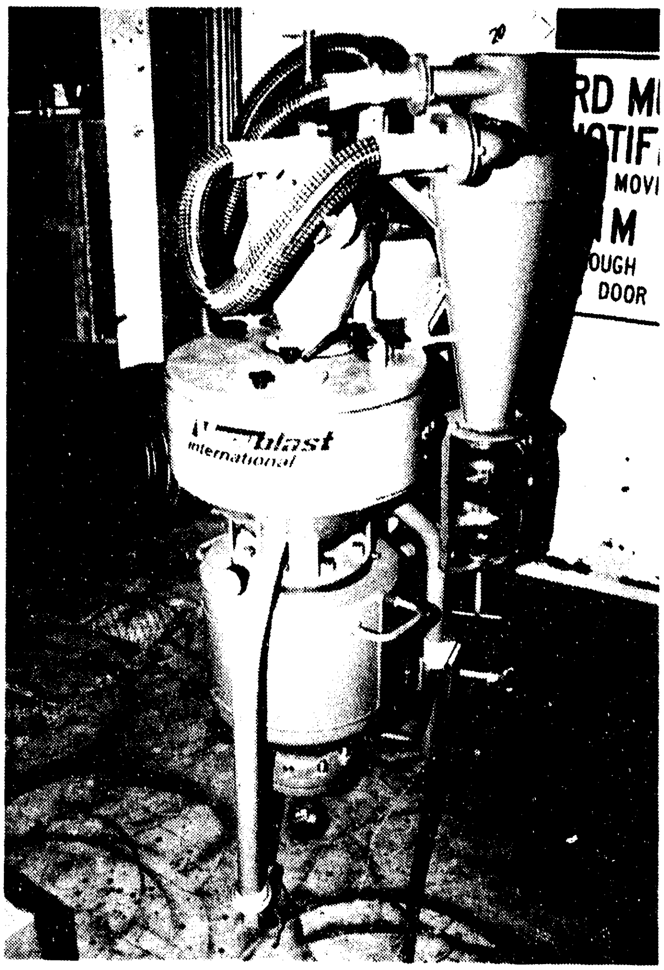
Bottom view hand held machine showing air motor and drum with special milling cutters

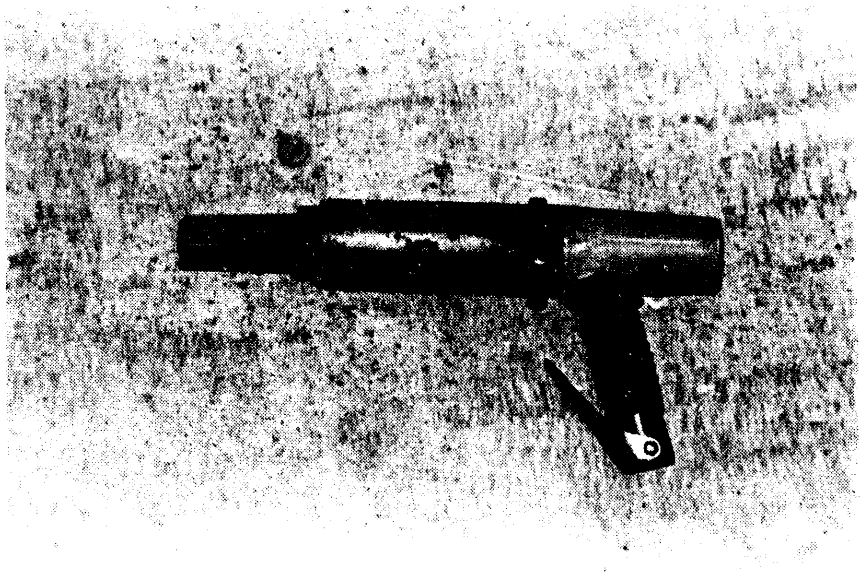


Photos also show floor surface produced by this equipment.

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



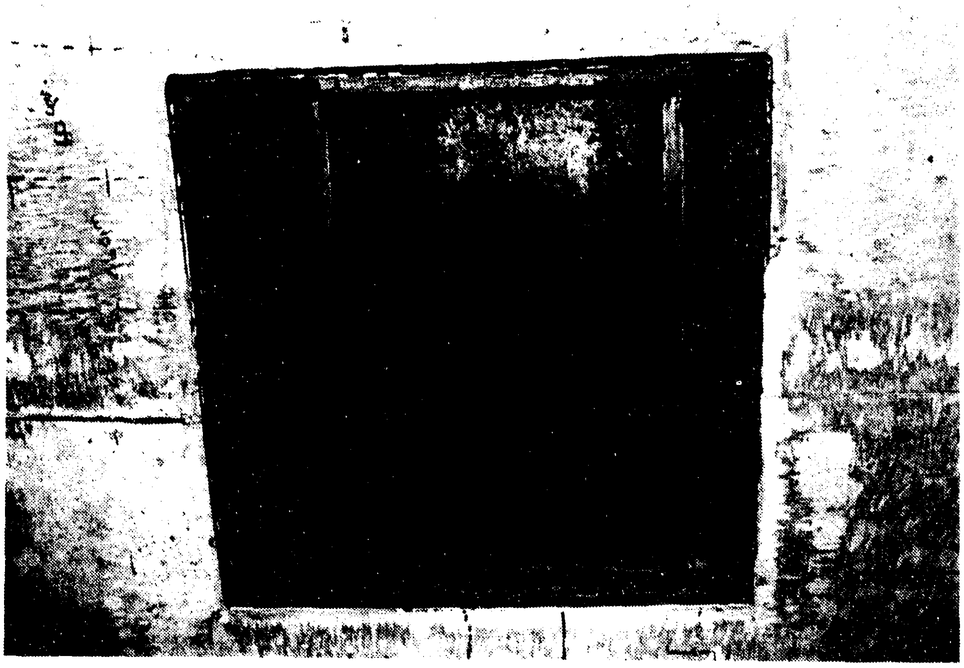


Needle scaler used in corners and other areas which were inaccessible for drum type machine.

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



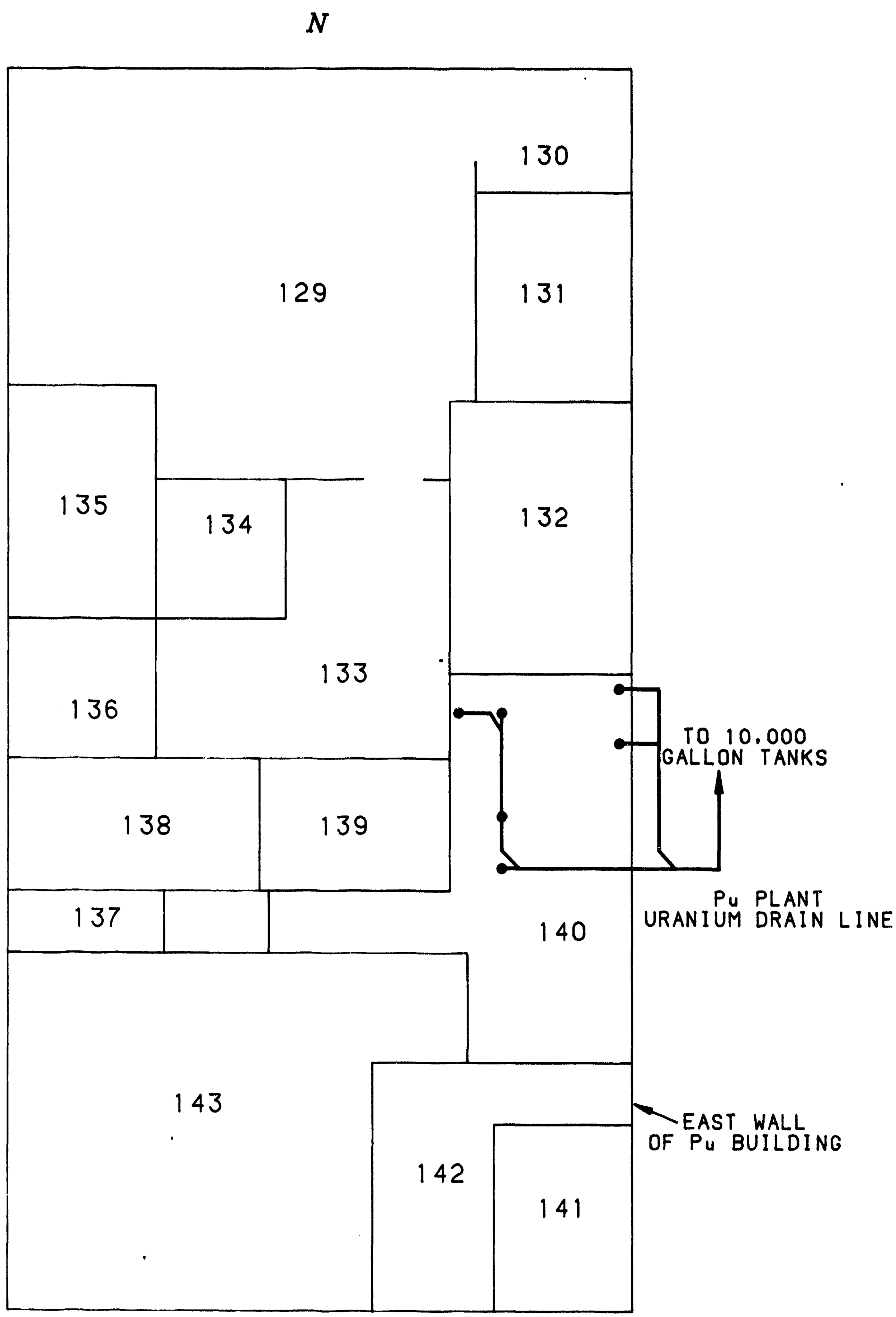
floor exhaust air filter box

Pu Plant Laboratory Drain System

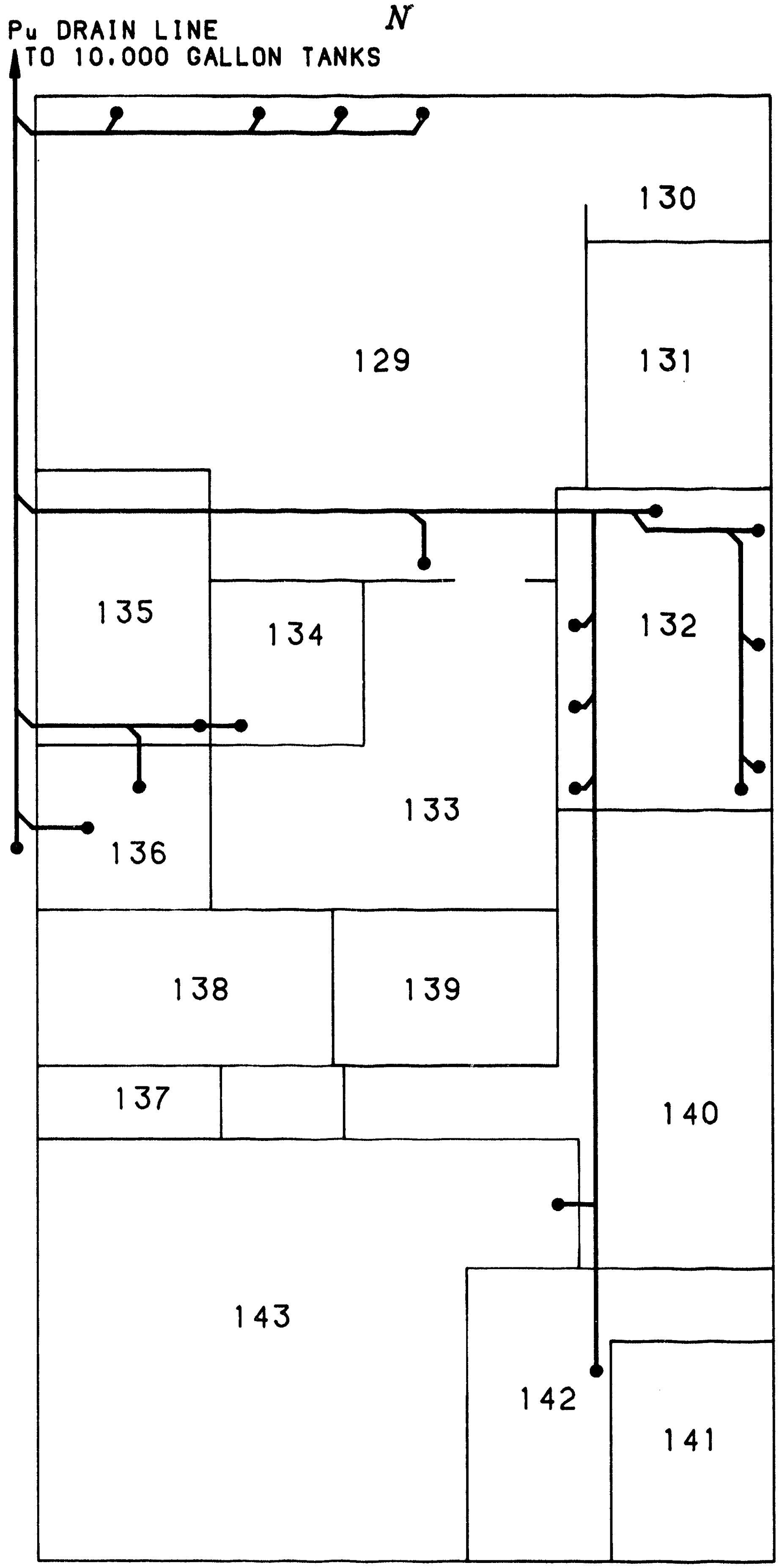
The laboratory drain system consisted of two separate drain systems. The uranium laboratory room drain system was located in Room 140 and exited the building through the east wall and terminated in the 10,000 gallon collection tanks. This system consisted of approximately fifty two feet of two inch durcon 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.

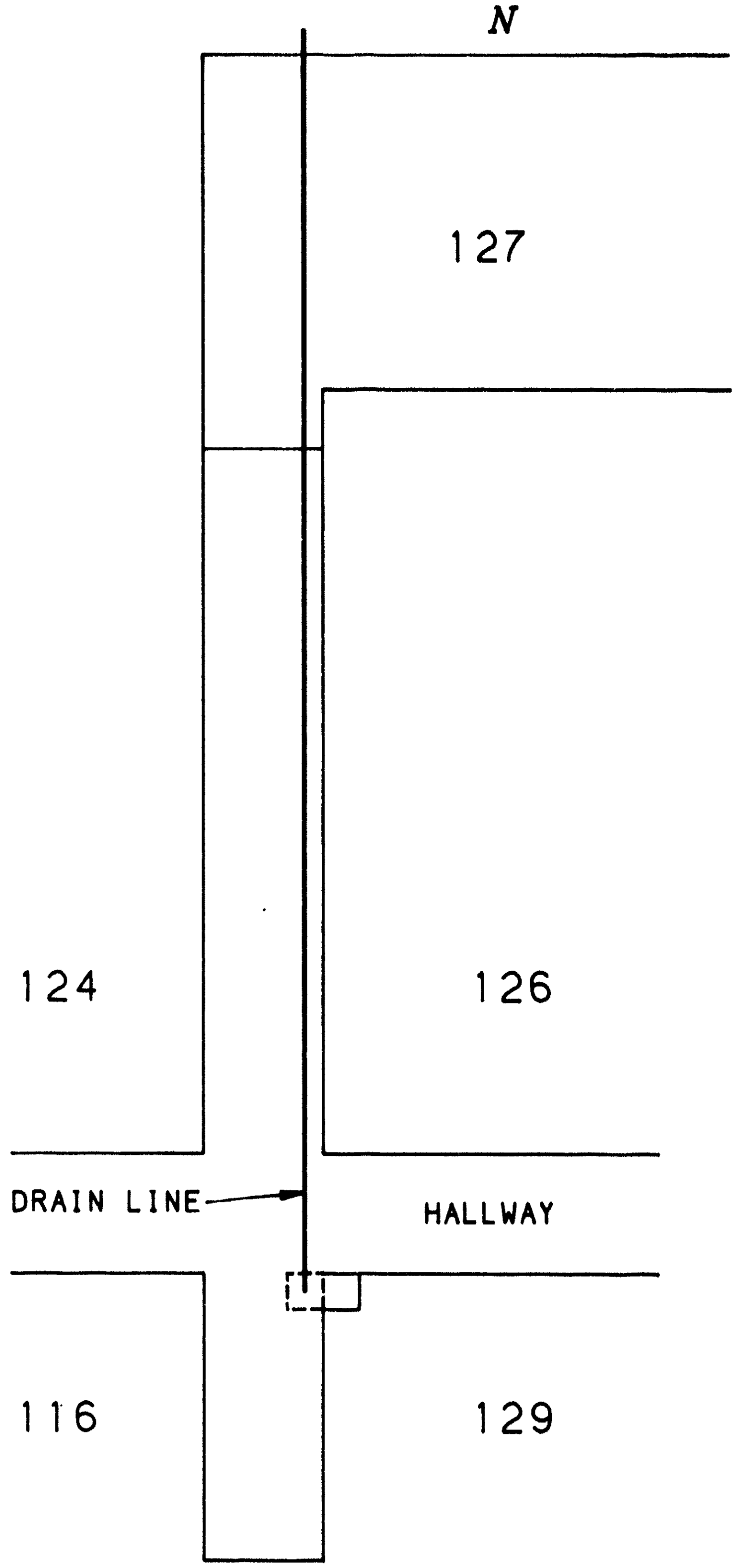
Our initial plan was to clean and survey the Pu drain system (figure #2 and #2A). To accomplish this, we saw the need to acquire some special detectors and to prove that this system was leak proof. We initially removed a portion of this system outside of the building between the building and the 10,000 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.



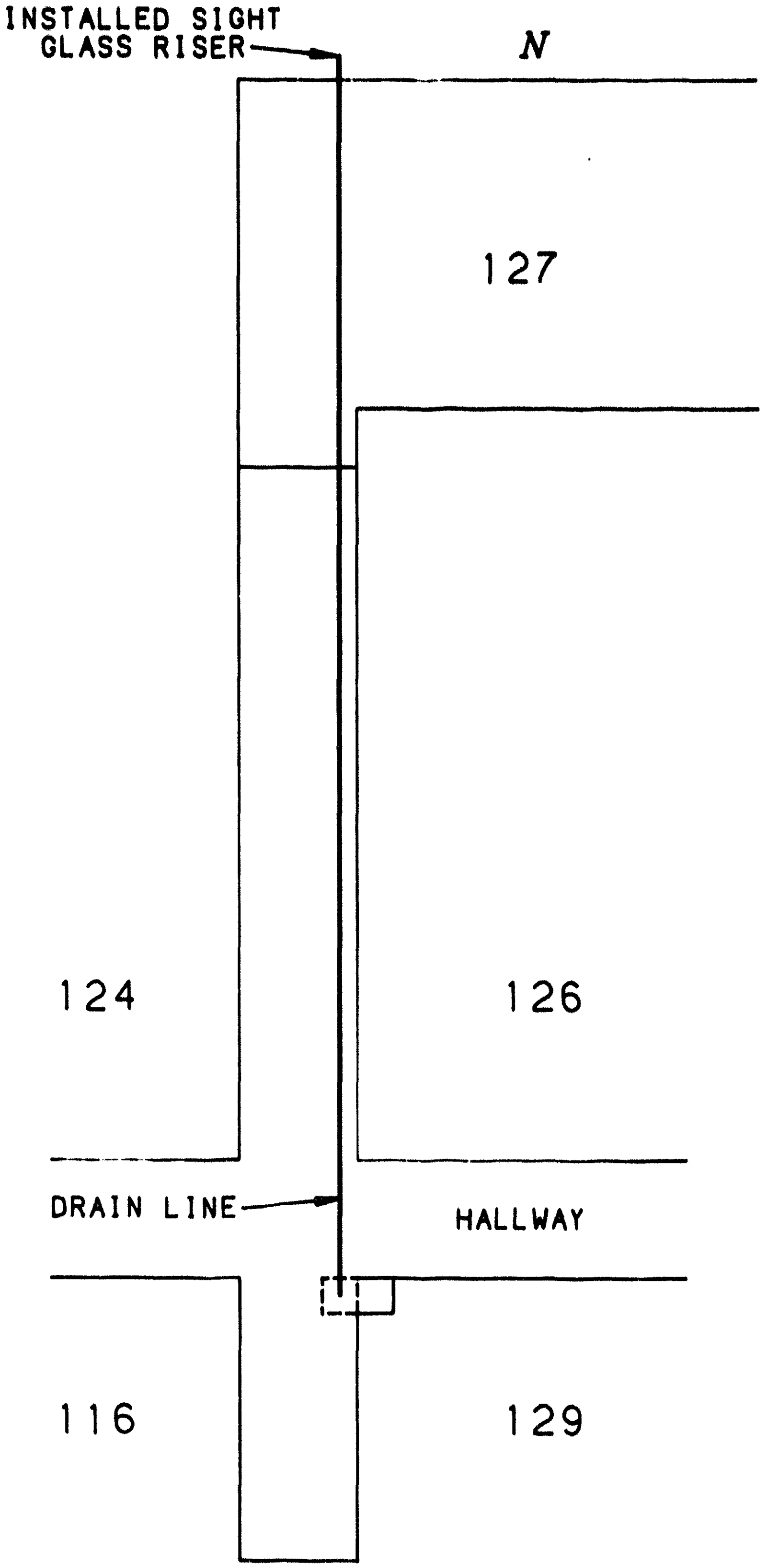
Pu LABORATORY AREA
FIGURE #1



Pu LABORATORY AREA
FIGURE #2



Pu DRAIN LINE
page 2 of 2
FIGURE #2A

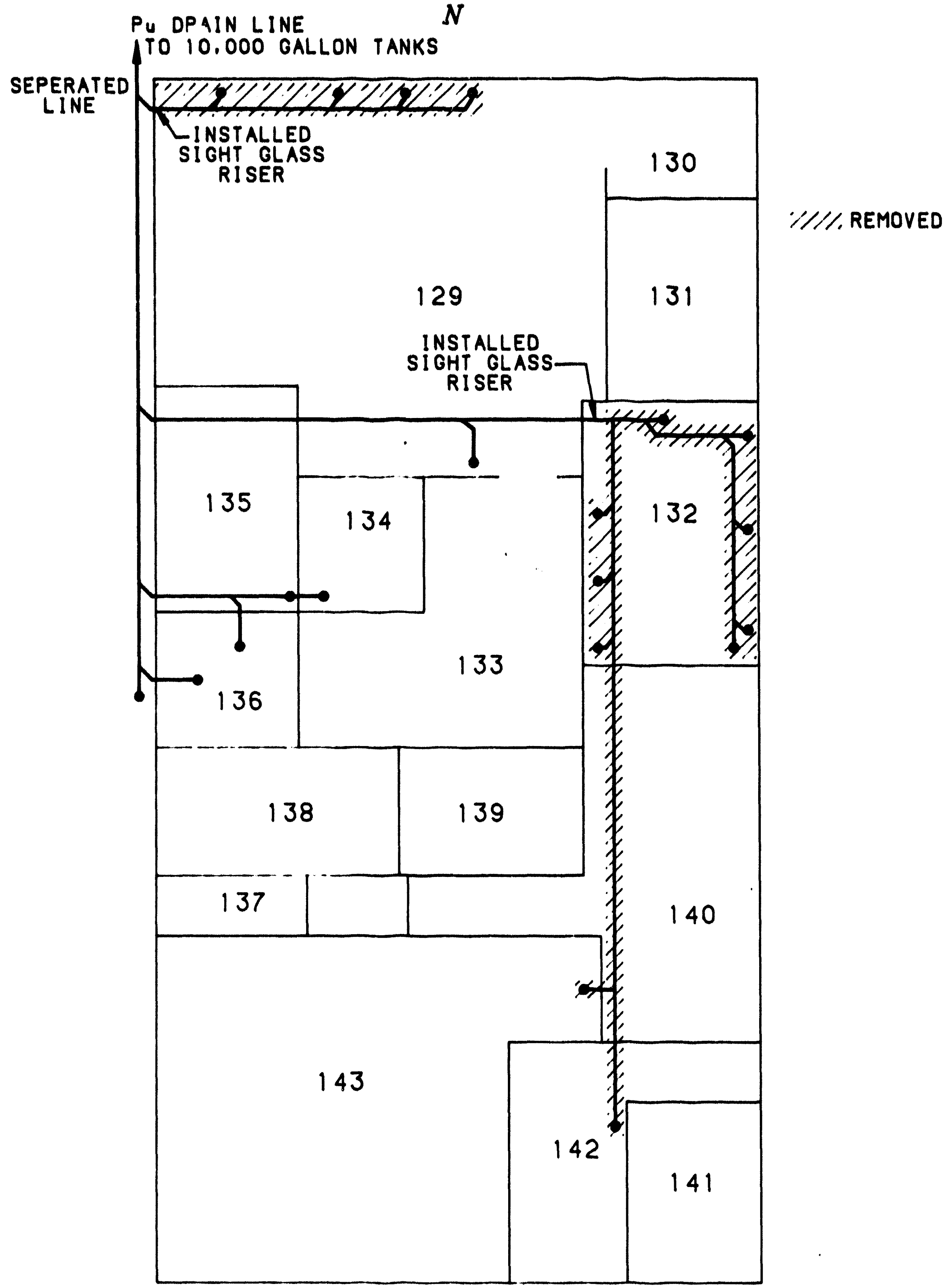


Pu DRAIN LINE

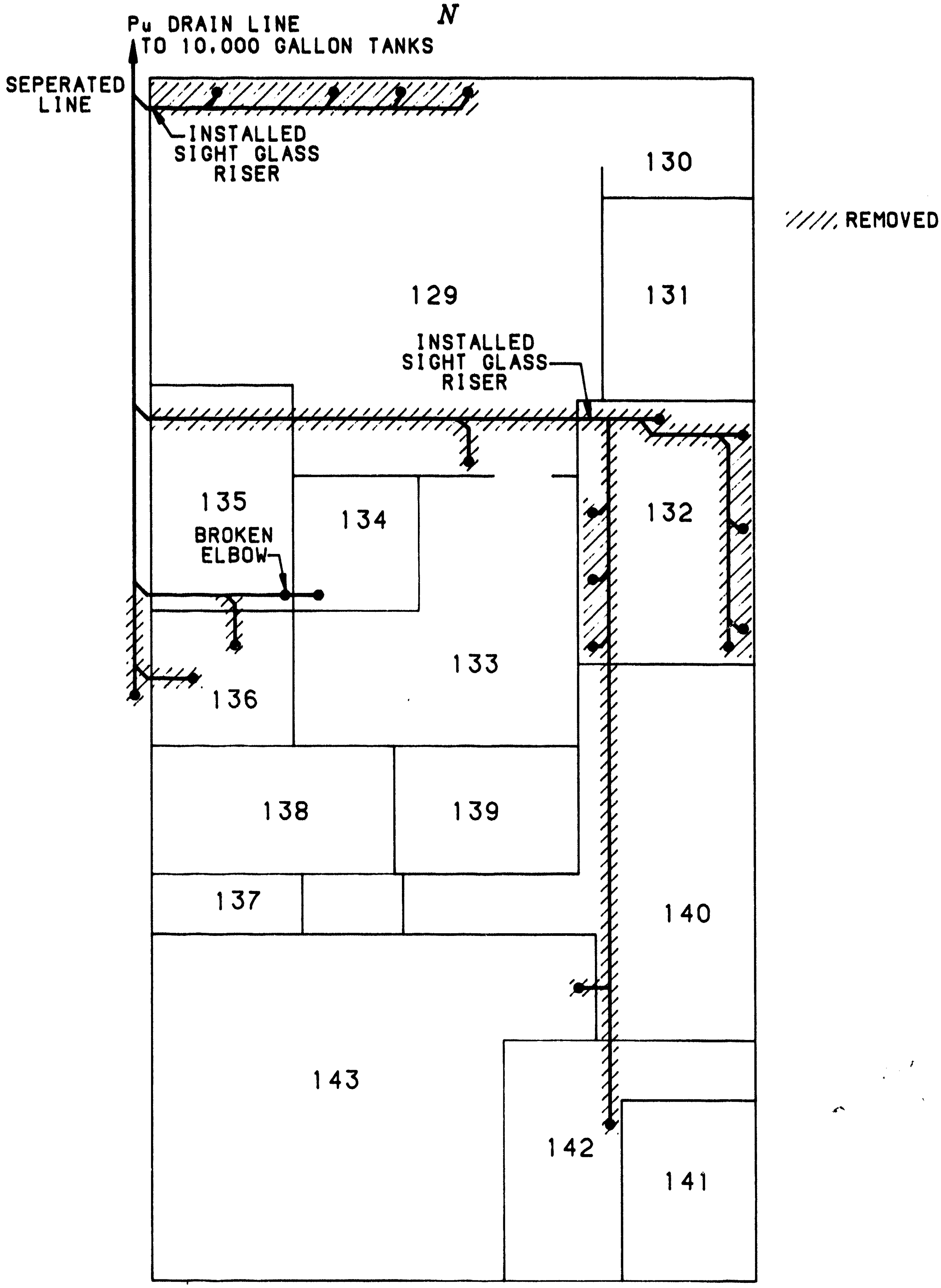
FIGURE #3

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).

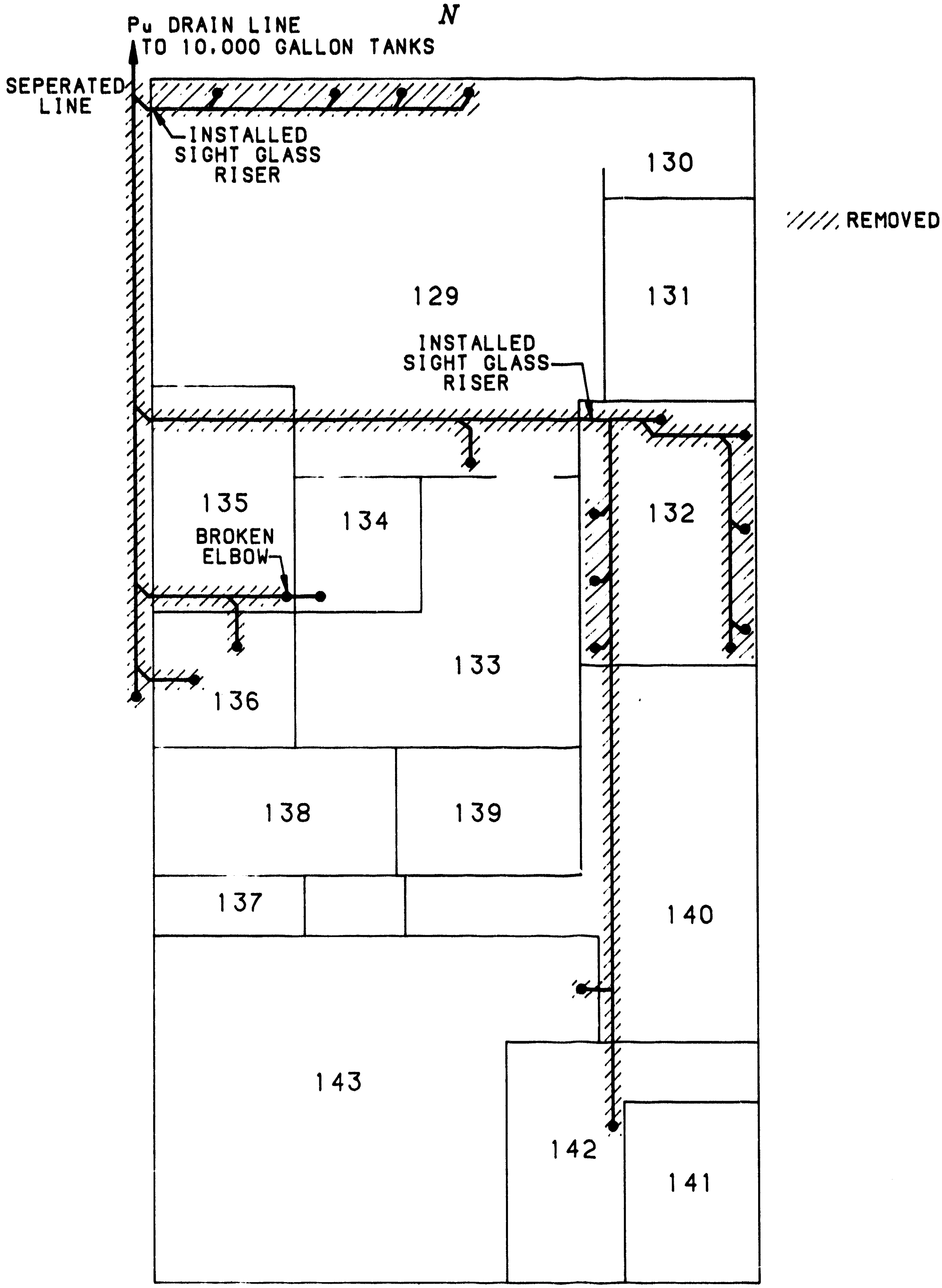
Our second leak test consisted of the remaining drain system in the laboratory area only. We installed two standpipes, one in the northwest corner of room 129, and the other in room 132 northwest corner (Figure #4). After filling this portion of the drain system with water, we still indicated a leak 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

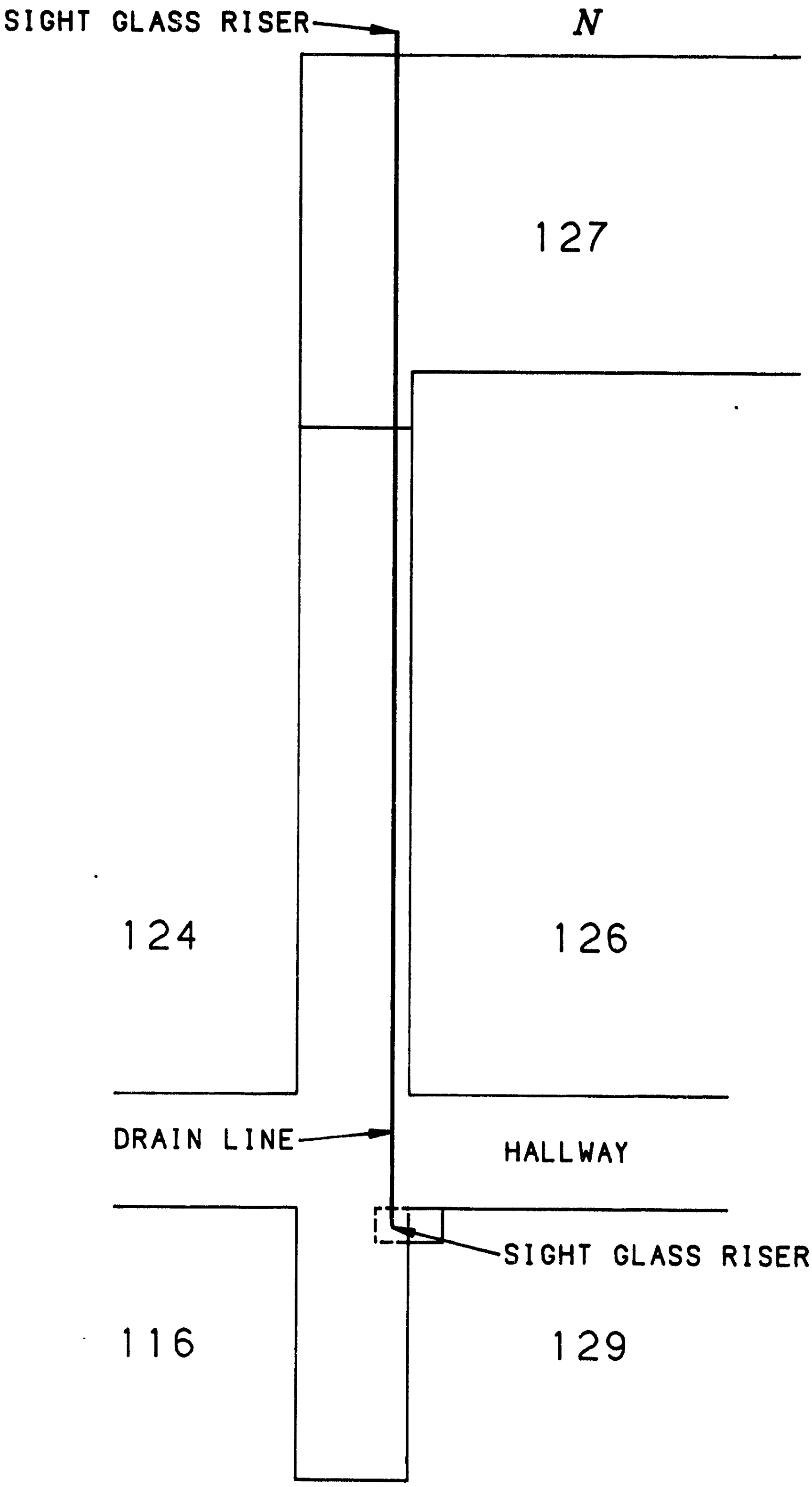


Pu LABORATORY AREA
FIGURE #5



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

W. A. Rogers

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

The last 1.5 hours of each Friday was used for a short work station safety meeting by the area supervisors, the remainder of the time was used for a total shop housekeeping detail. In addition, a monthly safety meeting with all personnel was conducted by the Health Physics Supervisor. All of this attention to safety and housekeeping was to emphasize the importance of minimizing contamination and personnel exposure.

DATA COLLECTION

The following procedures are included in the Appendix of this report because they define the work that was performed, the way it was accomplished and the accuracy of the results.

These procedures were included in DOE Report No. 4, but are repeated here because they are examples of the way tasks and problems were solved at the Cimarron Facility. Data collection and the accuracy of the results are an important part of this final report.

Procedure KM-NC-10-83, Rev. 3 4-1-87

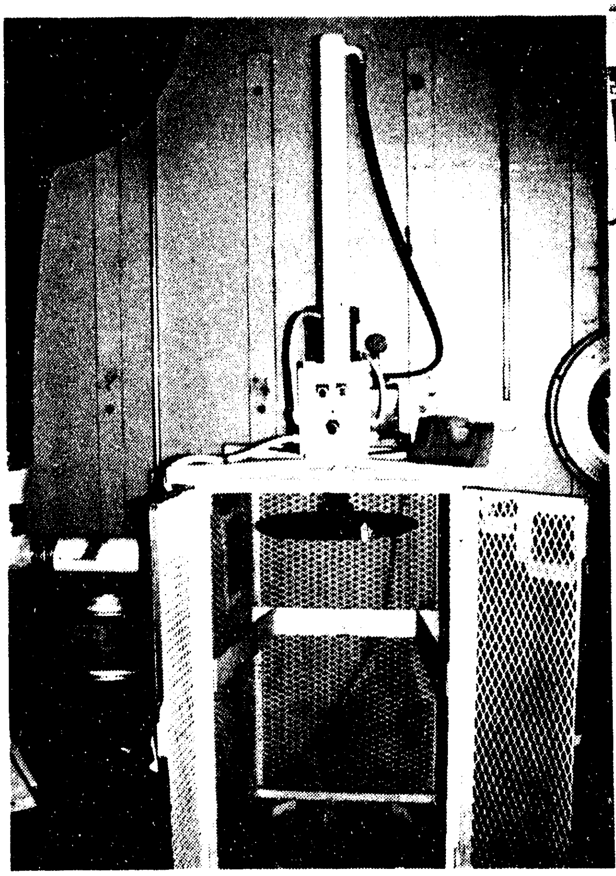
PLUTONIUM PLANT L.S.A. WASTE DRUM COUNTER.

Procedure KM-NP-10-89, Rev. 0 4-12-84

PLUTONIUM PLANT N.D.A. COUNTING OF T.R.U. WASTE

DRUM LOADING - COMPACTION - SHIPPING CONTAINERS

L.S.A. drum loading are accomplished in the vault where a series of open top DOT 17-H drums are selectively filled with packages as they are accumulated from the decontamination operations. An inventory sheet is maintained on each drum. When several drums are filled and the materials contained are compressable, example: (wipes - rags - plastic, etc.) three or four drums full of this material are compacted into one drum using a shop made compactor. The Photos illustrate the 17H drums and the compactor cabinet.



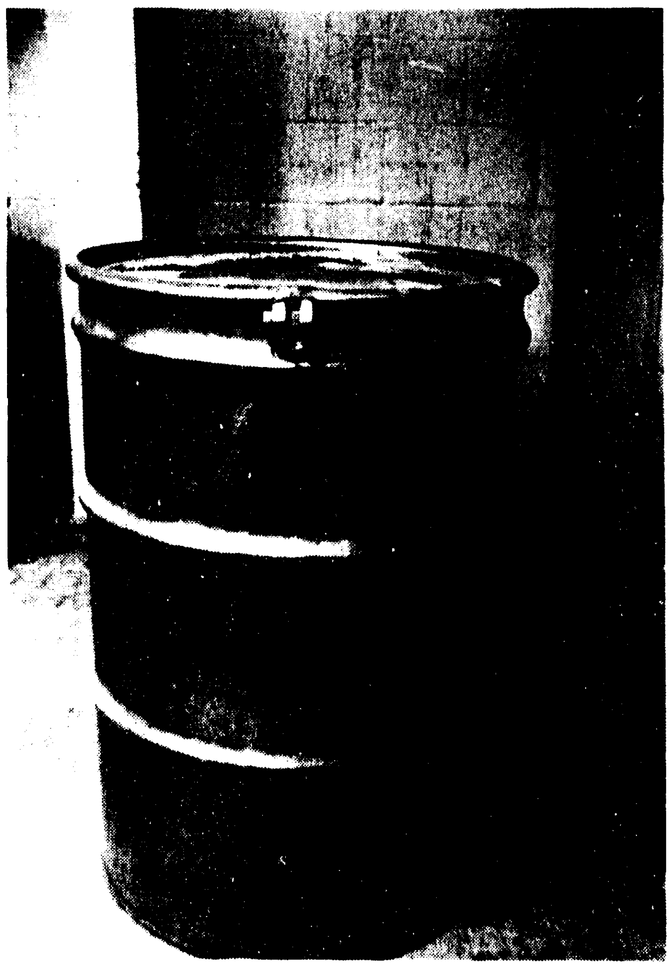
Hold down discs were used during the compaction of plastic and wipes because the material being compacted will follow the ram back up to the top of the drum. The hold down disc peripheral fingers engage the convolutions in the sidewall of the drum and hold the contents compressed, usually two or three of these hold down discs are used in each drum.

T.R.U. WASTE PACKAGING

The T.R.U waste packaging system consists of the following:

A polyethylene drum liner .090" thick is placed inside a DOT galvanized and chromate treated drum. The drum liner is filled with assayed packages and the lid is glued shut. The drum lid is glued and gasketed down and the compression ring is bolted and sealed closed with a jam nut and wire cable seal.

The filled drum is transported in an N-55 shipping container. Kerr-McGee owns (38) thirty eight N-55 containers which have made (32) thirty two round trips to the Hanford T.R.U. waste repository.



The N-55 overpack is illustrated in the photos below.

HEALTH AND SAFETY PROGRAM

Safety Meetings and Related Subjects.

The weekly safety meeting consists of a topic of interest such as the use of ladders, or high-jackers when the next work week may contain tasks where a ladder or scaffold would be required. When a new tool is obtained, it becomes the topic of a safety meeting where proper use and operation are discussed and demonstrated. Safety meetings are also used to discuss shop problems where decommissioning operations may cause a temporary or permanent change in an established routine. Safety meetings are conducted by the area supervisor or a person he has designated to prepare a presentation on a specific topic. Safety meetings are also used to discuss near misses where quick thinking and evasive action prevented an accident.

The topic of the weekly safety meetings and the supervisor's observation of the effect of the meetings are reported in the supervisor's monthly progress report to management.

FIRE AND EMERGENCY EVACUATION

Each calendar quarter an emergency evacuation is conducted where everyone evacuates to the designated area. The attendance board is carried out by the first person leaving the building. When all personnel are accounted for and surveyed for contamination, the evacuation procedure is reviewed and a scenario of a potential emergency is discussed and a course of action is described which would apply to the emergency. Such topics as how to handle an injured contaminated person and the use of the emergency building and its facilities are typical of these sessions.

Photo shows air lock extension at the entrance to the emergency building.

The Cimarron Facility has developed the capability to cope with fire emergencys involving Class A, B and C fires plus the unique problems associated with radioactive materials.

Enriched Uranium and Plutonium pose problems from their radioactive contamination and toxicity potential plus the possibility of a criticality. A criticality incident may result from a fire or improper fire fighting techniques. Water, in some cases, can cause a nuclear reaction to occur. A change in shape by melting or settling due to fire is another criticality risk.

Work place fires are job and property loss potentials. Good housekeeping and the use of proper work procedures and maintenance, along with properly trained people and good emergency equipment are essential in a fire loss prevention program. The fire action plans of Kerr-McGee and the Cimarron Facility are designed for these contingencies.

Accidental Release of Radioactive Materials

Two large loose leaf binders full of health physics procdures, emergency procedures, and contingency plans all add to the ability to detect and cope with an accidental release of radioactive materials.

For brevity sake appropriate for this report Procedure KM,-NP-10-81 "Plutonium Out of Confinement - Leaks, Spilles, etc." is included. This procedure provides instruction in a summary form for proper response to situations involving accidental releases.

In addition, sections of our contingency plan and emergency procedures are attached which describe:

a. the ventilation containment system:

b. instrumentation and alarm systems for release detection;

c. emergency procedure training;

d. contingency classifications, notifications and actions;

e. recovery plans; and

f. administrative controls.

SUMMARY EXPOSURE DATA FOR OPERATING PERSONNEL

D & D of the Cimarron Facility plutonium plant resulted in a total whole body penetrating dose of 70 manRem spread over 26 people during a nine year period. The maximum total whole body penetrating dose received by any individual was 9.37 Rem for the entire nine years. The average total dose received for the nine year period was 2.69 Rem or an average of 0.3 Rem per year per individual. The administrative staff exposure was much lower and as a result was not factored in the average total dose of any of the charts as this would bias the averages low.

BIOASSAY REPORTS

Routine bioassay (urine) sample results were below the detection limit of .01 dpm/sample volume. Special samples, requested after detected releases of airborne contamination showed positive results in four cases, involving nine people

Maximum for a six day total voiding (fecal and urine) was 1245.2 dpm for one incident. The other totals for a six day voiding ranged from 7.32 dpm to 324.8 dpm. In all cases, subsequent samples have been 0.1 dpm per sample volume.

In-VIVO lung counts have never shown detectable depositions of Plutonium.

PERSONNEL FILM BADGE RESULTS FOR DECOMMISSIONING
PU-PLANT 10/79 to 9/88 EXPOSURES REPORTED IN REMS

MAX.	9.37
AVE.	2.69
MIN.	0.18

	BEGINNING		ENDING		
	LIFETIME	DATE	LIFETIME	DATE	TOTAL
1.	7.28	10/79	13.08	8/88	5.80
2.	4.72	10/79	7.73	8/88	3.02
3.	.17	10/79	4.99	4/84	4.82
4.	0	10/79	2.23	8/88	2.23
5.	0	10/79	1.22	6/81	1.22
6.	3.27	10/79	3.65	8/88	.38
7.	.23	10/79	3.87	8/88	3.64
8.	.19	10/79	1.12	8/88	.93
9.	3.99	10/79	5.81	8/88	1.82
10.	.11	10/79	2.65	8/88	2.54
11.	3.20	5/80	4.55	8/88	1.35
12.	7.37	5/80	10.25	8/88	2.88
13.	.12	9/80	7.76	8/88	7.64
14.	0	1/81	2.23	8/88	2.33
15.	0	7/81	2.60	8/88	2.60
16.	0	8/81	1.22	8/82	1.22
17.	0	9/81	.83	8/88	.83
18.	0	9/81	2.83	8/88	2.83
19.	0	9/81	.62	8/88	.62
20.	0	10/81	1.92	6/88	1.92
21.	0	10/81	9.31	8/88	9.37
22.	0	12/83	.18	4/85	.18
23.	0	2/85	1.91	8/88	1.91
24.	0	5/85	3.10	7/88	3.10
25.	0	5/85	2.69	8/88	2.69
26.	0	12/85	1.99	9/87	1.99
					69.86

INTERNAL EXPOSURE

The table below shows exposure estimate assignments, by year for the Cimarron Facility Plutonium Plant decommissioning.

YEAR	NUMBER OF PEOPLE	TOTAL MPC-HRS	AVERAGE MPC-HR PER PERSON FOR THE YEAR	PER WEEK
1979+	8	17.20	2.15	0.17
1980	9	179.72	19.97	0.38
1981	19	5.86	0.31	0.10
1982	21	534.30	25.44	0.49
1983	20	2200.47	110.02	2.12
1984	19	1563.60	82.29	2.74
1985	22	206.80	9.40	0.18
1986	19	420.70	22.14	0.43
1987	18	453.00	25.17	0.48
1988++	18	17.00	0.94	0.10

During the total time of 464 weeks, a total of 26 individuals received a total of 5,598.65 MPC hours resulting in an average of 215.33 MPC hours per individual for the 464 weeks or an average of 0.46 MPC hours per week.

+October through December (13 weeks)
++January through August (35 weeks)
* Exposure Estimates Assignments Based on Air Samples 0.1xMPC

The table below shows the total exposure estimate assignments for the 26 people engaged in the decommissioning activities over a nine year period.

Worker	MPC-HRS	Worker	MPC-HRS	Worker	MPC HRS
A	228.92	J	25.08	S	60.86
B	229.85	K	212.19	T	347.48
C	225.35	L	465.19	U	625.71
D	83.43	M	475.39	V	4.10
E	80.07	N	366.02	W	62.40
F	207.81	O	81.99	X	73.80
G	224.54	P	108.24	Y	47.80
H	14.40	Q	113.37	Z	54.50
I	194.90	R	985.26		

As can be seen, the maximum exposure estimate assignment to a single individual was 985.26 MPC-HRS.. This is an average of 2.12 MPC-HRS. per forty hour week over the total time.

This data compiled by Ronald L. Fine.

Air Effluent Monitoring

Exhaust stack sample results are shown below by calendar quarter. The table show the total gross alpha released as well as the concentration in microcuries per milliliter

1979	mCi/ml			1.28 E-14	8.8 E-15
	Total mCi			1.95	0.87
1980	mCi/ml	5.18 E-15	3.54 E-15	5.25 E-15	1.08 E-14
	Total mCi	0.81	0.66	1.04	2.17
1981	mCi/ml	2.59 E-14	6.59 E-15	3.03 E-15	5.80 E-15
	Total mCi	4.45	1.22	0.61	1.08
1982	mCi/ml	4.24 E-15	4.93 E-15	4.22 E-15	8.99 E-15
	Total mCi	0.73	0.92	0.79	1.67
1983	mCi/ml	1.51 E-14	7.57 E-15	3.59 E-15	1.28 E-14
	Total mCi	2.58	1.40	0.67	2.54
1984	mCi/ml	3.03 E-14	4.76 E-15	2.83 E-15	5.52 E-15
	Total mCi	4.76	0.89	0.53	1.03
1985	mCi/ml	1.15 E-15	3.95 E-15	9.72 E-16	2.11 E-15
	Total mCi	0.18	0.73	0.18	0.39
1986	mCi/ml	1.56 E-15	9.32 E-16	4.969 E-15	1.60 E-15
	Total mCi	0.25	0.17	0.93	0.30
1987	mCi/ml	4.06 E-15	2.24 E-15	1.67 E-15	3.13 E-15
	Total mCi	0.48	0.34	0.22	0.32
1988	mCi/ml	9.39 E-16	4.85 E-16		
	Total mCi	0.08	0.06		

Liquid Effulent

Decontamination solutions were cleaned up by filtration and ion exchange methods to < 0.1 MPC, or cemented for burial as LSA waste. No liquid effluent was released from the Facility. Domestic waste water and decontamination solutions < 0.1 MPC (< 4.0 x 10^{-7} mCi/ml) were pumped to sanitary lagoons (evaporation ponds with no outlet). Subsequently, the dry sludge was removed from the sanitary lagoons and shipped as LSA waste. Samples of the dry sludge showed a range of 2.89 to 17.7 picocuries of plutonium per gram with an average concentration of 10.79 picocuries/gram.

ANNUAL ENVIRONMENTAL SAMPLE RESULTS

The annual environmental sample results for the Cimarron Facility are included for review. These reports include both the Mixed Oxide Plutonium Plant and the Uranium Oxide Fuel Plant. The reports included are for the years 1983 through 1988 and include the analytical results of the weekly air samples and the locations where the samples were taken. Reports which show the results of the annual samples for surface water, well water, surface soil, subsurface soil and vegetation are also included. There were no appreciable variations in any of the results obtained during the decommissioning.

The reports for prior years when the plant was on standby are on file. They show no significant changes and were not considered pertinent to this report.

CIMARRON FACILITY
1983 ANNUAL ENVIRONMENTAL SAMPLES (AIR)

Analysis - Gross Alpha (μCi/ml E-14)

WEEK NUMBER	NORTHWEST ½ MILE SAMPLE NO. 1101	KM LAKE EAST SAMPLE NO. 1102	JUNCTION HWY 33/74 SAMPLE NO. 1103
1	0.57	0.64	1.0
2	1.6	2.4	1.9
3	2.8	2.8	1.4
4	2.7	2.1	1.2
5	*	*	*
6	2.2	2.1	1.4
7	3.9	4.0	2.7
8	1.6	1.8	1.2
9	1.0	1.2	1.6
10	1.3	1.7	1.2
11	1.8	2.3	1.0
12	1.1	1.6	1.1
13	1.1	3.8	1.2
14	*	*	*
15	1.2	1.5	0.74
16	1.2	1.1	*
17	1.3	1.6	1.1
18	0.60	1.7	0.97
19	1.6	1.4	*
20	0.75	0.69	*
21	0.75	1.1	1.4
22	0.88	0.66	0.69
23	1.4	1.1	0.93
24	1.3	1.3	0.68
25	0.41	0.78	0.44
26	1.0	0.79	0.89
27	1.0	1.5	*
28	0.90	0.86	1.3
29	1.0	1.2	0.93
30	1.3	0.53	1.1
31	*	0.87	*
32	1.0	1.4	1.0
33	1.2	1.8	1.1
34	0.64	0.84	0.75
35	1.4	1.3	1.7
36	1.5	1.9	1.5
37	0.63	0.58	0.79
38	1.2	0.89	0.28
39	1.2	1.1	1.4
40	1.5	1.7	1.8
41	1.8	1.6	1.3
42	*	*	*
43	0.52	0.64	0.48
44	1.4	1.3	1.4
45	0.76	0.88	0.80
46	0.94	2.8	1.1
47	3.0	0.53	0.73
48	0.58	0.70	0.39
49	0.24	0.67	1.0
50	0.42	0.56	0.76
51	*	*	*
52	0.16	0.36	0.35

* No Sample

CIMARRON FACILITY
1983 ANNUAL ENVIRONMENTAL SAMPLES

Revised 4-30-84

SAMPLE LOCATION	SAMPLE NUMBER	DATE (1983)	GROSS ALPHA (pCi/l)	GROSS BETA (pCi/l)	Pu-239 (pCi/l)	U (mg/l)	F (mg/l)	NO_3 (mg/l)
Surface Water								
River - Upstream	1201	06/15	<10	<20	0.015 ± 0.007	0.011	0.4	9
River - Downstream	1202	06/16	<10	<20	0.008 ± 0.011	0.005	0.4	4
Pond NW of Plant	1203	06/15	<10	<20	0.019 ± 0.013	0.014	0.3	1
Pond West of Plant	1204	06/24	<10	<20	0.006 ± 0.006	0.005	0.3	2
KM Lake East	1205	06/14	<10	<20	0.003 ± 0.004	0.004	0.4	2
Pond NW of Incinerator	1206	06/16	160	160	0.008 ± 0.007	0.106	3.0	220
Stream NW of Old Pond 2	1208	06/22	<10	<20	0.004 ± 0.004	0.004	1.3	2
KM Lake West	1209	06/14	<10	<20	0.009 ± 0.006	0.004	0.4	2
Sanitary Lagoon East	1212	06/14	90	<20	0.010 ± 0.008	0.028	0.8	6
Sanitary Lagoon West	1213	06/14	14	<20	0.004 ± 0.004	0.011	0.8	4
Well Water								
North of Plant	1301	06/17	<10	<20	0.017 ± 0.015	0.011	0.8	10
SW of Old Pond 1 (dry)	1302	06/15	---	---	---	---	---	---
Farm SE of Plant	1303	06/15	<10	<20	0.009 ± 0.006	0.004	0.4	8
NW of Old Pond 1 (dry)	1304	06/15	---	---	---	---	---	---
NW of Old Pond 2	1305	06/15	370	1350	0.007 ± 0.006	0.007	2.4	170
SE of Old Pond 2 (dry)	1306	06/15	---	---	---	---	---	---
Junction Hwy 33 and 74	1307	06/14	<10	<20	0.011 ± 0.007	0.004	0.5	10
NE of Old Pond 2 (dry)	1308	06/15	---	---	---	---	---	---
SW of Old Pond 2 (dry)	1309	06/15	---	---	---	---	---	---
South of Old Pond 2 (dry)	1310	06/15	---	---	---	---	---	---
Vegetation					(pCi/g)	(µg/g)	(µg/g)	
North ½ Mile	1501	06/16			0.0004 ± 0.0004	0.18	6.	
North U Fence Line	1502	06/14			0.001 ± 0.0004	0.08	<1.	
South U Fence Line	1503	06/25			0.0007 ± 0.0006	0.18	<1.	
South ½ Mile	1504	06/14			0.0009 ± 0.0004	0.19	<1.	
East ½ Mile	1505	06/21			0.0004 ± 0.0003	0.18	5.	
West ½ Mile	1506	06/24			0.0006 ± 0.0004	0.19	<1.	
Covered Pu Pond	1507	06/21			0.0006 ± 0.0004	0.08	<1.	
Covered Pond 1	1508	06/16			0.0004 ± 0.0003	0.16	<1.	
Covered Pond 2	1509	06/16			0.0007 ± 0.0004	0.04	<1.	
Old Burial Pit	1510	06/21			0.006 ± 0.004	0.13	<1.	
North Pu Fence Line	1511	06/25			0.001 ± 0.0005	0.18	11.	

CIMARRON FACILITY

1983 ANNUAL ENVIRONMENTAL SAMPLES

Revised 4-30-84

Soil Surface

SAMPLE LOCATION	SAMPLE NUMBER	DATE (1983)	U-238 (µg/g)	Pu-239 (pCi/g)	F (µg/g)
North ½ Mile	1401	06/16	0.5	0.001 ± 0.001	130
North U Fence Line	1402	06/15	1.0	0.0008 ± 0.0007	130
South U Fence Line	1403	06/25	2.0	0.001 ± 0.001	130
South ½ Mile	1404	06/15	9.0	0.0008 ± 0.0005	350
East ½ Mile	1405	06/21	0.6	0.002 ± 0.001	78
West ½ Mile	1406	06/24	0.9	0.001 ± 0.0008	90
North 1 Mile	1407	06/21	0.3	0.0007 ± 0.0006	28
South 1 Mile	1408	06/25	9.0	0.0009 ± 0.0005	100
East 1 Mile	1409	06/16	0.9	0.0007 ± 0.0006	90
West 1 Mile	1410	06/26	1.0	0.0007 ± 0.0006	89
Northeast 1 Mile	1411	06/21	1.0	0.001 ± 0.0007	70
Northwest 2 Miles	1412	06/21	1.0	0.0008 ± 0.0007	88
Southwest 2 Miles	1413	06/21	1.0	0.0006 ± 0.0005	100
Southeast 2 Miles	1414	06/24	1.0	0.001 ± 0.0008	220
North 3.5 Miles	1415	06/21	1.0	0.0008 ± 0.0006	190
North 5 Miles	1416	06/21	1.0	0.0004 ± 0.0003	46
North 10 Miles	1417	06/21	0.6	0.001 ± 0.0007	67
North Pu Fence Line	1418	06/25	0.2	0.001 ± 0.0007	95

Soil Sub-Surface

SAMPLE LOCATION	SAMPLE NUMBER	DATE (1983)	U-238 (µg/g)	Pu-239 (pCi/g)	F (µg/g)
North ½ Mile	1401	06/16	0.6	0.0006 ± 0.0004	77
North U Fence Line	1402	06/15	2.0	0.0002 ± 0.001	160
South U Fence Line	1403	06/25	2.0	0.003 ± 0.0008	82
South ½ Mile	1404	06/15	0.6	0.003 ± 0.008	350
East ½ Mile	1405	06/21	0.6	0.001 ± 0.0007	45
West ½ Mile	1406	06/24	0.6	0.001 ± 0.0005	87
North 1 Mile	1407	06/21	0.3	0.0007 ± 0.0006	37
South 1 Mile	1408	06/25	9.0	0.001 ± 0.0007	130
East 1 Mile	1409	06/16	0.3	0.0008 ± 0.0006	90
West 1 Mile	1410	06/26	1.0	0.0006 ± 0.0005	87
Northeast 1 Mile	1411	06/21	1.0	0.0007 ± 0.0005	17
Northwest 2 Miles	1412	06/21	1.0	0.001 ± 0.0006	92
Southwest 2 Miles	1413	06/21	1.0	0.0007 ± 0.0005	92
Southeast 2 Miles	1414	06/24	1.0	0.0008 ± 0.0006	220
North 3.5 Miles	1415	06/21	1.0	0.001 ± 0.0006	25
North 5 Miles	1416	06/21	1.0	0.001 ± 0.0007	26
North 10 Miles	1417	06/21	1.0	0.0006 ± 0.0004	88
North Pu Fence Line	1418	06/25	1.0	0.0007 ± 0.0006	86

CIMARRON FACILITY
1984 ANNUAL ENVIRONMENTAL SAMPLES
(AIR)

Analysis - Gross Alpha
(μCi/ml E-14)

WEEK NUMBER	NORTHWEST ¼ MILE SAMPLE NUMBER 1101	KM LAKE EAST SAMPLE NUMBER 1102	JUNCTION HWY 33/74 SAMPLE NUMBER 1103
1	0.35	0.67	0.55
2	1.1	3.3	1.6
3	*	*	*
4	0.75	5.5	2.6
5	0.5[illegible]	1.5	0.9[illegible]
6	1.[illegible]	0.45	1.5
7	0.7[illegible]	*	1.2
8	4.6	1.6	1.4
9	4.8	8.3	1.2
10	0.3	1.5	1.7
11	[illegible].1	1.5	9.3
12	[illegible].7	5.9	9.3
13	0.29	1.1	0.83
14	0.66	1.2	0.72
15	0.36	0.63	1.0
16	0.38	0.79	0.74
17	0.55	1.1	0.78
18	0.79	1.3	0.93
19	1.1	1.2	1.1
20	0.57	0.70	1.4
21	0.54	0.52	0.52
22	0.64	0.83	*
23	1.0	1.2	0.88
24	0.75	1.0	1.4
25	0.71	1.3	0.96
26	0.67	1.1	1.2
27	1.2	1.2	*
28	1.0	1.1	0.85
29	*	*	*
30	0.40	1.2	1.4
31	1.5	1.9	0.50
32	0.65	1.1	0.73
33	0.81	1.5	0.81
34	1.8	1.7	2.6
35	0.86	1.1	1.4
36	0.57	*	0.87
37	0.61	0.95	1.0
38	0.61	0.90	0.65
39	0.98	0.91	0.95
40	0.50	1.1	1.4
41	2.4	1.1	1.0
42	1.2	*	0.57
43	*	*	*
44	0.12	*	0.36
45	0.48	0.46	0.68
46	0.80	0.91	0.52
47	0.50	0.55	0.32
48	0.56	0.59	0.31
49	0.67	0.92	0.55
50	0.49	1.2	0.42
51	0.51	*	0.24
52	0.28	0.43	0.37

* No Sample.

CIMARRON FACILITY

1984 ANNUAL ENVIRONMENTAL SAMPLES

SAMPLE LOCATION	SAMPLE NUMBER	DATE (1984)	GROSS ALPHA (pCi/l)	GROSS BETA (pCi/l)	Pu-239 (pCi/l)	U (mg/l)	F (mg/l)	NO_3 (mg/l)
Surface Water								
River - Upstream	1201	6/22	17	<20	0.007 ± 0.006	0.018	8	<1
River - Downstream	1202	6/22	38	<20	0.007 ± 0.006	0.048	<1	12
Pond Northwest of Plant	1203	6/22	16	<20	0.021 ± 0.009	0.010	8	2
Pond West of Plant	1204	6/22	14	<20	0.003 ± 0.004	0.009	<1	1
Kerr-McGee Lake East	1205	6/22	<10	<20	0.006 ± 0.005	0.008	<1	<1
Pond NW of Incinerator	1206	6/22	Dry	---	Dry	-----	Dry	---
Stream NW of Old Pond 2	1208	6/22	Dry	---	Dry	-----	Dry	---
Kerr-McGee Lake West	1209	6/22	<10	<20	0.021 ± 0.009	0.008	<1	<1
Sanitary Lagoon East	1212	6/22	33	<20	0.004 ± 0.005	0.010	<1	1
Sanitary Lagoon West	1213	6/22	35	<20	0.007 ± 0.006	0.008	<1	<1
Well Water								
North of Plant	1301	6/22	10	<20	0.015 ± 0.007	0.009	15	2
SW of Old Pond 1 (dry)	1302	6/22	---	---	---	-----	---	---
Farm Southeast of Plant	1303	6/22	<10	<20	0.009 ± 0.006	0.008	<1	<1
NW of Old Pond 1 (dry)	1304	6/22	---	---	---	-----	---	---
NW of Old Pond 2	1305	6/22	260	790	0.012 ± 0.007	0.007	<1	120
SE of Old Pond 2 (dry)	1306	6/22	---	---	---	-----	---	---
Junction Hwy 33 and 74	1307	6/22	<10	<20	0.008 ± 0.007	0.002	<1	2
NE of Old Pond 2 (dry)	1308	6/22	---	---	---	-----	---	---
SW of Old Pond 2 (dry)	1309	6/22	---	---	---	-----	---	---
South of Old Pond 2 (dry)	1310	6/22	---	---	---	-----	---	---
Vegetation					(pCi/g)	(µg/g)	(µg/g)	
North ½ Mile	1501	6/20			0.0011 ± 0.0009	0.52	8	
North U Fence Line	1502	6/22			0.0003 ± 0.0004	0.62	31	
South U Fence Line	1503	6/21			0.0044 ± 0.0019	0.29	11	
South ½ Mile	1504	6/21			0.0003 ± 0.0004	0.29	<5	
East ½ Mile	1505	6/21			0.0012 ± 0.0007	1.0	<5	
West ½ Mile	1506	6/21			0.0003 ± 0.0003	0.24	<5	
Covered Pu Pond	1507	6/22			0.0018 ± 0.0008	0.05	<5	
Covered Pond 1	1508	6/22			0.0003 ± 0.0004	0.24	11	
Covered Pond 2	1509	6/22			0.0003 ± 0.0004	0.05	12	
Old Burial Pit	1510	6/22			0.0003 ± 0.0004	0.14	11	
North Pu Fence Line	1511	6/22			0.0003 ± 0.0004	0.34	28	

CIMARRON FACILITY

1984 ANNUAL ENVIRONMENTAL SAMPLES

SAMPLE LOCATION	SAMPLE NUMBER	DATE (1984)	U-238 (μg/g)	Pu-239 (pCi/g)	F (μg/g)
Soil Surface					
North ½ Mile	1401	6/20	0.88	0.002 ± 0.001	470
North U Fence Line	1402	6/22	4.8	0.002 ± 0.001	380
South U Fence Line	1403	6/21	4.7	0.001 ± 0.0007	230
South ½ Mile	1404	6/21	0.68	0.001 ± 0.0006	530
East ½ Mile	1405	6/21	0.71	0.001 ± 0.0007	170
West ½ Mile	1406	6/21	0.58	0.007 ± 0.001	320
North 1 Mile	1407	6/20	0.49	0.006 ± 0.002	180
South 1 Mile	1408	6/21	1.3	0.012 ± 0.002	250
East 1 Mile	1409	6/21	0.97	0.009 ± 0.002	240
West 1 Mile	1410	6/20	0.83	0.001 ± 0.001	180
Northeast 1 Mile	1411	6/20	0.74	0.007 ± 0.002	190
Northwest 2 Miles	1412	6/20	0.78	0.005 ± 0.004	240
Southwest 2 Miles	1413	6/21	0.48	0.004 ± 0.002	240
Southeast 2 Miles	1414	6/21	0.90	0.002 ± 0.001	260
North 3.5 Miles	1415	6/20	1.3	0.004 ± 0.002	81
North 5 Miles	1416	6/20	0.53	0.003 ± 0.001	140
North 10 Miles	1417	6/20	0.62	0.009 ± 0.003	160
North Pu Fence Line	1418	6/22	1.3	0.003 ± 0.001	150
Soil Sub-Surface					
North ½ Mile	1401	6/20	0.94	0.002 ± 0.001	280
North U Fence Line	1402	6/22	3.8	0.003 ± 0.003	250
South U Fence Line	1403	6/21	1.0	0.002 ± 0.002	200
South ½ Mile	1404	6/21	1.1	0.010 ± 0.003	440
East ½ Mile	1405	6/21	1.2	0.005 ± 0.002	140
West ½ Mile	1406	6/21	1.2	0.002 ± 0.002	230
North 1 Mile	1407	6/20	0.56	0.003 ± 0.001	110
South 1 Mile	1408	6/21	1.2	0.005 ± 0.002	150
East 1 Mile	1409	6/21	0.60	0.006 ± 0.003	120
West 1 Mile	1410	6/20	0.32	0.006 ± 0.002	140
Northeast 1 Mile	1411	6/20	0.69	0.008 ± 0.003	110
Northwest 2 Miles	1412	6/20	0.69	0.009 ± 0.003	120
Southwest 2 Miles	1413	6/21	1.1	0.002 ± 0.002	210
Southeast 2 Miles	1414	6/21	1.0	0.002 ± 0.002	250
North 3.5 Miles	1415	6/20	1.1	0.002 ± 0.002	76
North 5 Miles	1416	6/20	0.63	0.011 ± 0.004	73
North 10 Miles	1417	6/20	0.74	0.001 ± 0.001	140
North Pu Fence Line	1418	6/22	1.2	0.005 ± 0.002	220

CIMARRON FACILITY
'985 ANNUAL ENVIRONMENTAL SAMPLES
(AIR)

Analysis - Gross Alpha
(uCi/ml x E-14)

Week Number	Northwest ½ Mile Sample 1101	KM Lake East Sample 1102	Junction Hwy 33/74 Sample 1103	Week Number	Northwest ½ Mile Sample 1101	KM Lake East Sample 1102	Junction Hwy 33/74 Sample 1103
01	0.89	2.1	0.86	27	0.79	0.90	1.1
02	1.8	2.5	2.2	28	0.96	0.90	1.9
03	0.84	1.5	0.91	29	1.0	1.0	1.5
04	1.9	1.2	1.7	30	0.69	1.0	0.93
05	*	*	*	31	0.56	1.2	0.58
06	3.0	1.5	0.54	32	0.83	0.90	0.63
07	0.9	0.99	0.42	33	0.27	0.64	0.66
08	0.99	0.56	0.93	34	0.27	0.75	0.70
09	2.3	0.84	0.96	35	0.15	0.79	0.77
10	0.94	5.0	0.60	36	2.0	0.75	0.93
11	0.84	1.2	0.77	37	0.27	0.28	0.97
12	0.80	1.2	0.49	38	0.24	0.39	0.27
13	0.81	1.3	0.52	39	0.29	1.8	0.29
14	0.82	0.85	0.66	40	0.27	0.68	0.47
15	0.76	1.0	0.46	41	0.20	0.36	0.79
16	1.1	1.5	0.27	42	0.35	0.36	0.28
17	0.64	0.43	1.1	43	0.15	1.2	0.67
18	0.63	1.0	1.9	44	0.18	0.39	0.40
19	2.4	8.9	1.1	45	0.10	0.42	0.41
20	0.42	0.66	0.15	46	0.25	0.10	0.20
21	0.53	2.8	*	47	0.10	0.50	0.69
22	*	*	*	48	0.20	0.14	0.61
23	2.3	0.52	*	49	0.20	0.64	0.41
24	0.48	0.86	1.5	50	0.41	0.34	0.45
25	1.2	0.78	1.8	51	0.27	0.32	0.38
26	*	*	*	52	0.15	1.1	0.41

* No Sample.

CIMARRON FACILITY
1985 ANNUAL ENVIRONMENTAL SAMPLES

Surface Water

Sample Location	Sample Number	Date (1985)	Gross Alpha (pCi/l)	Gross Beta (pCi/l)	Pu-239 (pCi/l)	U (mg/l)	F (mg/l)	NO_3 (mg/l)
River - Upstream	1201	06/22	<10	<20	0.007 ± 0.005	0.005	<0.2	<5.
River - Downstream	1202	06/22	23	22	0.003 ± 0.002	<0.002	<0.2	<5.
Pond Northwest of Plant	1203	06/22	18	<20	0.003 ± 0.002	<0.002	<0.2	<5.
Pond West of Plant	1204	06/22	22	<20	0.007 ± 0.004	<0.002	0.4	2.
Kerr-McGee Lake East	1205	06/22	16	<20	0.005 ± 0.003	<0.002	0.3	<0.2
Pond NW of Incinerator	1206	06/22	195	216	0.002 ± 0.002	0.15	4.	130.
Stream NW of Old Pond 2	1208	06/22	<10	<20	0.002 ± 0.002	<0.002	0.6	0.6
Kerr-McGee Lake West	1209	06/22	<10	<20	0.008 ± 0.004	<0.002	8.1	43.
Sanitary Lagoon East	1212	06/22	<10	<20	0.009 ± 0.004	0.005	0.6	0.8
Sanitary Lagoon West	1213	06/22	18	<20	0.007 ± 0.003	0.011	2.	0.7

CIMARRON FACILITY

1985 ANNUAL ENVIRONMENTAL SAMPLES

Well Water

Sample Location	Sample Number	Date (1985)	Gross Alpha (pCi/l)	Gross Beta (pCi/l)	Pu-239 (pCi/l)	U (mg/l)	F (mg/l)	NO_3 (mg/l)
North of Plant	1301	06/23	<10	<20	0.015 ± 0.008	0.009	0.1	<0.2
Southwest of Old Pond 2	1302	07/02	Dry	Dry	Dry	Dry	Dry	Dry
Farm Southeast of Plant	1303	06/27	<10	<20	0.003 ± 0.002	<0.002	0.9	2
Northwest of Old Pond 1	1304	07/02	Dry	Dry	Dry	Dry	Dry	Dry
Northwest of Old Pond 2	1305	07/02	37	124	0.008 ± 0.005	0.006	9.	23.
Southeast of Old Pond 2	1306	07/02	Dry	Dry	Dry	Dry	Dry	Dry
Junction Hwy 33/74	1307	06/23	<10	<20	0.014 ± 0.007	<0.002	0.3	5.
Northeast of Old Pond 2	1308	07/02	Dry	Dry	Dry	Dry	Dry	Dry
Southwest of Old Pond 2	1309	07/02	Dry	Dry	Dry	Dry	Dry	Dry
South of Old Pond 2	1310	07/02	Dry	Dry	Dry	Dry	Dry	Dry
South of Landfill	1311	06/21	10	31	0.015 ± 0.007	<0.002	<0.2	57.
West of Landfill	1312	06/21	2,200	8,275	0.020 ± 0.008	0.26	83	<20.
North of Landfill	1313	06/21	453	1,512	0.003 ± 0.003	0.070	120.	<5.
South of Burial Pit	1314	07/02	<10	<20	0.007 ± 0.003	<0.002	0.4	2.
North of Burial Pit	1315	07/02	3,125	189	0.019 ± 0.008	5.56	<0.2	11.
Northwest of Burial Pit	1316	07/02	200	<20	0.020 ± 0.008	0.19	<0.2	11.
North of Burial Pit	1317	07/02	20	27	0.003 ± 0.003	<0.002	<0.1	25.

CIMARRON FACILITY

1985 ANNUAL ENVIRONMENTAL SAMPLES

Surface Soil

Sample Location	Sample Number	Date (1985)	Pu-239 (pCi/g)	U (ug/g)	F. (ug/g)
North ½ Mile	1401	07/02	0.01 ± 0.001	0.59	150.
North Fence	1402	06/26	0.012 ± 0.002	6.6	150.
South Fence	1403	07/03	0.002 ± 0.001	0.85	100.
South ½ Mile	1404	06/22	0.005 ± 0.001	<0.03	360.
East ½ Mile	1405	06/26	0.007 ± 0.001	0.07	110.
West ½ Mile	1406	07/02	0.014 ± 0.002	0.29	120.
North 1 Mile	1407	06/27	0.005 ± 0.001	0.42	73.
South 1 Mile	1408	06/27	0.003 ± 0.001	0.03	160.
East 1 Mile	1409	07/02	0.003 ± 0.001	0.16	94.
West 1 Mile	1410	07/03	0.008 ± 0.003	0.20	130.
Northeast 1 Mile	1411	06/29	0.006 ± 0.002	0.27	89.
Northwest 2 Miles	1412	06/29	0.004 ± 0.001	0.63	130.
Southwest 2 Miles	1413	06/29	0.003 ± 0.001	<0.03	170.
Southeast 2 Miles	1414	07/02	0.006 ± 0.001	0.13	290.
North 3.5 Miles	1415	06/29	0.001 ± 0.001	<0.03	63.
North 5 Miles	1416	06/29	0.002 ± 0.001	0.45	33.
North 10 Miles	1417	06/29	0.004 ± 0.001	0.13	120.
North Pu Fence	1418	07/03	0.003 ± 0.001	0.33	120.

CIMARRON FACILITY

1985 ANNUAL ENVIRONMENTAL SAMPLES

Subsurface Soil

Sample Location	Sample Number	Date (1985)	Pu-239 (pCi/g)	U (ug/g)	F (ug/g)
North ½ Mile	1401	07/02	0.001 ± 0.001	0.85	200.
North Fence	1402	06/26	0.001 ± 0.001	3.5	160.
South Fence	1403	07/03	0.003 ± 0.001	1.2	120.
South ½ Mile	1404	06/22	0.010 ± 0.002	0.98	330.
East ½ Mile	1405	06/26	0.006 ± 0.001	<0.03	110.
West ½ Mile	1406	07/02	0.008 ± 0.002	0.53	130.
North 1 Mile	1407	06/27	0.005 ± 0.002	0.71	78.
South 1 Mile	1408	06/27	0.003 ± 0.001	0.21	160.
East 1 Mile	1409	07/02	0.004 ± 0.001	1.2	120.
West 1 Mile	1410	07/03	0.006 ± 0.001	0.36	130.
Northeast 1 Mile	1411	06/29	0.002 ± 0.001	0.72	64.
Northwest 2 Miles	1412	06/29	0.002 ± 0.001	0.86	97.
Southwest 2 Miles	1413	06/29	0.009 ± 0.003	<0.04	130.
Southeast 2 Miles	1414	07/02	0.003 ± 0.001	1.14	260.
North 3.5 Miles	1415	06/29	0.001 ± 0.001	<0.03	51.
North 5 Miles	1416	06/29	0.02 ± 0.001	0.16	42.
North 10 Miles	1417	06/29	0.0010 ± 0.0005	<0.03	160.
North Pu Fence	1418	07/03	0.002 ± 0.001	0.33	120.

CIMARRON FACILITY

1985 ANNUAL ENVIRONMENTAL SAMPLES

Vegetation

Sample Location	Sample Number	Date (1985)	Pu-239 (pCi/g)	U (ug/g)	F (ug/g)
North ½ Mile	1501	06/23	0.0002 ± 0.0002	0.02	6.
North Fence	1502	06/26	0.0002 ± 0.0002	0.07	5.
South Fence	1503	07/03	0.002 ± 0.001	0.03	1.
South ½ Mile	1504	06/23	0.0003 ± 0.0002	0.05	5.
East ½ Mile	1505	06/23	0.0002 ± 0.0002	0.03	4.
West ½ Mile	1506	06/23	0.0005 ± 0.0003	0.04	5.
Covered Pu Pond	1507	07/03	0.0005 ± 0.0003	0.05	4.
Covered Pond 1	1508	06/26	0.0011 ± 0.0004	0.03	5.
Covered Pond 2	1509	06/26	0.0005 ± 0.0003	0.04	6.
Old Burial Ground	1510	06/23	0.003 ± 0.001	0.07	3.
North Pu Fence	1511	07/03	0.0003 ± 0.0002	0.06	6.

[redacted]IMA[redacted]FACI[redacted]
1986 ANNUAL ENVIRONMENTAL SAMPLES
AIR
Analysis - Gross Alpha
(uCi/ml x E-14)

Week Number	Northwest 1/2 Mile Sample 1101	KM Lake East Sample 1102	Junction Hwy. 33/74 Sample 1103	Week Number	Northwest 1/2 Mile Sample 1101	KM Lake East Sample 1102	Junction Hwy 33/74 Sample 1103
01	1.2	1.5	<0.1	27	*	*	*
02	0.14	1.4	1.1	28	0.50	0.67	0.66
03	<0.1	2.7	1.8	29	0.80	0.37	0.57
04	*	1.2	1.2	30	0.47	0.28	0.53
05	1.2	1.5	0.92	31	0.75	0.73	0.81
06	*	*	*	32	1.2	0.28	0.57
07	0.52	1.1	1.2	33	0.54	0.55	0.32
08	0.48	1.4	1.6	34	0.30	1.2	0.55
09	1.0	1.2	1.5	35	0.48	0.34	0.36
10	1.0	1.0	1.0	36	0.21	0.16	0.44
11	0.48	0.56	0.56	37	0.22	0.26	0.52
12	0.84	0.84	1.4	38	0.51	0.29	0.34
13	1.3	*	1.3	39	*	*	*
14	1.2	0.76	0.96	40	0.47	0.41	0.59
15	0.92	0.84	1.2	41	0.92	0.79	0.74
16	0.72	0.96	0.80	42	1.2	1.6	1.7
17	0.84	0.84	1.1	43	0.83	0.74	1.0
18	*	1.2	0.88	44	0.71	0.86	0.63
19	*	0.80	*	45	0.20	0.70	0.54
20	0.96	0.52	0.68	46	0.47	0.87	1.0
21	1.4	0.72	0.52	47	0.37	0.94	0.58
22	0.64	0.68	0.88	48	0.91	0.44	0.94
23	0.55	0.64	0.82	49	0.42	0.42	0.23
24	0.78	0.60	0.63	50	0.65	0.38	0.34
25	0.83	0.64	0.42	51	0.27	0.34	0.34
26	0.62	0.56	0.80	52	0.26	0.52	0.36

*No Sample.

0613E

CIMARRON FACILITY
1986 ANNUAL ENVIRONMENTAL SAMPLES
SURFACE WATER

Sample Location	Sample Number	Date (1986)	Gross Alpha (pCi/l)	Gross Beta (pCi/l)	Pu-239 (pCi/l)	U (mg/l)	F (mg/l)	NO_3 (mg/l)
River - Upstream	1201	06/28	<10	21	<0.1	0.004	0.3	4
River - Downstream	1202	06/28	<10	<20	<0.1	0.004	0.3	4
Pond Northwest of Plant	1203	06/28	<10	<20	<0.1	0.005	0.3	<1
Pond West of Plant	1204	06/28	<10	<20	<0.1	0.006	0.4	1
Kerr-McGee Lake East	1205	06/10	<10	<20	<0.1	0.002	0.3	<1
Pond NW of incinerator	1206	06/28	130	199	<0.1	0.11	3.4	21
Stream NW of Old Pond 2	1208	06/28	46	600	<0.1	0.008	18	15
Kerr-McGee Lake West	1209	06/10	<10	<20	<0.1	0.002	0.4	2
Sanitary Lagoon East*	1212	--	--	--	--	--	--	--
Sanitary Lagoon West*	1213	--	--	--	--	--	--	--
New Sanitary Lagoon	1214	06/28	230	72	<0.1	0.21	1.1	1

*Lagoon not in use

0613E

CIMARRON FACILITY
1986 ANNUAL ENVIRONMENTAL SAMPLES

WELL WATER

Sample Location	Sample Number	Date (1986)	Gross Alpha (pCi/l)	Gross Beta (pCi/l)	Pu-239 (pCi/l)	U (mg/l)	F (mg/l)	NO_3 (mg/l)
North of Plant	1301	06/26	<20	<50	<0.1	0.016	1.0	17
Southwest of Old Pond 2	1302	06/28*	--	--	--	--	--	--
Farm Southeast of Plant	1303	06/28**	--	--	--	--	--	--
Northwest of Old Pond 1	1304	06/28*	--	--	--	--	--	--
Northwest of Old Pond 2	1305	06/26	36	396	<0.1	0.007	2.4	57
Southeast of Old Pond 2	1306	06/26*	--	--	--	--	--	--
Junction Hwy 33/74	1307	06/28	15	<20	<0.1	0.002	0.2	1
Northeast of Old Pond 2	1308	06/26*	--	--	--	--	--	--
Southwest of Old Pond 2	1309	06/26*	--	--	--	--	--	--
South of Old Pond 2	1310	06/26*	--	--	--	--	--	--
South of Landfill	1311	06/26	<10	<20	<0.1	0.003	0.4	87
West of Landfill	1312	06/28	94	7300	<0.1	0.017	59	1310
North of Landfill	1313	06/28	230	3000	<0.1	0.077	157	690
South of Burial Pit	1314	06/26	<10	<20	<0.1	0.002	1.5	9
North of Burial Pit	1315	06/26	5400	740	<0.1	7.0	0.5	5
Northwest of Burial Pit	1316	06/26	608	140	<0.1	1.6	0.8	4
North of Burial Pit	1317	06/26	<10	21	<0.1	0.02	0.4	8
Leo's Corral	1318	06/25	<10	<20	<0.1	0.004	0.4	2

*Dry well

**Well out of service

0613E

CIMARRON FACILITY

1986 ANNUAL ENVIRONMENTAL SAMPLES

SURFACE SOIL

Sample Location	Sample Number	Date (1986)	Pu-239 (pCi/l)	U (ug/g)	F (ug/g)
North 1/2 Mile	1401	06/28	<0.1	0.70	100
North Fence	1402	06/30	<0.1	35	350
South Fence	1403	07/02	<0.1	4.5	118
South 1/2 Mile	1404	06/28	<0.1	0.92	363
East 1/2 Mile	1405	07/02	<0.1	0.68	117
West 1/2 Mile	1406	06/28	<0.1	0.98	135
North 1 Mile	1407	06/28	<0.1	0.59	98
South 1 Mile	1408	06/27	<0.1	0.91	167
East 1 Mile	1409	06/28	<0.1	0.85	97
West 1 Mile	1410	07/02	<0.1	0.72	116
Northeast 1 Mile	1411	06/27	<0.1	0.88	80
Northwest 2 Miles	1412	06/28	<0.1	0.78	117
Southwest 2 Miles	1413	06/27	<0.1	1.0	169
Southeast 2 Miles	1414	06/27	<0.1	0.85	291
North 3.5 Miles	1415	06/27	<0.1	0.51	78
North 5 Miles	1416	06/27	<0.1	0.75	60
North 10 Miles	1417	06/27	<0.1	0.92	82
North Pu Fence	1418	06/30	<0.1	0.82	111

CIMARRON FACILITY

1986 ANNUAL ENVIRONMENTAL SAMPLES

SUBSURFACE SOIL

Sample Location	Sample Number	Date (1986)	Pu-239 (pCi/l)	U (ug/g)	F (ug/g)
North 1/2 Mile	1401	06/28	<0.1	0.58	117
North Fence	1402	06/30	<0.1	14	401
South Fence	1403	07/02	<0.1	2.0	142
South 1/2 Mile	1404	06/28	<0.1	0.72	369
East 1/2 Mile	1405	07/02	<0.1	1.6	164
West 1/2 Mile	1406	06/28	<0.1	0.76	136
North 1 Mile	1407	06/28	<0.1	0.58	93
South 1 Mile	1408	06/27	<0.1	0.96	160
East 1 Mile	1409	06/28	<0.1	0.89	98
West 1 Mile	1410	07/02	<0.1	0.72	129
Northeast 1 Mile	1411	06/27	<0.1	0.91	89
Northwest 2 Miles	1412	06/28	<0.1	0.95	117
Southwest 2 Miles	1413	06/27	<0.1	1.3	118
Southeast 2 Miles	1414	06/27	<0.1	0.85	291
North 3.5 Miles	1415	06/27	<0.1	0.67	79
North 5 Miles	1416	06/27	<0.1	0.72	68
North 10 Miles	1417	06/27	<0.1	0.92	80
North Pu Fence	1418	06/30	<0.1	1.2	118

CIMARRON FACILITY

1986 ANNUAL ENVIRONMENTAL SAMPLES

VEGETATION

Sample Location	Sample Number	Date (1986)	Pu-239 (pCi/l)	U (ug/g)	F (ug/g)
North 1/2 Mile	1501	06/28	<0.1	0.02	0.9
North Fence	1502	06/30	<0.1	0.41	1.5
South Fence	1503	07/02	<0.1	0.11	2.5
South 1/2 Mile	1504	06/28	<0.1	0.11	26
East 1/2 Mile	1505	07/02	<0.1	0.03	0.4
West 1/2 Mile	1506	06/28	<0.1	0.07	0.9
Covered Pu Pond*	1507	--	--	--	--
Covered Pond 1	1508	07/02	<0.1	0.10	1.3
Covered Pond 2	1509	07/02	<0.1	0.14	1.1
Old Burial Ground	1510	07/02	<0.1	0.14	1.1
North Pu Fence	1511	06/30	<0.1	0.14	1.0

*Location of New Sanitary Lagoon

CIMARRON FACILITY
1987 ANNUAL ENVIRONMENTAL SAMPLES
AIR

Analysis - Gross Alpha
(uCi/ml x E-14)

Week Number	Northwest 1/2 Mile Sample 1101	KM Lake East Sample 1102	Junction Hwy. 33/74 Sample 1103	Week Number	Northwest 1/2 Mile Sample 1101	KM Lake East Sample 1102	Junction Hwy 33/74 Sample 1103
01	*	1.5	1.1	27	0.62	0.49	0.41
02	1.7	2.2	1.9	28	0.85	0.86	0.53
03	*	*	*	29	0.32	0.77	0.62
04	1.3	1.3	0.94	30	0.27	0.73	0.65
05	0.79	0.91	1.0	31	0.35	0.59	0.22
06	0.95	0.82	0.71	32	0.45	0.27	0.26
07	1.2	1.5	1.1	33	1.2	1.3	0.76
08	1.2	1.3	1.1	34	1.1	1.1	0.89
09	1.2	1.3	1.1	35	1.0	1.8	1.0
10	1.3	1.3	1.2	36	1.4	2.2	1.7
11	2.2	1.7	0.84	37	0.59	1.2	1.0
12	1.6	1.3	1.1	38	1.7	0.89	0.50
13	0.81	0.75	1.0	39	1.5	1.5	0.53
14	1.1	1.1	0.63	40	0.36	0.58	1.1
15	1.0	0.86	0.67	41	0.72	2.3	1.4
16	1.5	1.2	0.88	42	0.46	0.87	1.2
17	1.8	1.1	1.3	43	<0.29	0.56	0.66
18	1.4	1.2	1.6	44	0.51	0.69	0.81
19	0.97	1.3	1.1	45	0.45	0.37	0.59
20	0.91	0.69	1.4	46	0.44	0.74	0.62
21	0.58	0.85	0.31	47	0.50	0.51	0.33
22	0.52	0.32	0.21	48	0.38	0.36	0.49
23	0.78	0.44	*	49	0.53	1.4	0.62
24	0.31	0.40	0.28	50	*	*	*
25	0.45	0.18	0.43	51	0.34	0.43	0.38
26	0.55	0.48	0.71	52	0.09	0.30	0.18

*No Sample.

0613E

CIMARRON FACILITY
1987 ANNUAL ENVIRONMENTAL SAMPLES
SURFACE WATER

Sample Location	Sample Number	Date (1987)	Gross Alpha (pCi/l)	Gross Beta (pCi/l)	Pu-239 (pCi/l)	U (mg/l)	F (mg/l)	NO_3 (mg/l)	Ra-224 (pCi/l)	Ra-226 (pCi/l)
River - Upstream	1201	06/16	<10	<20	0.002 ± 0.002	0.010	0.4	<1	0.025 ± 0.035	0.12 ± 0.04
River - Downstream	1202	06/16	14	<20	0.019 ± 0.005	0.021	0.4	1.1	0.56 ± 0.15	0.15 ± 0.15
Pond Northwest of Plant*	1203	--	--	--	--	--	--	--	--	--
Pond West of Plant	1204	06/16	<10	<20	0.004 ± 0.003	<0.005	0.3	2.4	0.027 ± 0.014	0.060 ± 0.014
Kerr-McGee Lake East	1205	06/16	<10	<20	0.011 ± 0.004	<0.005	0.3	2.0	0 ± 0.071	0.24 ± 0.05
Pond NW of incinerator	1206	06/16	27	<20	0.002 ± 0.002	0.039	1.4	5.7	0.072 ± 0.044	0.077 ± 0.041
Stream NW of Old Pond 2	1208	06/16	<10	<20	0.013 ± 0.007	<0.005	0.8	2.6	0.025 ± 0.022	0.052 ± 0.021
Kerr-McGee Lake West	1209	06/16	<10	<20	0.012 ± 0.004	<0.005	0.2	1.0	0.061 ± 0.070	0.06 ± 0.006
Sanitary Lagoon East*	1212	--	180	99	0.002 ± 0.002	0.18	0.9	1.0	0.019 ± 0.006	0.06 ± 0.006
Sanitary Lagoon West*	1213	--	170	98	0.022 ± 0.006	0.15	0.9	<1	0.047 ± 0.078	0.16 ± 0.09
New Sanitary Lagoon	1214	06/16	170	93	0.014 ± 0.005	0.17	1.1	<1	0.059 ± 0.12	0.025 ± 0.13

* Pond washed out in October 1986 flood.

CIMARRON FACILITY
1987 ANNUAL ENVIRONMENTAL SAMPLES

WELL WATER

Sample Location	Sample Number	Date (1987)	Gross Alpha (pCi/l)	Gross Beta (pCi/l)	Pu-239 (pCi/l)	Ra-224 (pCi/l)	Ra-226 (pCi/l)	U (mg/l)	F (mg/l)	NO_3 (mg/l)
North of Plant	1301	06/16	<10	<20	0.003 ± 0.002	0.13 ± 0.02	0.08 ± 0.022	<0.005	0.4	<1
Southwest of Old Pond 2	1302*	--	--	--	--	--	--	--	--	--
Farm Southeast of Plant	1303**	--	--	--	--	--	--	--	--	--
Northwest of Old Pond 1	1304*	--	--	--	--	--	--	--	--	--
Northwest of Old Pond 2	1305	06/15	<10	<20	0.008 ± 0.004	0.008 ± 0.028	0.27 ± 0.04	0.06	3.2	11
Southeast of Old Pond 2	1306	06/15	<10	<20	0.002 ± 0.002	0.034 ± 0.043	0.16 ± 0.06	0.006	0.2	1.7
Junction Hwy 33/74	1307	06/16	<10	<20	0.009 ± 0.004	0.007 ± 0.018	0.061 ± 0.025	0.005	0.2	2.8
Northeast of Old Pond 2	1308*	--	--	--	--	--	--	--	--	--
Southwest of Old Pond 2	1309	06/15	<10	<20	0.002 ± 0.002	0.13 ± 0.12	0.24 ± 0.15	0.006	0.5	19
South of Old Pond 2	1310*	--	--	--	--	--	--	--	--	--
South of Landfill	1311	06/16	<10	<20	0.010 ± 0.005	0.010 ± 0.005	0.28 ± 0.06	0.005	0.4	34
West of Landfill	1312	06/16	41	65	0.002 ± 0.002	0.29 ± 0.012	0.58 ± 0.02	0.045	18	620
North of Landfill	1313	06/16	84	25	0.004 ± 0.003	0.35 ± 0.12	0.18 ± 0.13	0.078	120	450
South of Burial Pit	1314	06/15	<10	<20	0.029 ± 0.067	0.057 ± 0.019	0.20 ± 0.02	0.005	1.3	4.8
North of Burial Pit	1315	06/16	3850	2450	0.005 ± 0.003	0.036 ± 0.13	0.12 ± 0.15	4.9	0.6	6.7
Northwest of Burial Pit	1316	06/15	420	300	0.002 + 0.002	0.10 ± 0.033	0.03 ± 0.03	0.54	0.6	4.6
North of Burial Pit	1317	06/15	13	<20	0.002 ± 0.002	0.10 ± 0.01	0.22 ± 0.01	0.010	0.3	2.2
Leo's Corral	1318	06/30	11	<20	0.003 + 0.002	0.079 ± 0.006	0.09 ± 0.007		<0.005	0.2

1.2

*Dry well

**Well out of service

0613E

CIMARRON FACILITY
1987 ANNUAL ENVIRONMENTAL SAMPLES
SURFACE SOIL

Sample Location	Sample Number	Date (1987)	Pu-239 (pCi/g)	U (ug/g)	F (ug/g)
North 1/2 Mile	1401	06/09	0.011 ± 0.002	0.80	180
North Fence	1402	06/15	0.013 ± 0.006	21.3	310
South Fence	1403	06/12	0.002 ± 0.001	2.5	140
South 1/2 Mile	1404	06/12	<0.001	1.6	330
East 1/2 Mile	1405	06/12	0.003 ± 0.001	1.4	110
West 1/2 Mile	1406	06/09	0.015 ± 0.002	1.5	150
North 1 Mile	1407	06/09	0.001 ± 0.001	0.36	53
South 1 Mile	1408	06/12	0.001 ± 0.001	1.2	170
East 1 Mile	1409	06/12	0.002 ± 0.001	0.96	130
West 1 Mile	1410	06/09	0.004 ± 0.001	1.1	130
Northeast 1 Mile	1411	06/09	0.001 ± 0.001	1.0	56
Northwest 2 Miles	1412	06/09	0.002 ± 0.001	1.5	94
Southwest 2 Miles	1413	06/12	0.001 ± 0.001	1.6	215
Southeast 2 Miles	1414	06/12	0.002 ± 0.001	1.5	270
North 3.5 Miles	1415	06/09	0.002 ± 0.001	0.68	36
North 5 Miles	1416	06/09	0.015 ± 0.002	0.56	49
North 10 Miles	1417	06/09	0.002 ± 0.001	0.79	165
North Pu Fence	1418	06/15	0.001 ± 0.001	1.1	120

AIIM

Association for Information and Image Management

1100 Wayne Avenue, Suite 1100
Silver Spring, Maryland 20910

301/587-8202

Centimeter

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 mm

1 2 3 4 5

Inches

MANUFACTURED TO AIIM STANDARDS
BY APPLIED IMAGE, INC.

2 of 2

CIMARRON FACILITY
1987 ANNUAL ENVIRONMENTAL SAMPLES
SUBSURFACE SOIL

Sample Location	Sample Number	Date (1987)	Pu-239 (pCi/g)	U (ug/g)	F (ug/g)
North 1/2 Mile	1401	06/09	0.003 ± 0.002	4.8	130
North Fence	1402	06/15	0.005 ± 0.001	3.4	440
South Fence	1403	06/12	0.002 ± 0.001	2.4	190
South 1/2 Mile	1404	06/12	0.013 ± 0.002	1.2	320
East 1/2 Mile	1405	06/12	0.015 ± 0.002	1.2	130
West 1/2 Mile	1406	06/09	0.001 ± 0.001	1.4	160
North 1 Mile	1407	06/09	0.002 ± 0.001	0.98	100
South 1 Mile	1408	06/12	0.002 ± 0.001	1.3	155
East 1 Mile	1409	06/12	0.002 ± 0.001	0.88	160
West 1 Mile	1410	06/09	0.001 ± 0.001	1.4	140
Northeast 1 Mile	1411	06/09	0.007 ± 0.002	0.82	51
Northwest 2 Miles	1412	06/09	<0.001	0.91	84
Southwest 2 Miles	1413	06/12	0.001 ± 0.001	1.7	280
Southeast 2 Miles	1414	06/12	0.006 ± 0.002	1.3	250
North 3.5 Miles	1415	06/09	0.002 ± 0.001	0.67	45
North 5 Miles	1416	06/09	0.003 ± 0.001	0.61	52
North 10 Miles	1417	06/09	0.002 ± 0.002	0.89	160
North Pu Fence	1418	06/15	0.005 ± 0.001	1.4	115

0794E

CIMARRON FACILITY
1987 ANNUAL ENVIRONMENTAL SAMPLES
VEGETATION

Sample Location	Sample Number	Date (1987)	Pu-239 (pCi/g)	U (ug/g)	F (ug/g)
North 1/2 Mile	1501	06/09	0.0014 ± 0.0004	1.0	<10
North Fence	1502	06/15	0.0004 ± 0.0002	<0.2	88
South Fence	1503	06/12	0.0005 ± 0.0003	<0.2	68
South 1/2 Mile	1504	06/12	0.0022 ± 0.0007	<0.2	39
East 1/2 Mile	1505	06/12	0.0012 ± 0.0004	<0.2	110
West 1/2 Mile	1506	06/09	0.001 ± 0.0004	<0.2	200
Covered Pu Pond*	1507	--	--	--	--
Covered Pond 1	1508	06/12	0.002 ± 0.001	0.24	60
Covered Pond 2	1509	06/12	0.0003 ± 0.0002	<0.2	34
Old Burial Ground	1510	06/12	0.003 ± 0.001	<0.2	49
North Pu Fence	1511	06/15	0.0015 ± 0.0005	<0.2	16

*Location of New Sanitary Lagoon

CIMARRON FACILITY
1988 ANNUAL ENVIRONMENTAL SAMPLES
AIR

Analysis - Gross Alpha
(uCi/ml x E-14)

Week of 1988	NW 1/2 Mile Sample 1101	KM Lake East Sample 1102	Jct.Hwy. 33/74 No. Sample 1103
01*	--	--	--
02	2.4	09	1.1
03	1.5	1.9	1.2
04	1.1	1.1	.74
05	1.7	.88	.45
06	1.5	2.7	1.8
07	1.6	9.8	.95
08	.42	1.1	1.1
09	1.1	11.5	1.4
10	.50	.90	.23
11	.97	1.7	.13
12	1.3	2.0	.88
13	1.1	.84	.40
14	.91	.85	.61
15	.48	1.5	.41
16	.86	1.6	.98
17	.62	.91	.49
18	.47	1.1	.52
19	.75	.85	.76
20	.69	.78	.93
21	.55	.40	.38
22	.6	.37	.59
23	.36	.30	.80
24	.46	.7	.55
25	.26	.45	.45
26	.51	.31	.42
27	.05	.35	.21

Samples not collected due to inclimate weather

CIMARRON FACILITY

1988 ANNUAL ENVIRONMENTAL SAMPLES

SURFACE WATER

Sample Location	Sample No	Date (1988)	Gross Alpha (pCi/l)	Gross Beta (pCi/l)	Pu-239 (pCi/l)	U-238 (mg/l)	F (mg/l)	NO_3 (mg/l)	Ra-224 (pCi/l)	Ra-226 (pCi/l)
River - Upstream	1201	06/24	11	<20	0.009±0.004	0.018	< 1	<1	0.021±0.037	0.117±0.034
River - Downstream	1202	06/24	14	<20	0.003±0.002	0.018	< 1	<1	0.021±0.066	0.088±0.060
Pond-NW of Plant*	1203	06/24	--	--	--		--	--	--	--
Pond - W of Plant	1204	06/24	23	<20	0.002±0.002	0.029	< 1	1.7	0.010±0.002	0.025±0.001
KM Lake - East	1205	06/24	< 10	<20	0.003±0.002	0.005	< 1	<1	0 ±0.13	0.211±0.594
Pond - NW of Inc.	1206	06/24	330	150	0.003±0.002	0.39	2.7	36	0.143±0.064	0.035±0.040
Stream NW Old #2	1208	06/24	< 10	<20	0.004±0.003	0.007	< 1	<1	0.020±0.079	0.039±0.088
KM Lake - West	1209	06/24	< 10	<20	0.003±0.002	0.005	< 1	<1	0.008±0.013	0.070±0.015
Sanitary Lagoon-E	1212	06/24	170	40	0.003±0.002	0.13	1.3	<1	0.006±0.027	0.024±0.031
Sanitary Lagoon-W	1213	06/24	110	80	0.002±0.002	0.130	1.2	14	0.072±0.013	0.072±0.014
New Sanitary Lagoon	1214	06/24	200	<20	0.006±0.003	0.11	1.3	<1	0.014±0.074	0.064±0.084

*Pond washed out in October 1986 flood.

CIMARRON FACILITY

1988 ANNUAL ENVIRONMENTAL SAMPLES

WELL WATER

Sample Location	Sample No.	Date (1988)	Gross Alpha (pCi/l)	Gross Beta (pCi/l)	Pu-239 (pCi/l)	Ra-224 (pCi/l)	Ra-226 (pCi/l)	U (mg/l)	F (mg/l)	NO_3 (mg/l)
North of Plant	1301	06/30	< 10	< 20	0.002 ± 0.0020	0.22 ± 0.08	0.37 ± 0.08	0.006	< 1	< 1
SW of Old Pond #1	1302	06/30	WELL	DRY						
NW of Old Pond #1	1304	06/30	WELL	DRY						
NW of Old Pond #2	1305	06/30	< 10	< 20	0.010 ± 0.004	0.01 ± 0.19	0.16 ± 0.22	0.007	2.7	25
SE of Old Pond #2	1306	06/30	12	< 20	0.010 ± 0.006	0.23 ± 0.25	0.29 ± 0.26	0.009	< 1	< 1
Jct HWYS & 74 & 33	1307	09/06	< 10	< 20	0.004 ± 0.003	0.079 ± 0.002	0 ± 0.002	0.005	< 1	< 10
NE of Old Pond #2	1308		WELL	DRY						
SW Of Old Pond #2	1309	06/30	< 10	< 20	0.002 ± 0.007	0.35 ± 0.24	0.23 ± 0.24	0.005	< 1	24
S of Old Pond #2	1310	06/30	WELL	DRY						
S of Landfill	1311	06/30	< 10	< 20	0.008 ± 0.004	0.04 ± 0.10	0.21 ± 0.11	0.005	< 1	38
W of Landfill	1312	06/30	90	231	0.012 ± 0.005	0.41 ± 0.02	1.09 ± 0.02	0.144	22	480
N of Landfill	1313	06/30	61	24	0.006 ± 0.003	0.12 ± 0.12	0.29 ± 0.11	0.128	3.1	570
S of Burial Pit	1314	06/30	< 10	< 20	0.002 ± 0.002	0.07 ± 0.12	0.23 ± 0.11	0.007	1.8	12
N of Burial Pit	1315	06/30	3800	989	0.002 ± 0.002	0.21 ± 0.40	0.18 ± 0.44	4.83	< 1	< 2
NW of Burial Pit	1316	06/30	378	116	0.012 ± 0.005	0.06 ± 0.05	0.06 ± 0.04	0.30	< 1	12
N of Burial Pit	1317	06/30	105	< 20	0.002 ± 0.002	0.03 ± 0.13	0.11 ± 0.12	0.128	< 1	< 1
Leo's Corral	1318	06/30	< 10	< 20	0.012 ± 0.005	0.28 ± 0.22	0.20 ± 0.17	0.009	< 1	4.5
U Plant Yard	1319									

CIMARRON FACILITY

1988 ANNUAL ENVIRONMENTAL SAMPLES

SURFACE SOIL

Sample Location	Sample Number	Date (1988)	Pu-239 (pCi/g)	U (Ug/g)	F (Ug/g)
North 1/2 Mile	1401	07/05	0 ± 0.01	0.83	250
North Fence	1402	07/05	0 ± 0.01	9.2	260
South Fence	1403	07/05	0.02 ± 0.01	0.76	160
South 1/2 Mile	1404	07/05	0 ± 0.01	1.3	310
East 1/2 Mile	1405	07/05	0 ± 0.01	0.99	150
West 1/2 Mile	1406	07/05	0 ± 0.01	0.67	160
North 1 Mile	1407	07/05	0 ± 0.01	0.44	70
South 1 Mile	1408	07/05	0 ± 0.01	1.0	170
East 1 Mile	1409	07/05	0 ± 0.01	1.2	150
West 1 Mile	1410	07/05	0 ± 0.01	1.2	140
Northeast 1 Mile	1411	07/05	0 ± 0.01	0.61	70
Northwest 2 Miles	1412	07/05	0 ± 0.01	0.98	70
Southwest 2 Miles	1413	07/05	0 ± 0.01	1.8	320
Southeast 2 Miles	1414	07/05	0 ± 0.01	1.4	300
North 3.5 Miles	1415	07/05	0 ± 0.01	0.72	80
North 5 Miles	1416	07/05	0 ± 0.01	0.40	50
North 10 Miles	1417	07/05	0 ± 0.01	1.1	95
North Pu Fence	1418	07/05	0 ± 0.01	1.9	140

CIMARRON FACILITY
1988 ANNUAL ENVIRONMENTAL SAMPLES
SUBSURFACE SOIL

Sample Location	Sample Number	Date (1987)	Pu-239 (pCi/g)	U-238 (Ug/g)	F (Ug/g)
North 1/2 Mile	1401	7-5-88	0 ± 0.01	0.64	100
North Fence	1402	7-5-88	0 ± 0.01	4.9	390
South Fence	1403	7-5-88	0 ± 0.01	2.0	150
South 1/2 Mile	1404	7-5-88	0.± 0.01	2.0	270
East 1/2 Mile	1405	7-5-88	0 ± 0.01	0.98	140
West 1/2 Mile	1406	7-5-88	0 ± 0.01	1.2	160
North 1 Mile	1407	7-5-88	0.02 ± 0.01	0.83	80
South 1 Mile	1408	7-5-88	0 ± 0.01	1.3	160
East 1 Mile	1409	7-5-88	0 ± 0.01	1.5	220
West 1 Mile	1410	7-5-88	0 ± 0.01	1.2	145
Northeast 1 Mile	1411	7-5-88	0 ± 0.01	0.82	60
Northwest 2 Miles	1412	7-5-88	0 ± 0.01	0.97	80
Southwest 2 Miles	1413	7-5-88	0 ± 0.01	1.5	210
Southeast 2 Miles	1414	7-5-88	0 ± 0.01	1.5	310
North 3.5 Miles	1415	7-5-88	0 ± 0.01	0.60	70
North 5 Miles	1416	7-5-88	0 ± 0.01	0.39	50
North 10 Miles	1417	7-5-88	0 ± 0.01	0.78	130
North Pu Fence	1418	7-5-88	0 ± 0.01	1.4	140

CIMARRON FACILITY
1988 ANNUAL ENVIRONMENTAL SAMPLES
VEGETATION

Sample Location	Sample Number	Date (1988)	Pu-239 (pCi/g)	U (Ug/g)	F (Ug/g)
North 1/2 Mile	1501	06/24	0.002 ± 0.002	0.049	< 10
North Fence	1502	06/24	0.0002 ± 0.0002	0.110	< 10
South Fence	1503	06/24	0.0002 ± 0.0002	0.049	< 10
South 1/2 Mile	1504	06/24	0.0002 ± 0.0002	0.013	< 10
East 1/2 Mile	1505	06/24	0.0002 ± 0.0002	0.026	< 10
West 1/2 Mile	1506	06/24	0.0002 ± 0.0002	0.005	< 10
Covered Pu Pond*	1507	--	--	--	--
Covered Pond 1	1508	06/24	0.0003 ± 0.0001	.065	< 10
Covered Pond 2	1509	06/24	0.0006 ± 0.0003	0.044	< 10
Old Burial Ground	1510	06/24	0.0005 ± 0.0003	0.069	< 10
North Pu Fence	1511	06/24	0.0009 ± 0.0004	0.048	< 10

*Location of New Sanitary Lagoon

CONCLUSIONS AND RECOMMENDATIONS

1. As the decontamination and decommissioning operations progressed it became clear that we should have scheduled the decommissionings at a faster pace to take advantage of lower burial costs. Burial costs and change in packaging requirements have grown progressively more expensive since 1979 when the price for L.S.A. waste was $7.50 per cu. ft., the current burial cost is $52.50 cu. ft.

   The burial costs for T.R.U. waste was estimated at $100/ft. early in the program, but when we obtained approval to start shipping the burial cost had risen to $207 cu. ft. and climbed to $265 cu. ft. by mid 1987 when we shipped our last load. The current price is approximately $400 per cu. ft. Cimarron shipped 9,035.4 cu. ft. of T.R.U. waste and 15,188 cu. ft. of L.S.A. waste We have commited $6,846,244 to date, our estimated total amount will be $7,480,361. Early estimates indicated we would spend $111 per sq. ft. for the D & D, however since then burial costs have escalated which raised our costs to $288 per sq. ft..

2. We should have taken advantage of computer data collection and retrieval methods early in the program which would have improved our record keeping by simplification, plus it would have made more data available by computer retrieval. This was recognized too late to be cost effective after the program was well under way and manual methods had been established.

3. Decontamination of the glove boxes would have been less difficult if the building had been designed with more floor space. The building should have been large enough to allow installation of the glove boxes with access to all sides. In same cases it was necessary to combine operations during production in one glove box as well as place one side of a glove box against the wall, this made housekeeping difficult and decontamination more difficult, it also made decommissioning much more difficult because of the restricted access.

4. The piping system proved to be a problem, during production it was discovered this system contained low spots that were difficult to drain. This made N.D.A.(non-destructive assay) difficult. During decommissioning these low spots became a bigger problem that required very careful planning to prevent contamination spread and excessive exposure to decommissioning personnel.

5. This plant was equipped with good tooling, the process was sound and the product produced was of excellent quality. It has been very difficult and disheartening to decommission this plant and dispose of equipment that was nearly new in condition, yet obsolete by 10 years of age.

APPENDIX

PLUTONIUM OUT OF CONFINEMENT - LEAKS, SPILLS, etc.

I. INTRODUCTION

Uncontained plutonium, outside the confinement of gloveboxes and slot hoods, is a potential hazard to persons in a room with such a condition. Inhalation, ingestion, injection or absorption of plutonium into the body can cause radiation damage to the body tissues, fluids, organs and bone.

The detection of plutonium in the working environment can be by visually seeing a spill of material, or by finding an opening in the confinement system. An automatic air sampler alarm or a liquid level alarm may be heard. The use of survey instruments is one of the best means of detection. Air sample counting is another means to discover plutonium out-of-control. Air pressure gauges and air flow indicators on the confinement systems can indicate the possibility that a leak of plutonium contamination has occurred.

Upon detection of plutonium out of confinement, it is important that personnel promptly protect themselves, obtain Health Physics service and rid themselves of any personal contamination. Investigation of the cause and evaluation

of the extent of the problem with subsequent correction, clean-up, and final recovery must then be accomplished. If the incident or spill is of great enough severity, formal reports
R1 to Company Management and the Nuclear Regulatory Commission are required.

It is the purpose of these instructions to provide plutonium plant personnel, particularly Health Physics personnel, with guidance for proper response to situations involving plutonium "out-of-confinement." This guide does not give instructions concerning releases of hazardous materials where total building evacuation is necessary, where the general public would be potentially exposed or other such serious incidents as are covered in our Emergency Manual.

II. THE INSTRUCTION TABLES

Tables, Nos. 1, 2 and 3, are included which show a list of actions to consider depending upon the contamination problem encountered. The problem(s) are defined in the scope of each table. In the columns marked "Priority" there are 4 categories, as follows:

1. Very prompt action - 1st priority
2. Within minutes after 1st priority action
3. Within hours after 1st priority action
4. Within days after 1st priority action

II. THE INSTRUCTION TABLES - continued

An attempt has been made to list the actions with the 1st priority at the top of the list and the least priority at the bottom. In many incidents not every action listed will need to be done. Each should be considered, however.

The "Responsibility" columns includes the "1st person." The "1st person" may be more than one person, however he is usually the first to detect a problem and spread the alarm. The "H.P." column lists actions or duties H.P. technicians can be expected to perform as well as duties other health and safety personnel may perform. Persons other than the 1st person or H.P. personnel are also listed. These may be persons involved in an incident or they may be persons used for the recovery from an incident.

The final column includes special qualifying "notes" or instructions and references to procedures. These "notes" are numbered and the numbers correspond to numbers in the "priority" columns adjacent to the specific action listed in the 1st column.

TABLE #1

Scope: Contamination found on body or clothing >500 <5,000 d/m - Probe

Actions to Consider When Applicable	Priority 1	2	3	4	1st Person	H.P.	Responsibility Others as Listed	Notes and References
Call H.P. for Assistance	x				x			1. KM-NP-10-67
Personnel Survey	x				x	x	Others Involved	
Remove & bag contam. clothes	x				x		" "	2. Use Table II if
Obtain Nose Swipes	1				x	x	" "	contamination
Personnel Decontamination	x				x	x	" "	>5,000 d/m is found.
Locate Contamination Source		2				x		
Quick fix of cause		x				x	Person(s) assigned	3. Give DTPA if Nose
DTPA Treatment		3				x	Person(s) in need	Swipe >50 d/m
Wound Count		4				x	Person(s) in need	KM-NP-10-90
Decontaminate Surfaces if Needed			x			x	Person(s) assigned	
Complete Location Cards			x		x		Others Involved	4. KM-NP-10-67, Use
Interview for more Details			x		x	x	" "	emergency manual if
Bio-Assay Sampling				5	x	x	Person(s) in need	medical help is
Particle Size of Contaminant				6		x		needed
Solubility of Contaminant				6		x		5. If positive Nose
"In-Vivo" Count (Schedule)				7	x	x	Person(s) in need	Swipes were found
Final Fix of Cause				x			Person(s) assigned	KM-NP-10-67
Final Survey(s)				x		x		
Compile Data				x		x		6. (If possible) when
Write & Distribute Report(s)				x		x		positive Nose Swipes
								are found
								7. Do if DTPA was given.

TABLE #2

Page 1 of 2

Scope:
1. A valid automatic air sampler alarm sounds, or
2. A visible spill is seen, or
3. Smoke is noticed, or
4. An opening or void in the confinement system is easily seen, or
5. A survey shows >5,000 d/m (smearable on equipment) or on a person (direct).

Actions to Consider When Applicable	Priority 1	2	3	4	1st Person	H.P.	Responsibility Others as Listed	Notes and References
Alert Others in Room	x				x			1. Give DTPA if:
Put on Respirator	x				x		All Others Involved	Nose Swipes > 50 d/m
Call H.P.	x				x			or Air = 2 x 10^{-10}
Quicktape or stop leak if found	x				x		Others Cooperate	uci/ml-hr. or smoke
Evacuate and stand outside of door	x				x		All Others Involved	inhaled; see
Personnel Survey	x				x	x	" " "	KM-NP-10-90
Remove & bag contaminated clothes	x				x	x	" " "	
Nose Swipes	x				x	x	" " "	2. Count Wounds - Use
Personnel Decontamination & Survey	x				x	x	" " "	KM-NP-10-67. If
Don special clothes & air pac		x				x	and at least one helper	medical attention is
Quick fix of cause		x					helper(s)	needed use Emergency
Cover contamination w/tape/plastic		x					helper(s)	Manual Procedures.
Turn on spill switch		x					helper(s)	
Collect Air Samples		x				x		
Seal off room and/or post signs		x				x	helper(s)	3. Use criteria in
Count Air Samples (1st count)		x				x		Bioassay sampling
DTPA Treatment		1				x	Person(s) in need	procedure KM-NP-10-67
Wound Count		2				x	" " "	
Investigate & Survey Record Findings			x			x		
Decide further action with Mgmt			x			x	Appropriate Mgmt	4. Use criteria in
Greenhouse for contamination control			x			x	Person(s) Assigned	KM-NP-10-67 and also

TABLE #2 CONTINUED

Scope:

Actions to Consider When Applicable	Priority 1	2	3	4	1st Person	H.P.	Responsibility Others as Listed	Notes and References
Clean up visible spill(s)			x				Person(s) Assigned	schedule In-Vivo
Complete Location Cards			x		x		Person(s) Involved	if the DTPA treat-
Interview Personnel			x			x	" "	ment was needed.
Notification List			x			x	HP&IS Mgr/Coordinator	
Determine Exposure Time			x			x		
Determine Respirator Factor			x			x		5. Use criteria in
Determine Final Air Concentration			x			x		KM-HP-10-65 when
Bioassay Sampling				3	x	x	Person(s) in need	>32 MPC-hr. Use
Particle Size of Aerosol				x		x	Lab	KM-HP-10-67 for high
Solubility of Contaminant				x		x	Lab	Bioassay results.
Begin Bldg & Equip. Decontamination				x			Person(s) Assigned	
Begin Permanent Fix				x			" "	
Final Survey after Fix				x		x		6. **Incident report by HP**
In-Vivo				4		x		**& operations Supervisors.**
Impose Work Restrictions				5	x	x	Supervision of &	**Report to NRC by Cor-**
							Person(s) Involved	**porate Staff Health**
Compile Data and Write Report(s)				6		x	See Note 6.	**Physicist & Vice Presi-**
								dent, Nuclear Licensing
								& Regulation.

TABLE #3

Scope: Detection of Pu by Stationary Air Sample Results Only -
Air Concentration >1 MPC

Actions to Consider When Applicable	Priority 1	2	3	4	H.P.
Notify Supervision	x				x
Post Room Requiring Respirators	x				x
Collect Additional Air Samples	1				x
Survey & Search for Cause		x			x
Obtain location cards - exposure period		x			x
Determine Respirator Factor			x		x
Particle Size of Aerosol			1		x
Solubility of Aerosol			1		x
Interview involved persons			x	x	x
Determine MPC-hrs/wk exposure			2		x
Give DTPA treatment			3		x
Issue Bioassay Sample Kits			4		x
Complete Investigation of Cause			5		x
Correct Cause of Problem		6	6	6	
Schedule In-Vivo Counting				7	x
Write and Distribute Reports				8	x

Responsibility — Notes and References

1. As instructed by H&S Supervisor
2. (a) <32 MPC-hrs/wk - caution employees to minimize further exposure (b) >32 MPC-hrs/wk, impose work restriction (c) 40 MPC-hrs/wk, notify Corporate Staff Health Physicist.
3. For exposures $>2 \times 10^{-10}$ uci/ml-hr., see KM-HP-10-90
4. Use procedure KM-HP-10-67
5. Compile data from surveys, interviews and investigations
6. Correct problem as soon as possible. Shut down offending operations if a "fix" cannot be made and subsequent air samples continue above 3 MPC.
7. Use criteria in KM-HP-10-67
8. KM incident reports by H.P. and operations supervisor. Reports to NRC by Corporate Staff Health Physicist and Vice President, Nuclear Licensing & Regulation.

1.3.1 Ventilating, Heating and Air Conditioning

Basic System

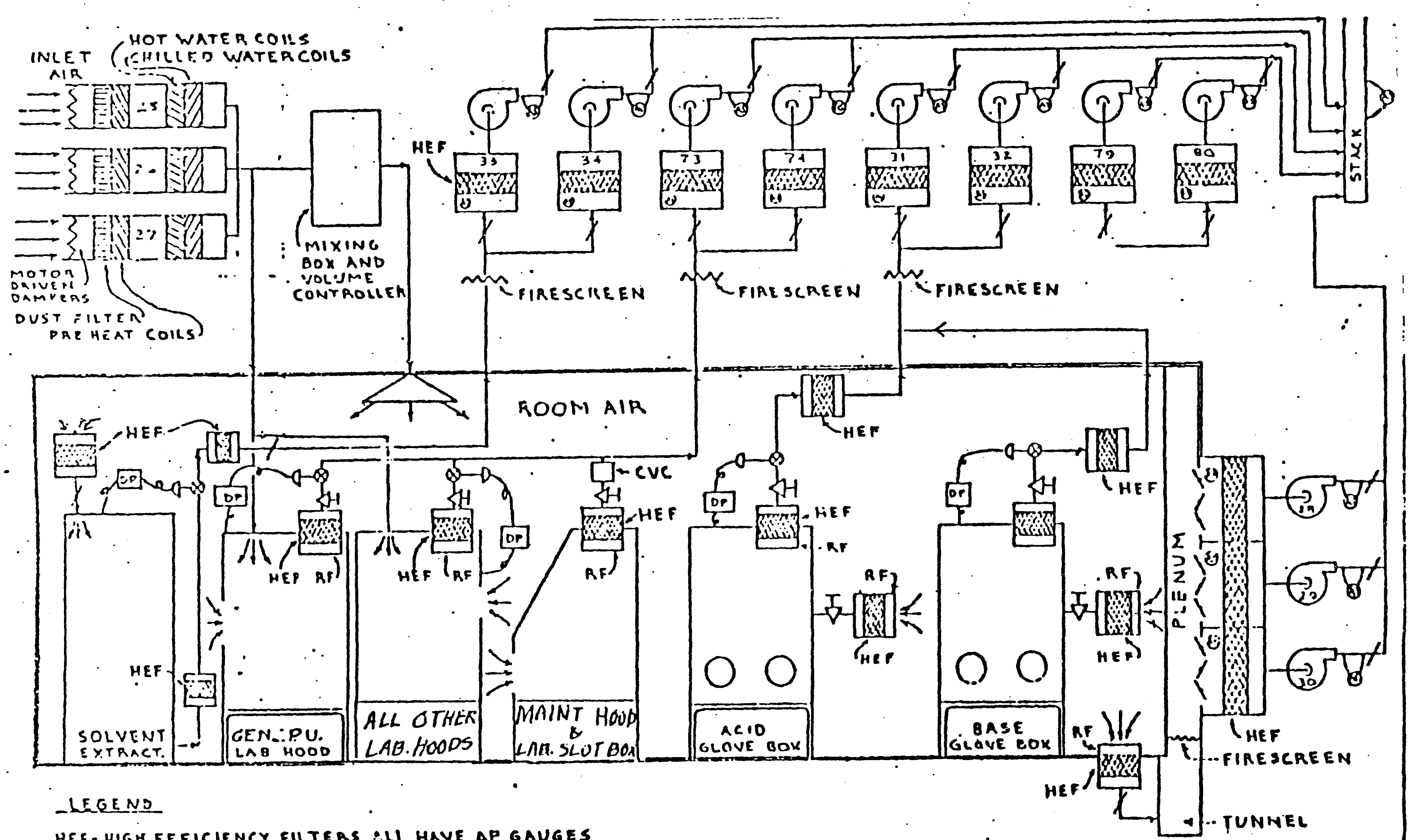
The building ventilation system is divided into three different sub-systems. The first consists of the building supply air fans and contains the heating and cooling coils. The second consists of the room air exhaust fans. The third system consists of the process exhaust fans. The process exhaust fans are further divided into four systems: the first exhausts the air from the acid glovebox; the second exhausts the air from the solvent extraction plant gloveboxes only; the third exhausts the air from all laboratory hoods and slot boxes; and the fourth exhausts the air from the gloveboxes handling basic solutions. A schematic ventilation flow diagram for the Cimarron Plutonium Plant is shown on Figure 6. During standby, the acid and basic glovebox ventilation systems are joined together.

General Design Features

Supply air and room exhaust air fan systems consist of three fans each, any two of which will supply and exhaust the required air through the interior of the building. The third fan serves as a standby fan in each system and also as an emergency fan to increase the air flow in any given area when required. The ventilation system is designed for 8 air changes per hour, minimum, and for an emergency of 12 air changes per hour.

The supply and exhaust air fans are interlocked so that a failure of a fan in either system will shut down the corresponding fan in the other system. All supply and exhaust fans are installed with back flow preventers. An emergency generator is provided to power the glovebox exhaust fans and one each of the supply and room air exhaust fans in case of power failure.

The entire ventilation system is equipped with instrumentation to detect abnormal operating conditions, such as excessive pressure drop through the absolute filters, loss of negative pressure in the spaces within the building,



LEGEND

HEF - HIGH EFFICIENCY FILTERS, ALL HAVE ΔP GAUGES
RF - ROUGHING FILTERS
AS - AIR SAMPLING
DP - DIFFERENTIAL PRESSURE CONTROLLER
CVC - CONSTANT VOLUME CONTROLLER

SCHEMATIC VENTILATION FLOW DIAGRAM

Figure 6

or loss of negative pressure within the gloveboxes. A stack monitor with alarm is installed to provide continuous sampling of the stack effluents.

Supply Air

All air entering the plant is supplied by the supply air fans. These fans are preceded by filters and precipitators to remove all dust. The heating and cooling coils are contained in the supply air fans, and the fans supply heated or cooled air as required. The supply air fans are housed in an upstairs fan room which is accessible only from outside the building. The heating and cooling coils are supplied by hot water boilers and a chilled water unit in the mechanical room on the first floor of the building. Mixing boxes are used to mix hot air or cool air as required by thermostats for the various spaces within the building. The office, reception and lunchroom area of the plant is heated and cooled using a recirculated air system with 25% fresh air makeup. All other portions of the building are heated and cooled with 100% fresh air.

Room Air Exhaust

All air is supplied to the rooms through ducts and diffusers located in the roof or ceiling of the spaces. The flow of air in the room is from ceiling to floor and all room air is exhausted through the floor into underground exhaust ducts. The underground exhaust ducts connect into an underground exhaust air tunnel, which is connected to the room air exhaust fans, which are on the second floor in a separate fan room.

A differential pressure of approximately 0.10 inches of water is maintained between the clean and potentially contaminated areas. Airlocks are installed between the change rooms and all process or laboratory areas. The change rooms, office, reception and lunchroom operate at normal atmospheric pressure.

A roughing filter followed by an absolute filter is installed in the floor at the entrance of the underground ducts. A bank of absolute filters is installed in the upstairs fan room ahead of the exhaust air fans. To protect the absolute filters from burning debris, stainless steel wire mesh is installed in the riser through which all exhaust air must flow from the underground ducts to the upstairs fan room.

Thus, room air is exhausted through a roughing filter and two absolute filters before being discharged through a stack to the atmosphere.

Process Exhaust

The glovebox exhaust system is designed to maintain a negative pressure of approximately 0.50 inches of water with respect to the room pressure with 3 volume changes per hour. The air in the gloveboxes is exhausted through three absolute filters before being discharged to the atmosphere.

The first absolute filter is located on the glovebox; the second absolute filter is located in the duct leaving the space; and the third absolute filter is in a bank of filters just ahead of the glovebox exhaust fans. Two fans are supplied for the glovebox exhaust system, one of which will adequately provide the normal air flow. The second serves as a standby fan and as an emergency fan should an increase in flow be required because of rupture of glove ports. The gloveboxes are supplied by room air which enters the gloveboxes through absolute filters.

The open face hoods and slot type hoods in the laboratory areas are exhausted through the laboratory exhaust system. This system consists of two fans and is similar in operation to the glovebox exhaust system. Open face and slot type hoods have an average face velocity of at least 125 linear feet per minute.

Installed ahead of the absolute filter in the glovebox is a roughing filter. Air leaving the glovebox exhaust fans is exhausted into the same stack as the room air exhaust fans.

2.0 ENGINEERED PROVISIONS FOR ABNORMAL OPERATIONS

2.1 Criteria for Accomodation for Abnormal Operations

2.1.1 Process Systems

The primary design basis for process equipment used during the operating period of the plant was to provide containment of radioactive materials for the prevention of air and surface contamination in areas occupied by personnel. All operations involving plutonium were conducted in glovebox enclosures to prevent loss and spread of plutonium contamination. The gloveboxes were fabricated specifically for material containment.

Properly designed, installed, and operated ventilation systems are necessary for the safe, efficient operation of a nuclear fuel processing facility and for protection of the environment around such a facility. The purposes of these systems are to:

Provide positive pressure gradients from clean areas to suspect areas;
Prevent discharge to the environment of hazardous concentrations of radioactivity;
Maintain comfortable working conditions within the facility;
Maintain particulate captive air velocities at all portals to contaminated vessels and enclosures.

The ventilation systems will remain in operation during all forthcoming decontamination and dismantling procedures.

2.1.2 Alarm Systems and Release Prevention

Ventilation System

The following alarms and indicators are provided to aid in the proper operation and maintenance of the ventilation systems.

- Loss of negative pressure in any of the exhaust systems or in any of the following rooms or areas results in the sounding of an alarm:

health area, maintenance room (116), wet processing room (128), scrap recovery room (127), dry processing rooms (123) and (124), and inspection and assembly room (121),

- Both the cold duct and the hot duct of the suspect area air supply systems is equipped with alarms against loss of pressure.

- The pressure differential across each filter, or filter banks, is indicated.

- Manometers are installed at the door of each room in the process area indicates the direction of air flow when the door is opened.

- All intermediate and final HEPA filters are tested for leakage on a regularly scheduled basis.

- A monitor located in the main stack provides continuous monitoring of particulate radioactive material.

Criticality Detection

A gamma sensitive radiation detection system energizes clearly audible alarms in the event of an accidental criticality. Alarm trip settings are set at 15 mR/hr above the normal or operating background for each of the eight detectors in the system.

The detectors are located in the main process areas to provide plant coverage in accordance with the requirements of 10 CFR 70.24.

Signals from the detectors are fed to a central control panel located in the plant reception area. Capabilities at the central control panel include visual meter readouts of the gamma dose rate at each detector location and visual warning of detector malfunction and/or levels above the trip setting. Adjustable alarm trip settings for each detector and manual reset and control of evacuation alarm system is located on the detectors in the process area.

Activation of the evacuation alarm requires at least two detectors to exceed the alarm trip setting limits. The criticality detection system is connected to the plant emergency power system in addition to normal power.

Contamination Detection

Early warning of high level airborne contamination is achieved by operating continuous air monitors in the general lab and in the process areas. Each monitoring device is equipped with a local alarm and recorder.

2.1.3 Support Systems

2.1.3.1 Structural Performances vs. Site Environmental Factors

2.1.3.1.1 Severe Natural Phenomena

The necessity for protecting employees and the public from radiation and other operational hazards is the key consideration in the design and construction of the CPF. Sequoyah Fuels engaged a consulting engineering firm to evaluate the tornado potential and credible consequences relative to the Cimarron Plutonium Facility. The report is included as Attachment II to this plan.

2.1.3.1.2 Accidents at Neighboring Activities

The CPF is located in a relatively isolated area with the only activity in the area being service stations approximately 1/2 mile south and 1/2 mile north of the site.

Activities other than CPF on the immediate site include the Uranium plant which has been put on standby and a Kerr-McGee Technology Division research project involving coal de-ashing. Credible accidents at these other activities are not expected to be of such nature that the activities at the CPF could be interrupted or that plutonium material containment could be jeopardized.

2.1.3.2 Confinement Barriers and Systems

The primary design basis for the ventilation and exhaust systems is to minimize and effectively control airborne contamination. Spare fans are provided to serve as a standby fan for equipment failure and also as a supplemental fan to increase the air flow to a minimum of 12 air change per hour in any given areas when desired or required by emergency. The supply air is filtered to provide fresh, clean air for all plant areas.

The air flow from ceiling to floor is considered the best design for contamination control and generally minimizes breathing zone airborne concentrations.

The air balance requirement to ensure air flow from areas of non-radioactivity to areas of higher radioactivity is to prevent contamination spread.

The incoming air to gloveboxes is drawn through a high efficiency filter to limit the consequences of box pressurization. Glove box air pressure is maintained negative to the room pressure. This AP is 0.5 inch (water gauge).

The high efficiency filtrations for the exhaust systems are provided to minimize operational losses of material and to comply with regulatory limits by controlling the release of radioactivity to the unrestricted environment.

2.1.3.3 Access and Egress of Operating Personnel and Emergency Response Teams

For security purposes the entire Plutonium Facility is enclosed by 8' chain link fencing with 3 strand barbed wire at the top. The fenceline around the facility has two emergency exits on the west side and one on the south side in addition to a personnel and vehicle gate located on the south side.

There is only one personnel entrance which is at the front of the building and this gate is under continual surveillance by a guard located in the security area of the building entrance.

Access of emergency response teams is necessarily limited to the personnel entrance and subjected to the same security measures as operating personnel. Any member of an emergency response team not previously authorized for plant entry must be accompanied by an authorized person.

2.1.3.4 Fire and Explosion Resistance and Suppression

The Cimarron Plutonium Facility is satisfactorily protected against fire loss or damage. The plant is never left unattended or unguarded. The building is of fire-resistive construction (type A) with the structural materials being steel and concrete and concrete roofing. The facility is equipped with fire fighting equipment and personnel are instructed in fire fighting techniques required for this type plant.

See section 1.3.1 of this plan for information on fire detectors.

Fusible salt heat detectors are located in glove boxes that will provide a fire alarm in the guard station where the location of the fire is shown on a panel board in the hallway. There are no detectors located in the specified areas for waste storage. Due to the criticality hazards normally involved with Plutonium sprinkler systems have not been installed.

2.1.3.5 Shielding

Radiation shielding was used only on glove boxes and glove box windows when required to assure that whole body exposures to personnel would not exceed 3 rem for calendar quarter.

Under the existing conditions at the facility such shielding is no longer used nor is it planned for use during the decontamination procedures.

2.1.4 Control Operations

The criteria for controlling and maintaining the capabilities of plant engineered systems to respond as planned to abnormal conditions are based on the management philosophy of maximum protection of employees and the public from radiation and other operational hazards. In order to maintain a "readiness" status Health Physics, Maintenance, and Security personnel are required to perform routine inspections and checks of all systems on a frequency determined necessary by management personnel to assure proper functioning of all equipment and procedures required for maximum response to emergency conditions.

2.2 Demonstration of Engineered Provisions For Abnormal Operation

2.2.1 Process Systems

As described in applications for license SNM 1174 and amendments 1 through 4 all process systems have been cleaned of plutonium and are in the stages of final decontamination and dismantling. The systems in use for decontamination such as washing, pressure spraying, solvent cleaning, painting, etc., are established methods and are performed only after extremely detailed planning.

The ventilation systems, which have functioned properly since start of the operations in 1970 will continue to function throughout the planned decommissioning operations.

2.2.2 Alarm Systems and Release Prevention Capability

The alarm systems described in 2.1.2 are expected to continue to function satisfactorily. The major requirement for release prevention in operations containing plutonium is the proper operation of the ventilation systems and the several redundencies in the alarm systems permit ample warning when misoperation has occurred.

The utilization of multiple levels of contamination control almost precludes the accidental release of radioactive material. Personal surveys at the point of contact with radioactive materials (at the glovebox), continuous air monitors in the operating rooms, and continuous stack monitors will maintain control of accidental releases. Although an accidental criticality is considered an extremely small possibility the detection alarm system will be maintained throughout the decommissioning operations.

The continuous stack sampler includes a recorder and alarm system located in the health physics office, with a high level alarm remoted to the guard station.

The minimum detection level of the continuous stack monitor is 96 MPC hours for soluble 239 Pu at the stack. This minimum detection level is based on an observed increase of 5 counts per minute in a time period of 15 minutes with the alarm trip set for 15 counts/minute.

Instrument detection of a 5 c/m increase in a 15 minute period results from a concentration of 2.3 X 10^{-11} uCi/ml at the stack (383.3 MPC for soluble 239Pu and 23 MPC for insoluble 239Pu). An increase to the alarm trip within a 15 minute period results from a concentration of 6.9 X 10^{-11} uCi/ml at the stack (1150 MPC for soluble 239Pu and 69 MPC for insoluble 239Pu).

A detailed stack sampling program includes specific requirements to provide continuous monitoring of radioactive particulates released into the air.

The continuous sampler is calibrated at least monthly with a 239Pu standard source. A weekly sample is counted in a Hewlett Packard (Model 5561A) or other suitable counting system for the purpose of calculating the stack effluent.

Early warning of airborne contamination in excess of concentration guidelines is achieved by operating continuous air monitors in the main process areas.

Each monitoring device is equipped with a local alarm and recorder. These are the fixed filter type systems with a minimum detection capability in 1 hour of at least 10 times the applicable 10 CFR 20 limits.

The continuous air monitors are normally located downstream of the room air flow from the work activity or location being monitored

The set point is variable depending upon the radon-thoron background being encountered, and several other variables depending on the work being performed.

2.2.3 Support Systems

2.2.3.1 Structural Performances vs. Site Environmental Factors

The report referenced in section 2.1.3.1.1 demonstrates that the Cimarron Plutonium Facility reflects through its design, construction and operation an extremely low probability for tornado accidents that could result in the releases of significant quantities of radioactive materials. In addition, the site location and the engineered features included as safeguards against the hazardous consequences of severe meteorological conditions or tornadic winds ensures a low risk of public exposure.

2.2.3.2 Confinement Barriers and Systems

The ventilation and exhaust systems previously described are anticipated to continue satisfactory performance in effectively preventing release of radioactive materials to the environment.

2.2.3.3 Access and Egress

The past experience gained through training and drills for emergencies permits anticipation of continued satisfactory performance during abnormal conditions.

2.2.3.4 Fire Protection

An important safety consideration involved in dismantlement activities is fire protection.

Details of the aspects of fire protection at the Cimarron plutonium plant are described in detail in Section 8 of the license application for standby operations dated August 7, 1976 and is included in this plan as Attachment III. The plant structure is constructed of fire-resistant concrete and steel. The building is manned twenty-four hours per day with operational and security personnel who can detect fires or hazardous conditions. Gloveboxes contain heat sensors and are connected to a fire detection alarm system. The plant telephone system can readily trigger the plant-wide public address system to announce the presence of a fire or other emergency.

Plant personnel are trained in the use of fire-fighting equipment and assigned to the fire brigade. Arrangements have been made with local fire departments to provide off-site assistance in the event of a serious fire. Fire fighting and alarm equipment is periodically inspected, and fire drills are held periodically. Preparations have been made to prevent, detect, control and extinguish plant fires.

2.2.4 Control Operations

The basic philosophy that each individual is responsible for his and his fellow worker's safety is supplemented by health physics programs to assure and demonstrate that conditions in the plant and in the surrounding environs are safe.

The health physics standards adopted for the Cimarron Plutonium Plant are consistent with those stipulated in the latest amended version of Title 10, CFR Part 20, Standards for Protection Against Radiation. Future amendments to Part 20 will be incorporated into the health physics program as may be required.

Stringent operating precautions are taken and the process equipment is designed to prevent the spread of radioactive materials. Radiation detection and measurement instruments are utilized to reveal the presence of plutonium contamination so that the necessary steps may be taken to control or eliminate contamination.

Details of the program elements are available for review in section 6 of the application for renewal of license SNM 1174 and is included in this plan as attachment IV.

3.0 CLASSES OF RADIOLOGICAL CONTINGENCIES

3.1 Classification System

This radiological contingency plan characterizes several classes of emergency situations and relates them to response levels. The system of classification used consists of largely mutually exclusive groupings and it covers the entire range of credible emergency situations.

Specific implementing procedures have been prepared for emergency situtions and can be found in Attachment I to this contingency plan.

3.2 Classification Scheme

3.2.1 Notification of Unusual Event

Unusual events are in process or have occurred which indicate a potential degradation of the level of safety of the plant. No releases of radioactive material requiring offsite response or monitoring are expected unless further degradation of safety systems occurs.

The following unusual events will fall into this category:

1. The release of radioactive materials to the unrestricted areas in an amount when averaged over a 24 hour period would exceed ten times the limits specified for such materials in Appendix B Table II of 10 CFR 20.

   The above contamination would be determined by measurement of stack emissions assuming a dilution factor of 1000 from the stack to the facility boundary. Releases of this level could be caused by moisture transfer of soluble contamination through final HEPA filters or partial failure of final HEPA filters.

2. Failure of both incoming electrical power supplies and the emergency diesel generator can not be started, or loss of the main power switchgear.

3. Sudden increase in the liquid level in the sanitary lagoons which would indicate imminent possibility of overflow.

4. Rumors of the possible gathering of peaceful demonstrators

Licensee Actions

1. Promptly notify Corporate Management (Appendix A of Attachment 1) who will promptly notify NRC Region III and/or Headquarters of nature of unusual condition as soon as discovered.

2. Augment on-shift resources as needed.

3. Assess and respond.

4. Escalate to a more severe class, if appropriate.

or

5. Close out with verbal summary with NRC and any other offsite authorities with written report to follow within 24 hours.

3.2.2 Alert

Events are in process or have occurred which involve an actual or potential substantial degradation of the level of safety of the plant. Any releases are expected to be limited to small fractions of the EPA Protective Action Guideline exposure levels.

The following conditions will fall into this Alert category:

1. The release of radioactive materials to unrestricted areas which appears to have been corrected and which the average concentration over a 24 hour period would exceed 500 times the limits specified for such materials in Appendix B, Table II of 10 CFR Part 20. The above measurement would be made at the stack assuming a dilution factor of 1,000 from the stack to the facility boundary. Releases of this level could be caused by failure of the final HEPA filters.

2. Failure of both incoming electrical power supplies and the emergency diesel generator can not be started, or loss of the main power switchgear, and it is apparent that the ventilation system will be inoperable for an extended period of time.

3. Overflow of sanitary lagoon dikes.

4. Rumors of the possible gathering of militant demonstrators.

<u>Licensee Actions</u>

1. Promptly notify Corporate Management who will promptly notify NRC Region III and/or Headquarters, and state and/or local authorities of alert status and reason for alert as soon as discovered. (Appendix A of Attachment 1)

2. Augument resources and activate onsite operational support emergency facilities and equipment. Bring key emergency personnel to standby status.

3. Assess and respond.

4. Dispatch onsite monitoring teams and associated communications.

5. Provide periodic plant status updates to offsite authorities.

6. Provide periodic meteorological assessments to offsite authorities and, if any releases are occurring, does estimates for actual releases.

7. Escalate to a more severe class, if appropriate.

<u>or</u>

8. Close out or recommend reduction in emergency class by verbal summary to NRC and other offsite authorities followed by written summary within 8 hours.

3.2.3 Site Area Emergency

Events are in process or have occurred which involve actual or likely major failures of plant functions needed for protection of the public. Offsite releases are not expected to exceed EPA Protective Action Guideline exposure levels except near site boundary.

The following conditions will fall into this category:

1. A continuing release of radioactive materials to unrestricted areas which the average concentration over a 24 hour period would exceed 500 times the limits specified for such materials in Appendix B, Table II of 10 CFR Part 20. The above measurement would be made at the stack assuming a dilution factor of 1,000 from the stack to the facility boundary. Continuing releases of this level could be caused by failure of final HEPA filters with the continuous stack monitor alarm system malfunctioning for several days without the malfunction being detected by health physics personnel and without the change in delta pressure across the filters being detected by the utility operators.

2. Complete loss of electrical power and it becomes obvious that the security battery backup power will run down before normal or emergency generator power is available.

3. Breach of sanitary lagoon dikes because of events such as earthquakes or flooding.

4. A gathering of demonstrators or any other threat with a potential for an attempt to occupy or sabotage the plant. This situation results in direct notification of local law enforcement agencies and NRC security by plant personnel.

Licensee Actions

1. Promptly notify Corporate Management who will promptly notify NRC Region III and/or Headquarters, EPA, state and/or local offsite authorities of site area emergency status and reason for emergency as soon as discovered. (Appendix A of Attachment I)

2. Augument resources by activating onsite emergency response organization.

3. Assess and respond.

4. Dispatch onsite and offsite monitoring teams and associated communications.

5. Dedicate an individual for plant status updates to offsite authorities.

6. Make senior technical and management staff available onsite for consultation with NRC and state on a periodic basis.

7. Provide meteorological and dose estimates to offsite authorities for actual releases via a dedicated individual or automated data transmission.

8. Provide release and dose projections based on available plant condition information and foreseeable contingencies.

9. Escalate to general emergency class, if appropriate.

<u>or</u>

10. Close out or recommend reduction in emergency class by briefing NRC Region III and/or Headquarters, EPA, state and/or local offsite authorities followed by written summary within 8 hours of closeout or class reduction.

3.2.4 General Emergency

Events are in process or have occurred which involve actual or imminent loss of confinement integrity. Releases can be reasonably expected to exceed EPA Protective Action Guideline exposure levels offsite for more than the immediate site area.

The following conditions will fall into this category:

1. The release of radioactive materials to unrestricted areas which the average concentration at the point of release over a 24 hour period would exceed 5,000 times the limits specified for such materials in Appendix B, Table II of 10 CFR Part 20. The above criteria assumes a dilution factor of 1,000 from the stack to the facility boundary. Releases of this level could be caused by loss of containment walls, roof or final HEPA filters due to fire, explosion, tornado, earthquake, plane crash, lightning, or sabotage.

2. Complete loss of electrical power and it becomes obvious that the loss is due to sabotage by a subversive group that may have the intent to attempt a plant entry for theft or take over of the plant.

3. A confirmed criticality event.

4. Take over of plant by radical group or theft of plutonium by stealth.

Licensee Actions

1. Promptly inform Corporate Management who will promptly notify NRC Region III and/or Headquarters, EPA, state and/or local offsite authorities of general emergency status and reason for emergency as soon as discovered (Parallel notification of state/local). (Appendix A of Attachment I)

2. Augment resources by activating onsite emergency response organization.

3. Assess and respond

4. Dispatch onsite and offsite monitoring teams and associated communications.

5. Dedicate an individual for plant status updates to offsite authorities.

6. Make senior technical and management staff available onsite for consultation with NRC and State personnel on a periodic basis.

7. Provide meteorological and dose estimates to offsite authorities for actual releases via a dedicated individual or automated data transmission.

8. Provide release and dose projections based on available plant condition information and foreseeable contingencies.

<u>or</u>

9. Close out or recommend reduction of emergency class by briefing NRC Region III and/or Headquarters, EPA, State and/or Local offsite authorities followed by written summary within 8 hours of closeout or class reduction.

3.3 Range Of Postulated Accidents

The postulated events listed in section 3.2 range from those events which indicate a potential degradation of safety in the unusual events classification to those events listed under the general emergency classification which indicate actual loss of confinement of radioactive materials.

The unusual events are considered most likely to occur and procedures for handling these events are incorporated into the plant Health Physics procedures and standards.

The general emergency classification is considered extremely unlikely to occur and procedures for the postulated events are presented in the attached Emergency Manual.

8.0 RECORDS AND REPORTS

8.1 Records of Incidents

A record of radiological contingencies described in section 3 of this Radiological Contingency Plan as "Unusual Event," "Alert," "Site Area Emergency," and "General Emergency" will be made by the Health Physics personnel. A copy of the report will be provided to the Standby Manager, the Corporate Medical Director and the Director of the Corporate Emergency Control Organization. The original will be maintained in the health physics file until after the license is terminated. The only exceptions are that the records made by Security Personnel concerning security contingencies will be maintained in the security file, and the "unusual event" reports will not be sent to the Corporate Medical Director or the Director of the Corporate Emergency Control Organization.

The reports shall consist of a description of the contingency; the date; time and cause of the contingency; corrective action taken to terminate the emergency; the action taken or planned to prevent a reocurrence of the event; the signature of the person who prepared the report; the date, time and who was notified of the event; and the distribution provided for the written report.

8.2 Records of Preparedness Assurance

The following records are maintained to confirm the maintenance of preparedness to respond to radiological contingencies. Attendance sheets with the signatures of those who attend training sessions are maintained with the training records.

1. Records of the new-hire and annual retraining on the radiological contingency plan and emergency procedures will be maintained in the health physics file.

2. Records of quarterly criticality evacuation training and drills conducted by health physics personnel and quarterly fire brigade training and drills conducted by the Facility Fire Marshall are maintained in the health physics file. Records of quarterly security training and drills conducted by the Standby Manager are maintained in the security files.

3. Inspection, inventory and location records of fire extinguishers and emergency lights made by utility personnel are maintained in the Maintenance and Utility File. Inventory and location records of the emergency building equipment and supplies (listed in attached Emergency Manual) made by health physics personnel are maintained in the health physics file.

4. Maintenance, Surveillance, and testing records on emergency equipment are maintained on record sheets showing the routines performed by Security, Health Physics, and Utility Personnel. The listing below shows who performs the routines and maintains the records on various emergency equipment.

Utility Personnel	Health Physics Personnel	Security Personnel
Emergency Vehicles	Criticality Alarm System	Intrusion Alarms
Emergency Generators	Exhaust Stack Alarm	SNM Detectors
Ventilation Equipment	Room Air Sample Alarms	Metal Detectors
Fire Alarms	Emergency Bldg. Equip.	Explosives Detectors
Emergency Lights		Communication Equip.

5. Records of agreements with outside support organizations (Local police and Fire Departments) are maintained on file by the Standby Manager.

6. Copies of revised radiological contingency plans and emergency procedures will be provided to offsite agencies affected by the change(s). A record distribution of plans and procedures will be maintained. Revisions to the plan and procedures will be covered by documented training sessions for all facility personnel affected by the change(s).

8.3 Reporting Arrangements

Radiological contingencies described in Section 3 of this Radiological Contingency Plan as "Alert," "Site Area EMergency," and "General Emergency" will result in notification of the Corporate Medical Director and the Director of the Corporate Emergency Control Organization by the Cimarron Standby Manager. Corporate Management will notify the U.S. Nuclear Regulatory Commission, U.S. Environmental Protection Agency, and American Nuclear Insurers and state agencies when appropriate. The only exception to this is the reporting of serious physical security events which are reported directly to NRC as well as corporate management by the Cimarron Standby Manager.

Notification of the public on (1) the occurrence of an emergency condition, (2) its effect on the health and safety of operating personnel, the public and the environment, (3) progress on its control, and (4) recovery from the emergency condition will be made by the Corporate Communications/Public Information Department at the direction of the Director of the Corporate Emergency Control Organization.

PURPOSE: To provide a conservative estimate of contamination levels in combustible LSA waste, concrete, and sand that cannot be easily surveyed with alpha detection instrumentation. R3

I. Equipment Used

A. Ludlum Model 2500 Scaler Ratemeter.
B. Two - 5 inch photomultiplier tubes.
C. Plastic scintillator - 5 inches in diameter and 36 inches long.
D. Drum turn table.
E. Lead lined pit.

II. Equipment Settings

A. Ludlum Model 2500

1. High voltage ≈ 8.2 ≈ 2100 volts.
2. Window - in - 0.30.
3. Threshold - 0.90.
4. Energy Multiplier - 100 KEV.
5. Timer - clock - 4.9 minutes - 10 revolutions of drum for each count.

III. Sources Used

A. 0.1 mCi Cs^{137} Source #1597 G. R.
B. 1 mCi Ra^{226} Source # None.
C. 0.4688g Pu Standard (FFTF pellet encased in brass).
D. 245 cpm 2pi Pu^{239} Source #P-1819 to document 95% confidence level of Hewlett-Packard Model #5560A automatic sample counter.
E. Source #P-1959, P-5983, P-5565, P-1819, P-3029, and 6896 to document Hewlett-Packard automatic sample counter effeciency from 3 dpm to 1,866,000 dpm.
F. ≈ 2,000,000,000 dpm collected on ≈ 4,000 air sample filters and counted with Hewlett-Packard automatic sample counter. These air samples were placed in packages of 100 or 50 samples and sealed in plastic using the bag sealer.

IV. Counter Response

H.V. - 8.20 window in - 0.10 E.M. - 100 KEV count time 1.0 minute.

73.2 NCi/g in 125 lbs. standard drum.

H.V. - 8.20 W - 0.1 E.M. - 100 KEV Count Time 1.0 Min.

Threshold	Bkg. CPM	73.2 NCi/g in 125 Lbs. std. drum	Ratio Net counts/bkg.
0.10	150997	196956	
0.20	60043	80254	
0.30	42880	54403	
0.40	30387	33047	
0.50	10181	15189	
0.60	6816	11280	
0.70	4821	8979	1.86
0.80	3489	7095	2.03
0.90	2598	5433	2.09
1.00	1845	4333	2.34
1.10	1400	3315	2.37
1.20	1110	2413	2.17
1.30	1140	1846	1.62
1.40	881	1437	
1.50	722	1125	
1.60	644	857	
1.70	630	801	
1.80	514	674	
1.90	554	587	
2.00	480	558	
2.10	446	556	
2.20	453	485	
2.30	411	478	
2.40	398	468	
2.50	400	433	

From this data a threshold setting of 0.90 and a window setting of 0.30 was selected.

V. Detector Linearity

H.V. - 8.20 window in - 0.30 threshold 0.90 Energy Multiplier - 100 KEV.

0.488g Pu standard - FFTF pellet encased in brass placed in 1/2" thick 9 inch long lead columniator. See Figure #1.

VI. Construction of Dummy Loads of Combustible Waste

A. Assume uniform distribution of radioactive material in each waste drum. To simulate this with our standards each drum was divided into six load zones. See Figure #2.

B. Four dummy loads were constructed using plastic, pvc pipe, cardboard, tape, and wipes to fill in between these load zones with a net weight of 75 lbs., 125 lbs., 175 lbs., and 225 lbs. Each of these drums was then loaded from ≈ 2 NCi/g of waste to ≈ 90 NCi/g of waste and calibration curves plotted. See Figures #3, #4, #5, and #6.

C. To document response from a point source in zone A, B, and C the 125 lbs. standard was loaded with ≈ 20 NCi/g of waste. Source #42 and #43 were used containing 238,575,384 dpm alpha.

Zone A - center of drum - 9,459 net counts
Zone B - center of drum - 18,094 net counts
Zone C - center of drum - 19,750 net counts

D. After considering this data all combustible drums of waste will be packaged to a minimum of 75 lbs. and a maximum of 225 lbs. To ensure that the value assigned to each drum is in fact less than 73.2 NCi/g we will use the most restrictive calibration factor which was obtained from the 75 lbs. standard drum. Each successive calibration will be done with 75 lbs. standard only.

R3 VII. Construction of Dummy Loads for Sand and Concrete

A. Assume uniform distribution of radioactive material in each waste drum. To simulate this with our standards each drum was divided into three load zones.

R3 B. Two dummy loads were constructed using washed sand for one and 1 1/2 inch rock for the other with 4" PVC pipe in the center, along outer wall, and half way in between to place standard packs in.

R3 C. After considering this data all concrete and sand drums will be packaged to less than 600 lbs. To ensure that the value assigned to each drum is in fact less than 73.2 NCi/g we will use the most restrictive calibration factor which was obtained from the sand standard. Since our top end standard was only 54.42 NCi/g we will repackage any drum indicating greater then 54.42 NCi/g.

R_3 D. Since the difference in backgrounds between sand and gravel were ≈ 2000 counts per 4.9 minutes and this will vary with origin of material we will assign 5 NCi/g to all drums that count 10 NCi/g or less.

VIII. Instructions for Packaging LSA Waste

A. KM-NC-10-82.

B. All packaged trash will be sorted with an Eberline E-500B with an open window GM tube. All packages with 0.3 mr/hr or greater will be handled as TRU waste. All packages less then 0.3 mr/hr will be handled as LSA waste.

C. To prevent shielding problems, metal and combustible waste must be separated. All metal will be surveyed with an alpha survey meter and all combustible will be counted in the LSA drum counter.

D. To prevent shielding problems concrete and sand may not be mixed with metal.

IX. Instruction for Use of LSA Waste Drum Counter

A. Each day that the LSA waste drum counter is to be used:

1. The drum turn table must be timed to ensure it making 10 complete revolutions in 4.9 minutes.

2. Five source counts must be taken using the 73.2 NCi/g - 75 lbs. standard to verify the count system is operating properly and within a 95% confidence level twice daily.

R3

3. Three 4.9 minute background counts with a 0.0 NCi/g - 75 lbs. standard or sand standard on turn table and the turn table rotating will be taken and averaged. This background will be used for all drums counted that day.

4. Pu Plant waste drum counter count sheet will be used to record all drum counts. See Figure #8 or 9.

5. Net counts times calibration factor will be equal to NCi/g of waste. This will be multiplied by actual grams of waste in drum and converted to total g Pu.

6. At the first of each month a new CHI^2 control chart will be made.

7. After repair and at least yearly, a calibration to obtain a new calibration factor for this counter shall be required.

8. All drums will be counted before being compacted and the net counts above background will be added to arrive at a value for the compacted drum. See attached sheet Figure #10.

COUNTS/MINUTE	1.0

DETECTOR LINEAVITY CHECK

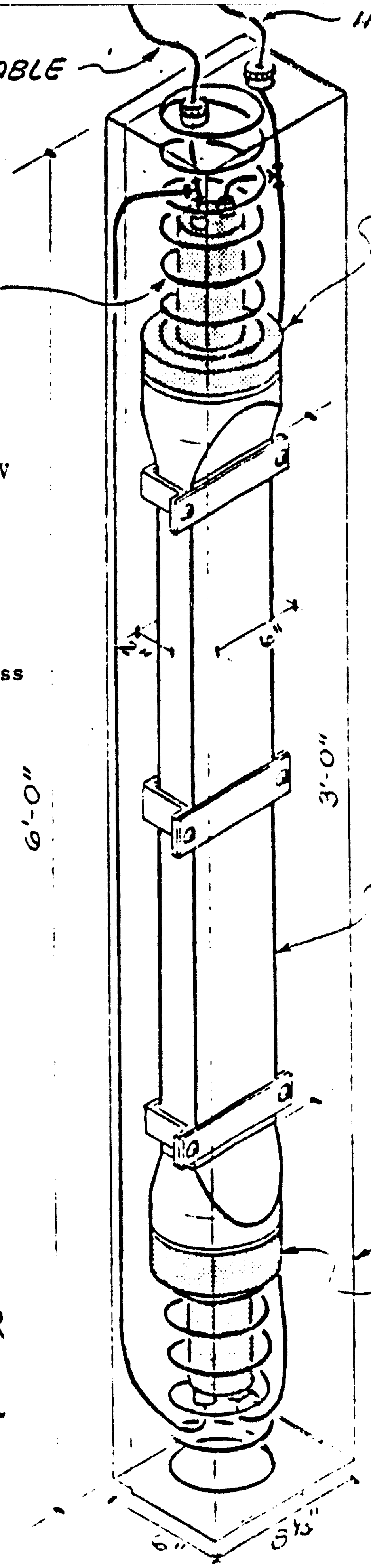
H.V. 8.2 Window in .30

Threshold .9 EM - 100 KEV

.4688g Pu Standard

FFTF pellet encased in brass

Columinated in 1/2" lead columinator.



TOP	6410, 6415
MIDDLE	6962, 7007
CENTER	6704, 6762
MIDDLE	7274, 7181
BOTTOM	6438, 6261

L.S.A.
DRUM COUNTER
DETECTOR

Figure #1

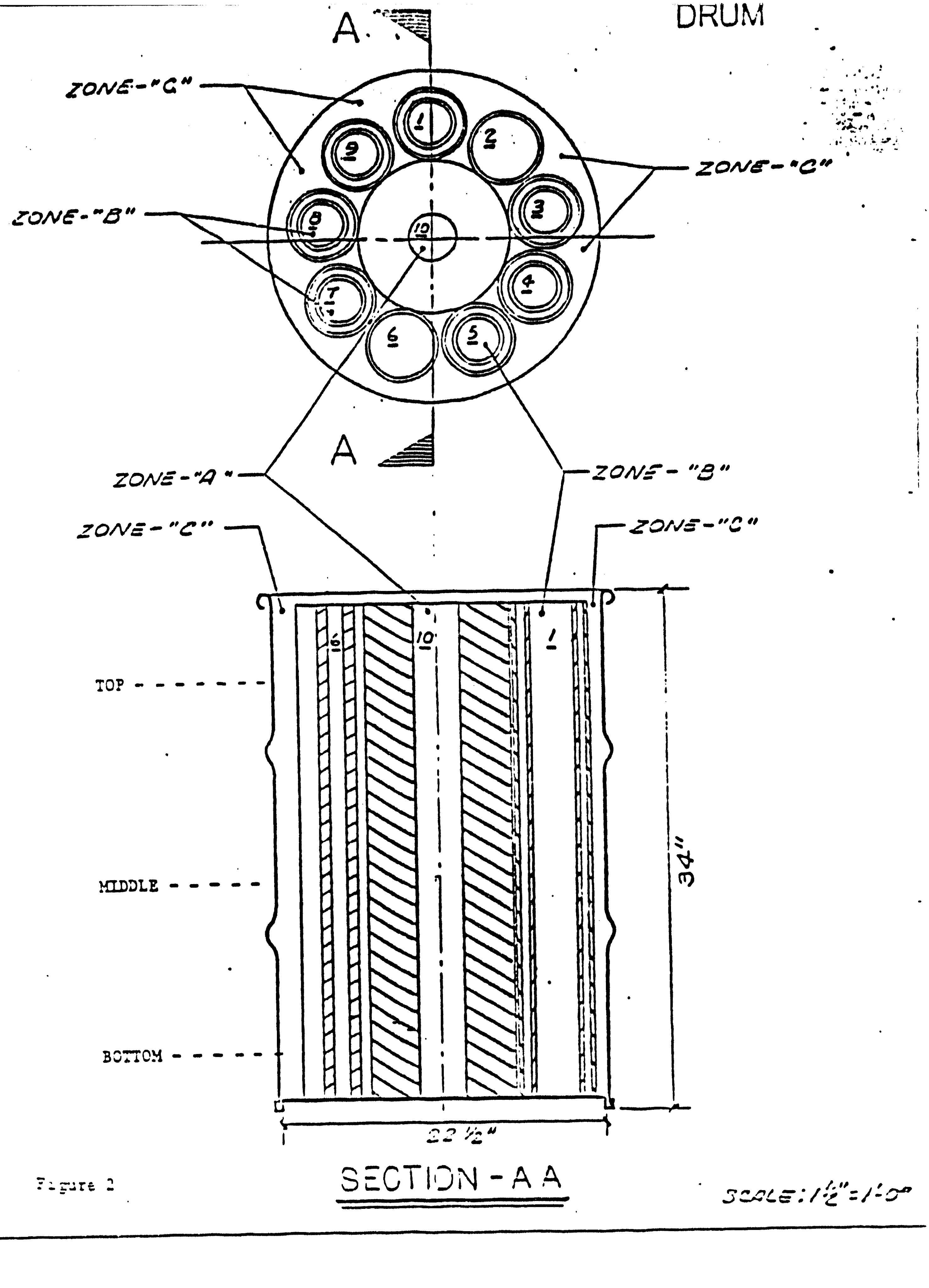

DRUM
A
ZONE-"C"
ZONE-"C"
ZONE-"B"
1
2
3
4
5
6
7
8
9
10
A
ZONE-"A"
ZONE-"B"
ZONE-"C"
ZONE-"C"
6
10
1
TOP
MIDDLE
BOTTOM
34"
22 ½"
SECTION - A A
SCALE: 1½"=1'-0"

Figure 2

Figure 3

LSA Drum Counter 10-16-86

75 lb. std.

```
           GSBL
   360.00  ENT↑
 1.842314  GSBa
   473.00  ENT↑
 1.842314  GSBa
  3653.00  ENT↑
 8.770702  GSBa
  3533.00  ENT↑
 8.770702  GSBa
 12232.00  ENT↑
38.502579  GSBa
 12221.00  ENT↑
38.502579  GSBa
 34371.00  ENT↑
72.519682  GSBa
 34236.00  ENT↑
72.519682  GSBa
 37831.00  ENT↑
88.607983  GSBa
 37841.00  ENT↑
88.607983  GSBa
           GSB1

     0.99  ***
     1.55  ***
3.22784613-03  ***
           GSB3
           GSBC

0.390753466  ***
1.557344030  ***
0.002227646  ***
```

0.0022 μCi/g/count

LSA Waste Drum Counter For Rock + Sand

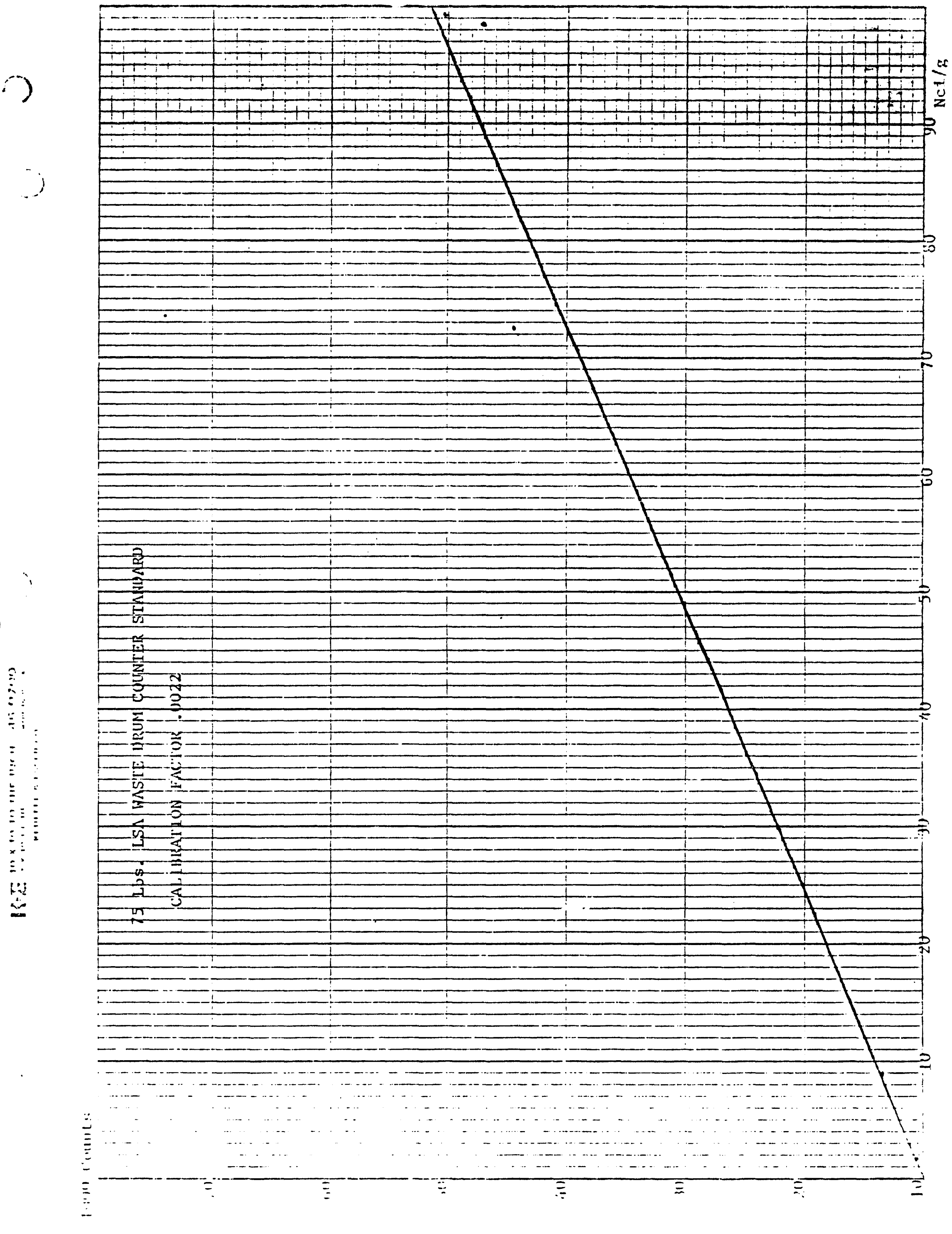
3-31-87

626# stat.

[illegible]

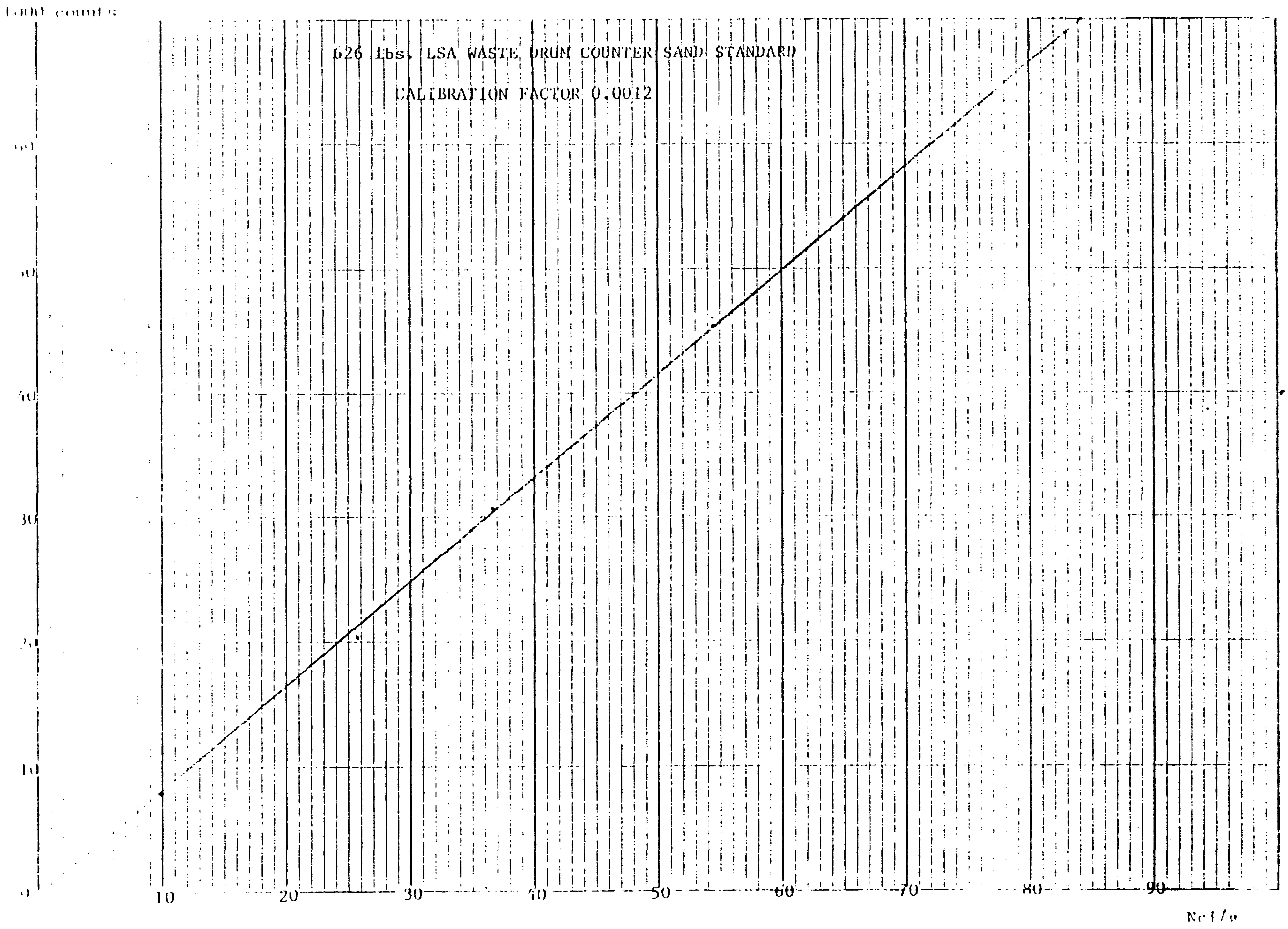
0.0012 nCi/g / count

Figure 4



75 Lbs. LSA WASTE DRUM COUNTER STANDARD
CALIBRATION FACTOR .0022
Nci/g
10
20
30
40
50
60
70
80
90

Figure 4A



626 lbs. LSA WASTE DRUM COUNTER SAND STANDARD
CALIBRATION FACTOR 0.0012
1000 counts
Nci/g
10
20
30
40
50
60
70
80
90

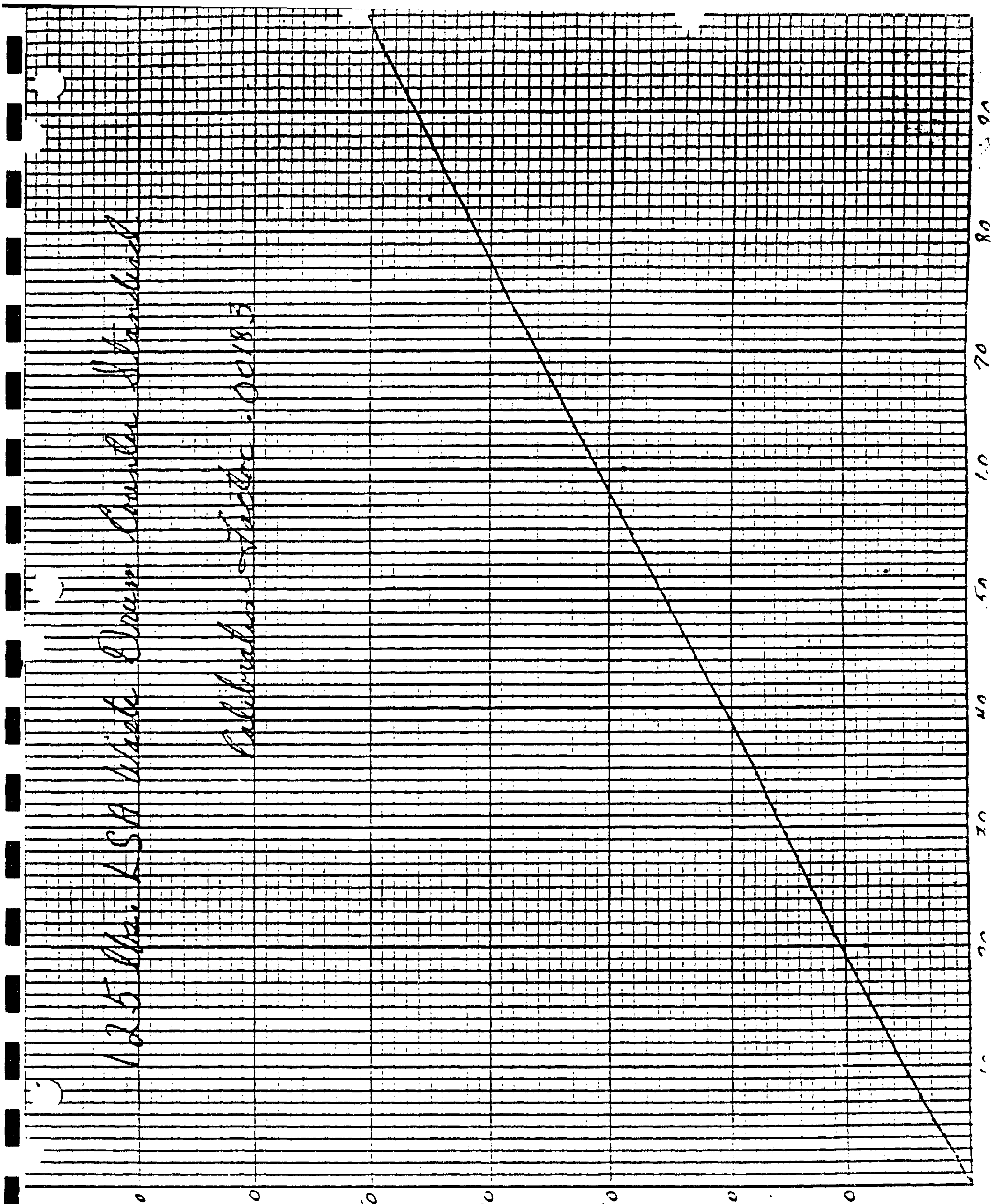


Figure 5

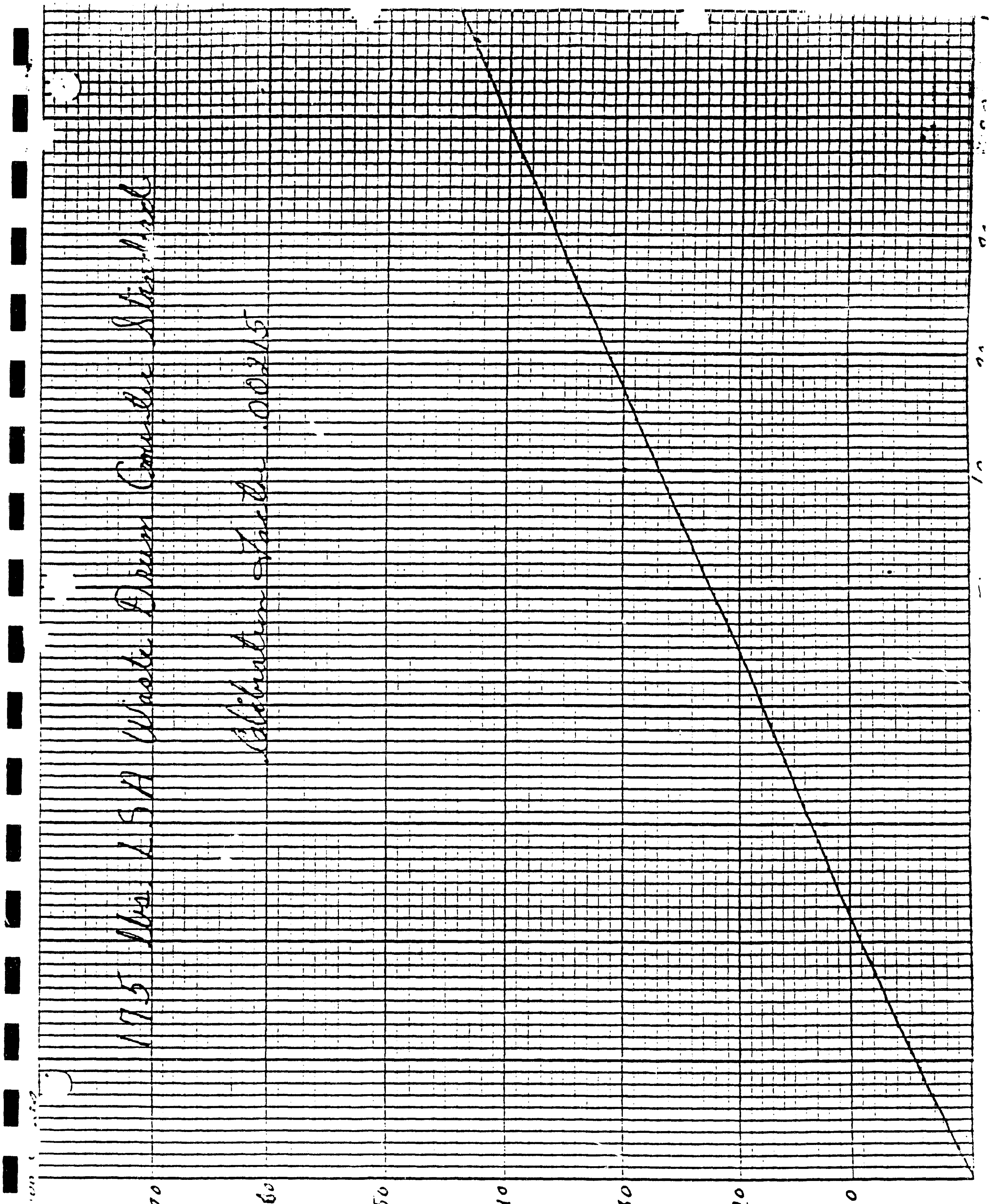


Figure 6

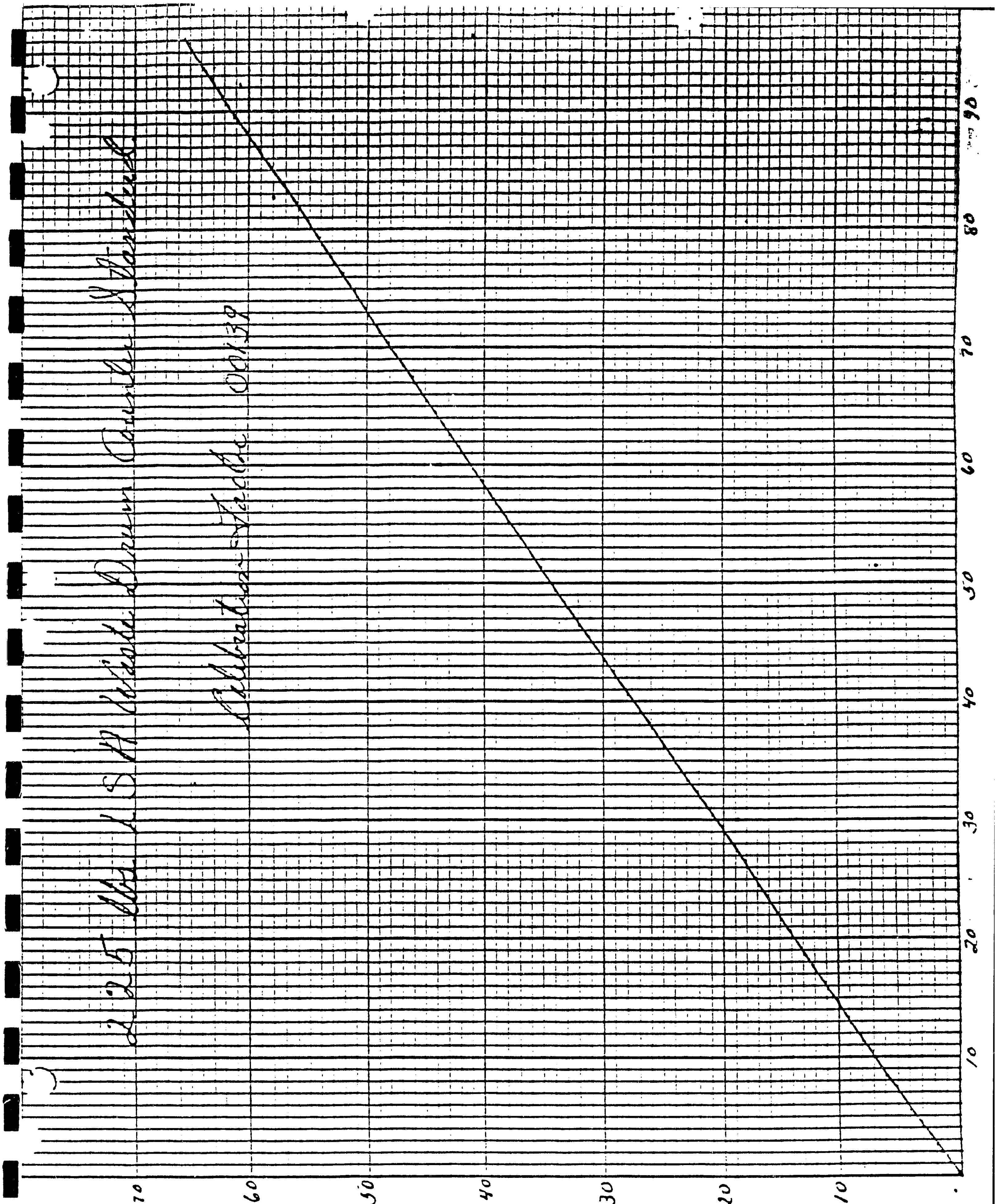

225 lbs LSA Waste Drum Counter Standard
Calibration Factor 00139
10
20
30
40
50
60
70
80
90

Figure 7

Figure 8

PU PLANT LSA WASTE DRUM COUNTER COUNT SHEETS

DRUM NUMBER ____________________ DATE ____________________

OPERATOR ____________________

H.V. 8.2 WINDOW .3 THRESHOLD .9

E.M. 100 KEV COUNT TIME 4.9 MINUTES

BKG. - 1 ____________________

BKG. - 2 ____________________

BKG. - 3 ____________________

TOTAL ____________________ ÷ 3 = ____________________ AVG. BKG.

GROSS COUNT - 1 ____________________

GROSS COUNT - 2 ____________________

TOTAL ____________________ ÷ 2 = ____________________ AVG. COUNT

\- ____________________ AVG. BKG.

____________________ NET AVG. COUNT

0.0022 CAL. FACTOR X NET AVG. COUNTS ____________ = ____________ Nci/g
([illegible]2 MAX)

Figure 1

Pu Plant LSA Waste Drum Counter Count Sheets
For Concrete and Sand

Drum No. ________ Operator ________ Date ________

Gross wt ________ H.V. 8.2 E.M. 100 KEV
Tare ________ Window 0.3 Count time 4.9 min
Net wt ________ Threshold 0.9

Bkg -1 ________
Bkg -2 ________
Bkg -3 ________
Total ________ ÷ 3 = ________ Avg. Bkg.

Gross ct -1 ________
Gross ct -2 ________
Total ________ ÷ 2 = ________ Avg ct
________ Avg Bkg
________ Net Avg Ct.

.0012 Cal. Factor X Net Avg Ct. ________ = ________ nCi/g
(54.42 max)
10 or less assign 5 nCi/g

Net Wt ________ X 453.592 = ________ grams

________ grams X ________ nCi/g = ________ nCi total

$\frac{nCi \times 10^{-9}}{1.045\ Ci/g}$ = ________ g Pu

or

________ g Pu

Pu-PLANT LSA DRUM COUNTER
COMPACTED DRUMS

DATE: ____________ DRUM #: ____________ OPERATOR: ____________

Count #	Net Avg. Counts
________	________
________	________
________	________
________	________
________	________
________	________
Total	________

Gross Wt. ____________

Tare ____________

Net Wt. ____________

Total Net Wt. ________ Lbs. x 453.59 g/lb. = ________ grams

.0028 Cal. factor x total net avg. counts ________ = ________ Nci/g (78.4 max.)

________ grams X ________ Nci/g = ________ Nci total

$\frac{\text{Nci} \times 10^{-9}}{1.12 \text{ Ci/g}}$ = ________ g Pu

or

________ g Pu

PURPOSE: Outline a proven method for handling and counting line generated waste in a safe and efficient manner.

RESPONSIBILITY:	ACTION:
Facility Manager and/or His Designated Alternate(s)	1. Administratively responsible for the practice of procedure conditions. 2. Approve changes in procedure.
Health Physics	1. Perform required surveys. 2. Inspect packages for defects. 3. Suggest improvements in procedures. 4. Maintain records of packages, NDA count results, MBA ledgers, and CHI^2 results. 5. Perform at least a monthly audit of NDA records, count procedures used, and vault physical inventory to insure correct counting and packaging of TRU waste.
Decon Supervisors	1. Follow procedure conditions. 2. Keep Health Physcis informed of unusual requirements. 3. Ensure proper packaging of waste. 4. Ensure that count procedures are strictly followed. 5. Train NDA counter operators. 6. Initiate procedural changes.
Individual Employees	1. Observe procedure conditions.
NDA Counter Operators	1. Strictly follow procedure conditions. 2. Suggest improvements in procedures. 3. Maintain records of packages counted. 4. Inform decon supervisors and Health Physics of any problems.

I. SAFETY AND NUCLEAR SAFETY

A. Observe all SOL(Safe Operating Limits) signs in area.

1. One uncounted package per shelf on transer carts.

2. Two uncounted packages per cart.

3. Maximum of ten uncounted packages in any room (except vault).

4. Two foot spacing, center to center, is to be maintained if packages are placed on the floor.

6. All packages $>$ 100 MR/hr shall be counted first and moved to the vault as quickly as possible, to avoid unnecessary personnel exposure.

7. The Cs^{137} sources will be stored in a lead shield when in the count room and not being used to determine package density, to minimize personnel exposure.

8. At the end of each work day all counted packages, Pu check sources, Pu standard sources, and Cs^{137} sources will be returned to the vault for proper storage.

II. EQUIPMENT (Attachment #1)

A. Ludlum 2500 Scaler Rate Meter.

1. Settings.

a. High voltage - adjusted to peak Cs^{137} source at $\approx$ 662 KEV.

b. Cs Threshold - 5.8

c. Pu Threshold - 3.2

d. Window - 1.3

e. Energy Multiplier - 100 KEV

f. Count Time - 0.5 minutes

B. 2" x 2" NaI detector.

C. Five - FFTF mixed fuel powder standards assayed and verified by ERDA.

D. Two - FFTF mixed oxide fuel powder check sources assayed and verified by ERDA.

E. 100 μCi Cs^{137} source.

F. One - adjustable package stand.

G. One - Cs^{137} source stand.

III. EQUIPMENT CHECKS

A. Calibration.

1. Will be done in accordance with procedure KM-NP-15-48 (Sources #2, #7, and #11 will not be used).

2. Will be performed:

a. At least yearly.

b. After any equipment failure in the system.

c. When daily checks will not maintain a 95% confidence level.

B. A CHI^2 control sheet will be made monthly using the 1.934g Pu and 9.681g Pu check sources that are stored in the vault to establish a 95% confidence level.

C. Twice daily when the NDA count system is in use a check will be run using the 1.934g and 9.681g Pu check sources. Five counts will be taken with each source and the results will be plotted on the monthly control sheets.

D. If the counts taken do not fall within the limits on the control charts, no packages may be counted and Decon Supervisor must be notified.

IV. PACKAGES

A. All packages shall be double bagged, except for non-line trash, and must meet proper configuration standards.

1. Maximum length - 16 inches.

2. Maximum surface area - 12 inches x 12 inches square to insure corners are in count window.

B. All packages must have a Pu ID card(KM-3007-A) and be filled out before NDA counting. (Attachment #2).

1. Date.

2. Job No. - (Room No. and Box No.).

3. Material Type.

4. MBA No.

5. Originator.

6. H. P. Release.

   a. MR/hr with E-500-B open window.

   b. DPM smearable.

   c. H. P. signature.

V. COUNTING WASTE

A. At the start of each day a Pu and Cs background and a Cs^{137} source count will be run. (Attachment #3).

1. Ludlum 2500.

   a. Take 10, 0.5 minute counts on Pu threshold(3.2) with nothing on the stand. Average the counts for Pu background.

   b. Change threshold to 5.8 and take 10, 0.5 minute counts and average them for the Cs background. Place the Cs^{137} source in the center of rear stand and take 10 counts and average them for the Cs^{137} source count. Subtract the Cs background from the CS^{137} source count to get the $Cs^{137}I_o$

   c. Record all counts and average on the daily background check sheet.

B. Record all pertinent data on Pu Scrap Counting Worksheet (KM-4949). (Attachment #4).

1. Date.

2. Operator signature.

3. Pu background.

4. $Cs^{137}I_o$

5. Series No.

6. Item No. - Pu ID Card No.

7. MR/hr.

8. Calibration factor.

9. Type of material.

10. Room the package is from.

11. Box the package is from.

C. Place package on package stand at proper elevation so as to be centered with detector.

1. Take two counts on the Pu threshold(3.2) and record on the worksheet. Subtract the Pu background from each gross count to get the net count. Add the two net counts and divide by two to get the #1 average net count.

2. Change threshold to Cs channel(5.8). Take two counts to get Cs background. Place Cs^{137} source in center of rear stand and take two counts. Subtract the background from each gross count to get net count. Add the two net counts and divide by two to get the average net count. Divide the average net count by the Cs^{137} I_o to get the Ti factor of Cs^{137} fraction. Match this fraction with the one on Pu correction factor sheet to get the Pu correction factor. (Attachment #5).

3. Mutiply the #1 average net Pu counts times the calibration factor then divide by the correction factor to get the g Pu for side #1.

4. Turn the package 180° degrees and repeat steps 1-3 to get the g Pu for side #2.

5. Add #1 g Pu and #2 g Pu and divide by two to get the average g Pu.

   a. For all packages meeting proper dimensions (Section IV, paragraph A) multiply average g Pu by 1 to get total g Pu for package.

b. If cylinder calibration is used multiply average g Pu by the length in feet to get total g Pu.

c. If a plane surface calibration is used multiply average g Pu by number of square feet to get total g Pu.

6. After the package is counted the total g Pu is also recorded on the Pu ID card along with the initials of the NDA counter personnel. (Attachment #2).

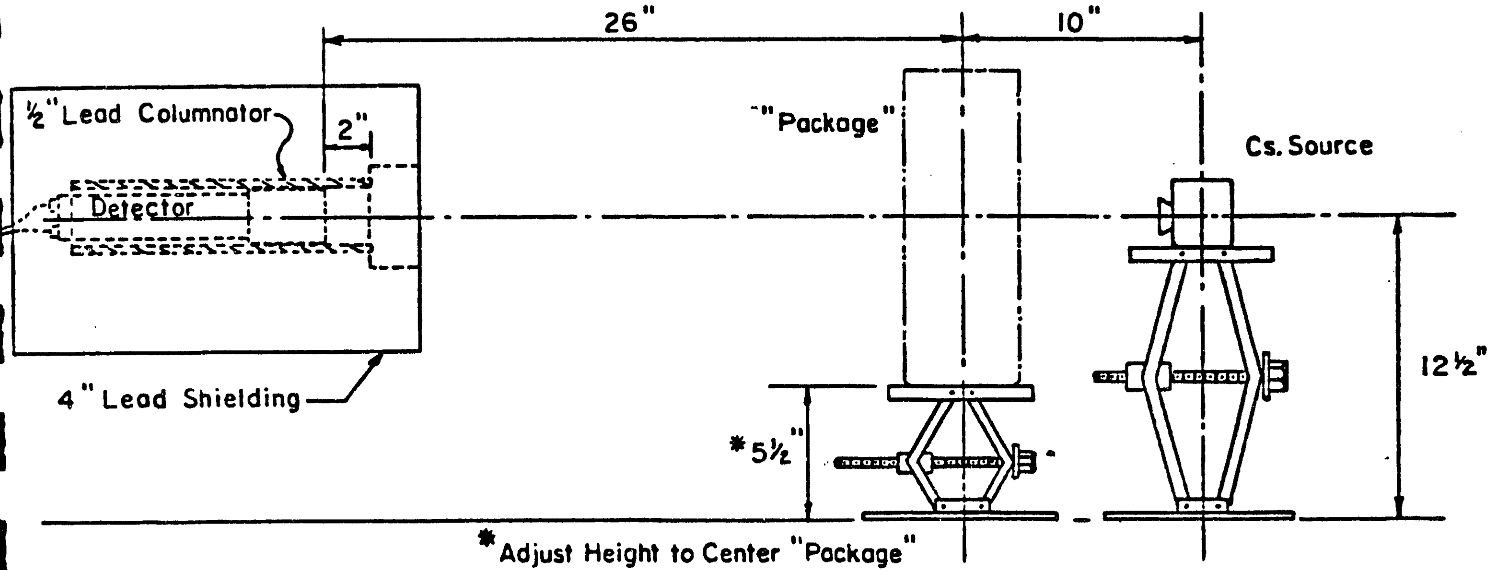
7. At the end of the shift, the NDA counter personnel should go to the vault and obtain from the vault custodian the location of each package counted that day, by drum No., and record this on the bottom of the corresponding Pu Scrap Counting Worksheet (Attachment #4). This way the worksheets can be put in the appropriate file in the H. P. office.

8. If a package is counted at $>$ 9.680 g Pu, it is to be sent back and bagged into the same box it was taken out of to be split up so as to be $<$ 9.680 g Pu.

9. If a counted package does not exceed the minimum detectable limit, it will be assigned a value of 1/2 the minimum detectable limit.

ATTACHMENT #1

N.D.A.-1
PACKAGE SET-UP



Cs. THRESHOLD ________ **Pu. THRESHOLD** ________
WINDOW ________ **WINDOW** ________

HIGH VOLTAGE ________

CALIBRATION FACTOR ________
MINIMUM DETECTABLE LEVEL ________

ASSIGN ______ TO ALL PACKAGES LESS THAN
OR EQUAL TO ______ G. Pu.

MAXIMUM VALUE THAT CAN BE COUNTED ________ G. Pu.

ATTACHMENT #2

NO. 60951

PLUTONIUM IDENTIFICATION CARD KM-3007-B

CAUTION

RADIOACTIVE MATERIAL

DATE

JOB NO	LOT NO

MATERIAL TYPE	CODE
MBA	NET WEIGHT gms
ORIGINATOR	SAMPLE NO

HP RELEASE

m/r	d/m

SURVEYED BY

WASTE COUNTER

SOURCE	MATERIAL	Pu ______ gms

DISPOSITION

Transferred to Storage on Internal Transfer Number	

BY

ATTACHMENT #3

Pu SCRAP COUNTER FORM

DAILY CHECK SHEET

SERIES #____________ DATE:____________

OPERATOR:____________

H.V.________ Pu T.________ Cs^{137} T.________ Window________

Multiplier________ Recess________ Distance________ Count Time________ min.

	Background Pu Channel	Background Cs Channel	100 uCi Cs^{137} Cs Channel
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
SUM			
AVG			

Avg. 100 uCi Cs^{137} - Avg. Cs Channel Bkgd = Cs I_o

Cs I_o = ____________

Avg. Pu Channel Bkgd.= ____________

ATTACHMENT #4

PU SCRAP COUNTING WORKSHEET KM-4949

TE	PU PKGD/ 0.5 MIN.	SERIES NO.
OPERATOR	$I_0 C_s$ 137	ITEM NO.
MR/HR	Calibration Factor (GPu/ 0.5 Min. Ct.)	
TYPE OF MATERIAL (PIPE, PLASTIC, FLANGE, ETC.) AND BOX REMOVED FROM		
IF CYLINDER SHAPE, LENGTH Ft.	IF PLANE SHAPE, LENGTH Inches x Inches Width ÷ 144 = Sq. Ft.	

Cs^{137} 0.5 MIN. CTS.

0 DEGREES			180 DEGREES		
BACKGROUND	GROSS	NET	BACKGROUND	GROSS	NET

Average Net ______ Average Net ______

$\frac{\text{Average Net}}{I_0} = (T_1)$ ______ $\frac{\text{Average Net}}{I_0} = (T_1)$ ______

Correction Factor = ______ Correction Factor = ______

Pu 0.5 MIN. CTS.

0 DEGREES			90 DEGREES		
BACKGROUND	GROSS	NET	BACKGROUND	GROSS	NET

1 Average Net ______ # 2 Average Net ______

$\frac{\#1 \text{ Avg. Net} \times \text{Calib. Factor}}{\text{Correction Factor}} = (\#1 \text{ GPu})$ ______ $\frac{\#2 \text{ Avg. Net} \times \text{Calib. Factor}}{\text{Correction Factor}} = (\#2 \text{ GPu})$ ______

$\frac{\#1 \text{ GPu} + \#2 \text{ GPu}}{2} =$ Avg. GPu ______

______ x ______ = ______
Avg. GPu b GPu in Package

Package: b = 1
Cylinder: b = # of Ft.
Plane: b = # of Sq. Ft.
24 x 24 x 12 Filter: b = 1

Pu WASTE COUNTING(LUDLUM 25 & 2x2 NaI)

Pu Correction Factor for Self Absorption & Package Density

$$\text{(Pu Corrected Counts)} = \frac{\text{Pu Counts}}{\text{Correction Faction}}$$

Cs^{137} Fraction	Pu Correction Factor	Cs^{137} Fraction	Pu Correction Factor	Cs^{137} Fraction	Pu Correction Factor	Cs^{137} Fraction	Pu Correction Factor
.05	.21	.29	.52	.53	.72	.77	.87
.06	.23	.30	.53	.54	.73	.78	.88
.07	.26	.31	.54	.55	.73	.79	.88
.08	.27	.32	.55	.56	.74	.80	.89
.09	.29	.33	.56	.57	.75	.81	.90
.10	.30	.34	.57	.58	.75	.82	.90
.11	.31	.35	.58	.59	.76	.83	.91
.12	.33	.36	.59	.60	.77	.84	.91
.13	.35	.37	.59	.61	.77	.85	.92
.14	.36	.38	.60	.62	.78	.86	.92
.15	.37	.39	.61	.63	.79	.87	.93
.16	.39	.40	.62	.64	.79	.88	.93
.17	.40	.41	.63	.65	.80	.89	.94
.18	.41	.42	.64	.66	.81	.90	.95
.19	.42	.43	.64	.67	.81	.91	.95
.20	.43	.44	.65	.68	.82	.92	.96
.21	.44	.45	.66	.69	.82	.93	.96
.22	.45	.46	.67	.70	.83	.94	.97
.23	.47	.47	.67	.71	.84	.95	.97
.24	.48	.48	.68	.72	.84	.96	.98
.25	.49	.49	.69	.73	.85	.97	.98
.26	.49	.50	.70	.74	.85	.98	.99
.27	.51	.51	.70	.75	.86	.99	.99
.28	.52	.52	.71	.76	.87	1.00	1.00

NOTE: For all Cs^{137} Fractions less than 0.5 use .21 as Pu Correction Factor.

Document No.: KM-NC-11-16
Section: 10
Revision: 1

CIMARRON CORPORATION

CIMARRON FACILITY

EMERGENCY MANUAL

SECTION TEN

FINAL RECOVERY PLAN

10.1 Introduction

After actions to(1) terminate the emergency cause, (2) rescue personnel, and (3) secure the immediate area around the accident site have been accomplished, a more thorough damage assessment is to be made. A careful evaluation of remaining hazards is to be conducted. Mechanical hazards may remain from spilled chemicals and solvents, downed electrical wires, broken gas pipes, water pipes, and debris. Radiological hazards may also be present in the form of radioactive material possibly contaminating a large area down wind of the accident site.

10.2 Area Control

In the event radioactive contamination spread is likely, the Health Physics survey team which made the preliminary survey for re-entry and rescue purposes is to be assigned to demarcate an exclusion area for the protection of the general public. Within the exclusion area a "hot line" contamination control point is to be established near the perimeter of the contamination spread area. The exclusion area boundry is to be no less than 50 yards from the contamination area. A path, such as a roadway, will be the only connection between the exclusion area and the "hot line". Ideally the "hot line" should be upwind and up hill from the scene of the accident.

Usually an 8 point radial survey is made, depending upon the situation. For plotting purposes the following recordings are to be made:

a. Reference point, direction from reference and distance from reference.

b. Distance of instrument detector from emitter, intensity, and time of measurement.

c. Type of radiation detected, (α, β, γ); by swipe or direct.

d. "Hot spot" location.

Air samples are to be taken near and downwind of the exclusion area boundry. The exclusion area boundry will be established and maintained by field measurements to include:

a. All areas $\gtrsim$ 1 MPC (See Section 7.1.5.2).

b. All contaminated areas $\gtrsim$ 500 d/m fixed/60 cm^2 and/or $\gtrsim$ 100 d/m smearable/100 cm^2. If the uranium plant only is involved, all contaminated areas $\gtrsim$ 1320 d/m fixed/60 cm^2 and/or $\gtrsim$ 220 d/m smearable/100 cm^2.

c. All areas $\gtrsim$ 0.5 mrem/hr.

R1 Make a map of the exclusion area boundry and a copy to the Civil police who will patrol outside the exclusion area perimeter if the need is established by the Emergency Director.

All personnel authorized to enter the hazard area are to do so by using the established path to the "hot line". At the "hot line" two(2) personnel are assigned the duty of monitors. They will issue anti-C clothing, protective equipment and dosimeters to those entering and monitor those who are leaving, and collect their anti-C clothing and equipment. The monitors will maintain a log of all who enter and exit. They will also record the personal dosimeter readings.

If safe to use, the Emergency Building will be the control center and may also be the "hot line" location. If unsafe to use, an alternate location will be established.

10.3 Decontamination

Several monitors will need to be assigned for a thorough survey of the affected areas during decontamination. Alpha cannot be detected if the surfaces to be measured are wet. If plutonium is the contaminant, gamma can be detected by suitable instruments.

Airborne contaminants may be reduced by using water as a fixative agent but care must be exercised not to cause run-off of contaminated liquids.

Earth moving and handling equipment may be needed to drum contaminated soil and debris for subsequent proper burial.

Hard surface decontamination is accomplished by using various cleaning methods such as vacuum, water, detergents, steam, solvents, acids and abrasion. Temporary fixation may be accomplished by using tape or plastic patches, oiling, or painting.

10.4 Release Limits

Personnel performing decontamination work and monitoring may cross the "hot-line" if they desire to leave the contamination area but do not desire to exit exclusion area; when monitoring shows less than:

a. 500 d/m/60 cm^2 fixed alpha and/or 100 d/m smearable alpha,

b. 2 mrad./hr beta and gamma.

Personnel and their equipment may only exit the exclusion area when monitoring shows:

a. <20 d/m/100 cm^2, smearable alpha

b. <100 d/m/100 cm^2 fixed alpha,

c. <0.2 mrad/hr from fixed beta and gamma isotopes.

It will be the duty of the "hot-line" monitors to ascertain from the individuals exiting the contamination area if they also desire to leave the exclusion area. They will monitor accordingly and record the persons location ("in" or "out") of the exclusion area. They will maintain a log of who is in the contamination area.

10.5 Outside Help

In the event of contamination spread beyond Kerr-McGee property, the NRC is to be promptly notified. This agency can supply any and all help, if needed including manpower and equipment. This help could begin arriving within 3-4 hours from the time of notification.

Use the Outside Assistance Plan portion of this manual to secure local help and assistance from the NRC. See Appendix A for telephone numbers.

DATE
FILMED
6/23/94

END