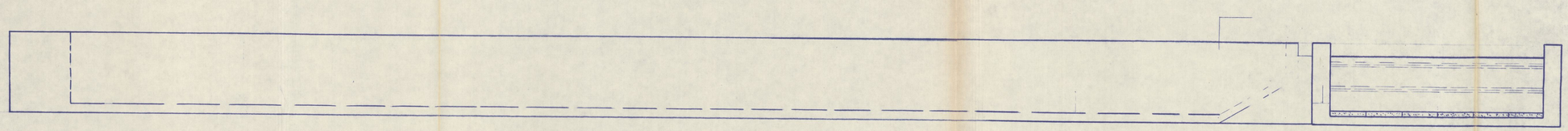
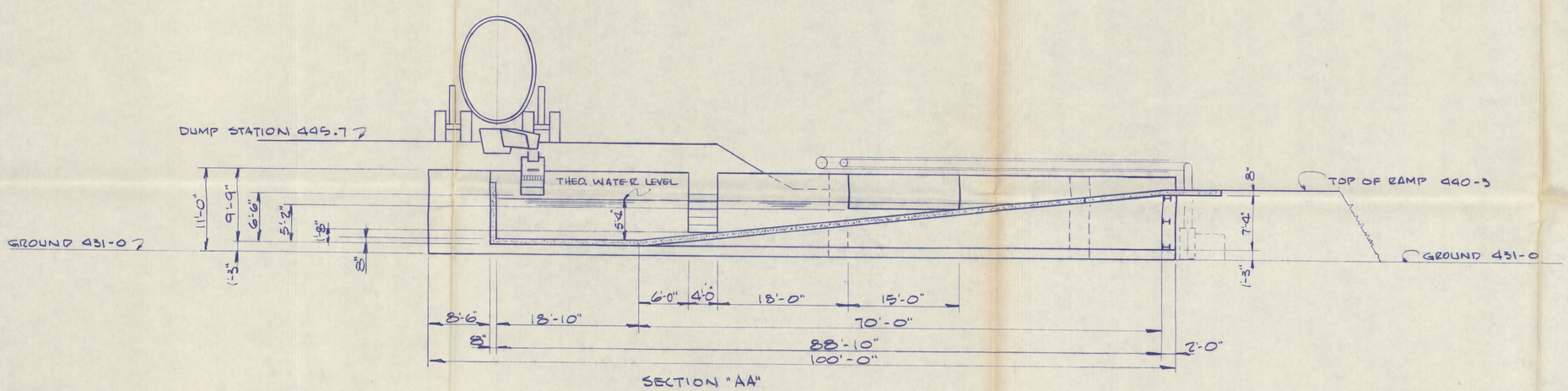
EXHIBIT F

CHEMETCO 84-8-35



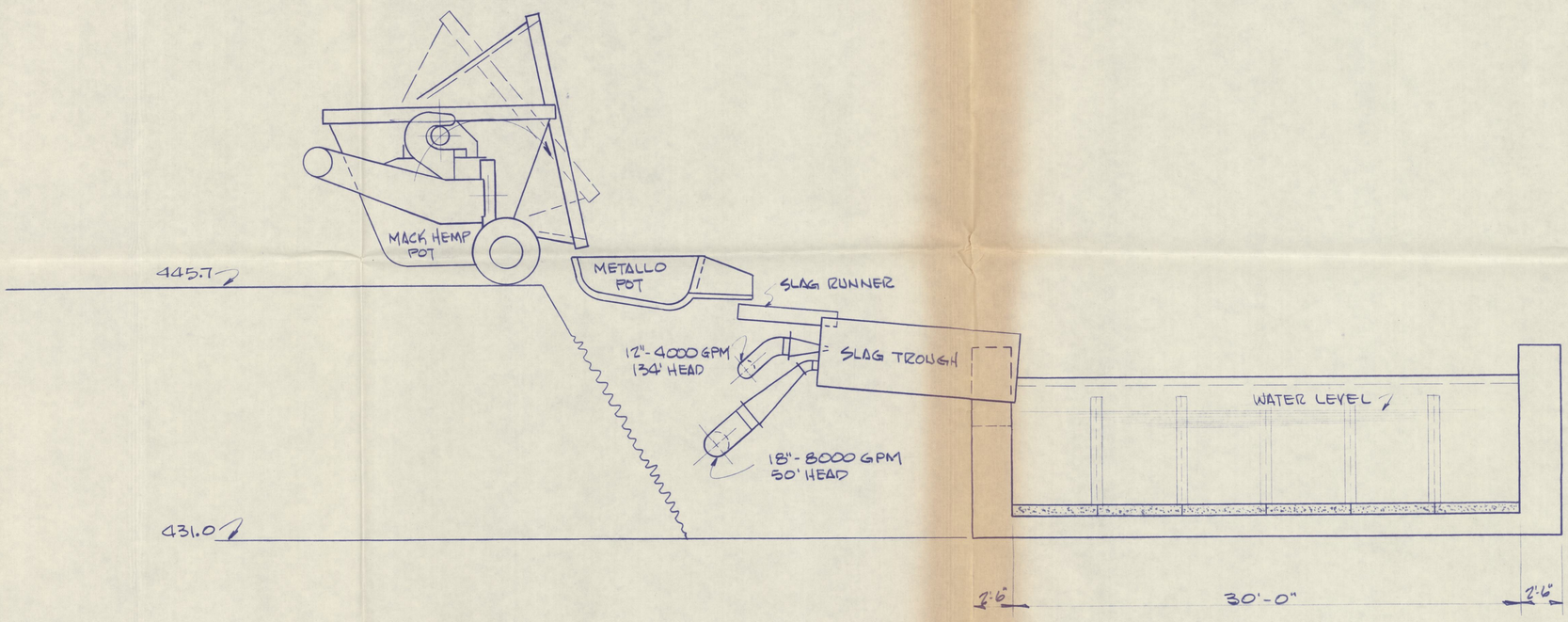
SECTION "BB"



SECTION "AA"

PRELIMINARY
NOT FOR CONSTRUCTION

REVISIONS			CHEMETCO	
NO.	DESCRIPTION	DATE	MAIN TITLE SLAG GRANULATION	
			SUBTITLE LAYOUT	
			DETAIL NAME SECTIONS "AA" AND "BB"	
			SCALE 1/8" = 1'-0"	APPROVED BY
			DRAWN BY WPM	DATE
			TRACED BY	FILE DWG. NO.
			CHECKED BY	H-1140



SECTION "CC"

PRELIMINARY
NOT FOR CONSTRUCTION

REVISIONS		
NO.	DESCRIPTION	DATE

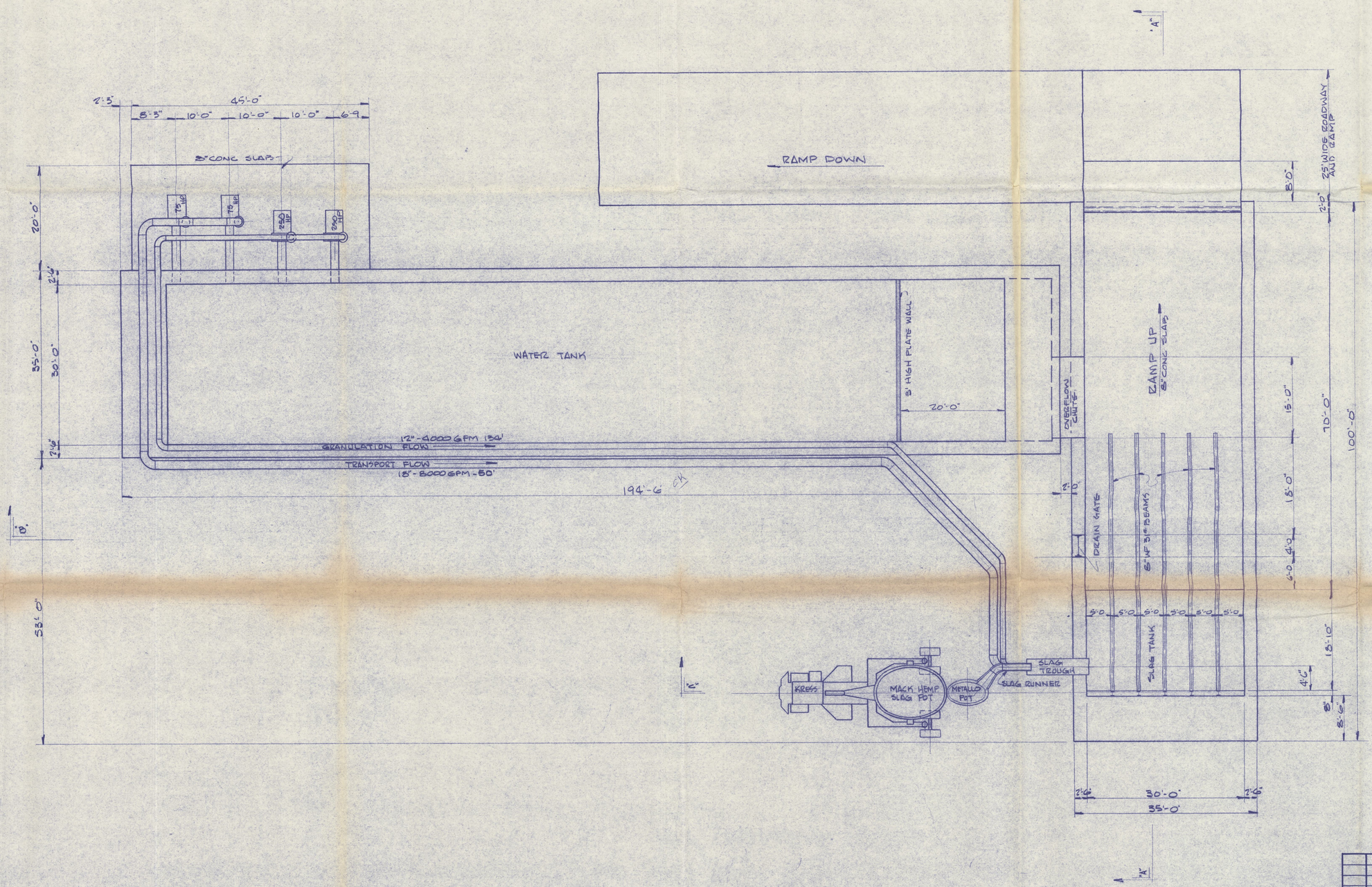
CHEMETCO

MAIN TITLE SLAG GRANULATION

SUBTITLE LAYOUT

DETAIL NAME SECTION "CC"

SCALE	APPROVED BY
DRAWN BY WFM	DATE
TRACED BY	FILE DWG. NO.
CHECKED BY	H-1140-



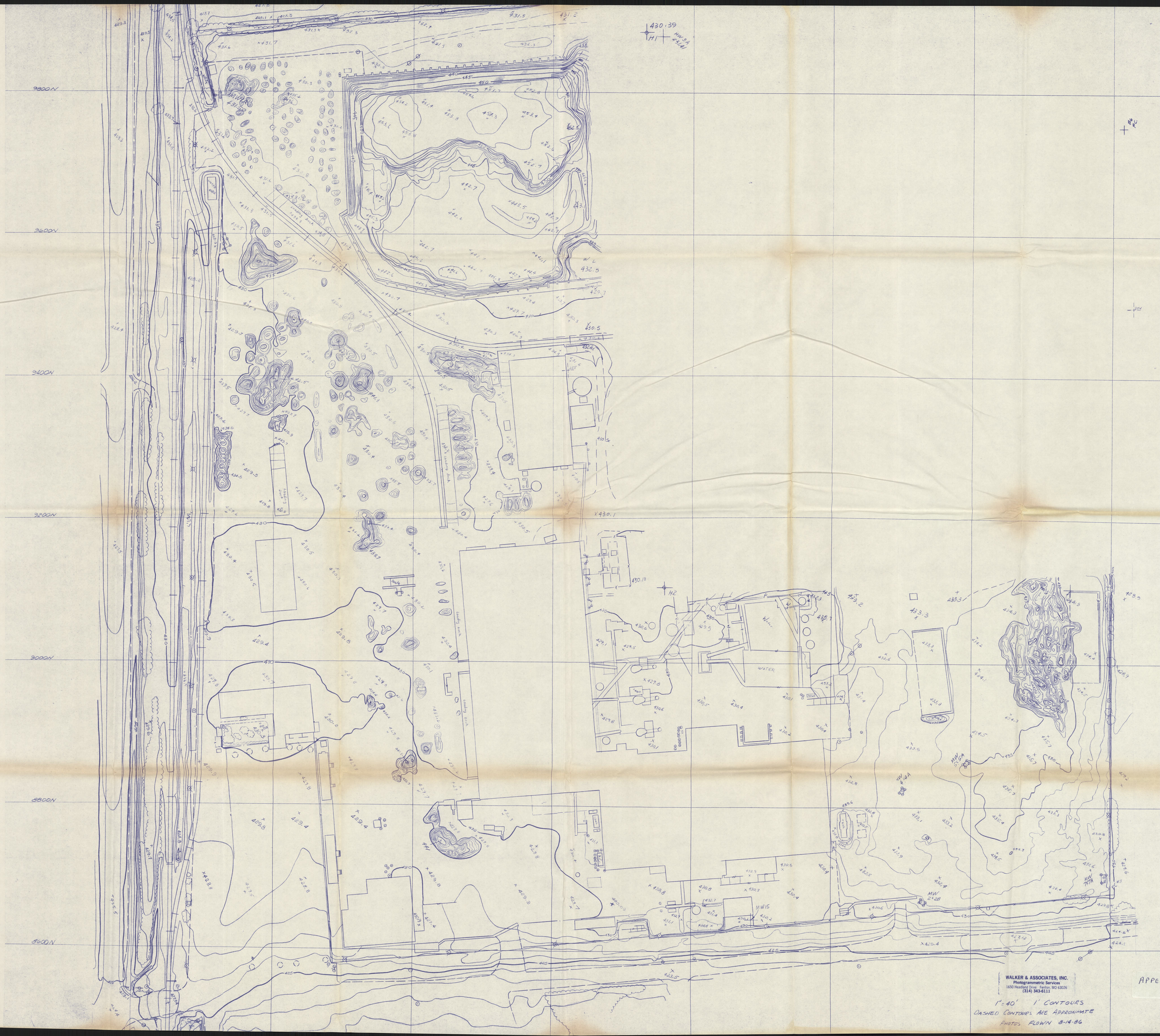
PRELIMI

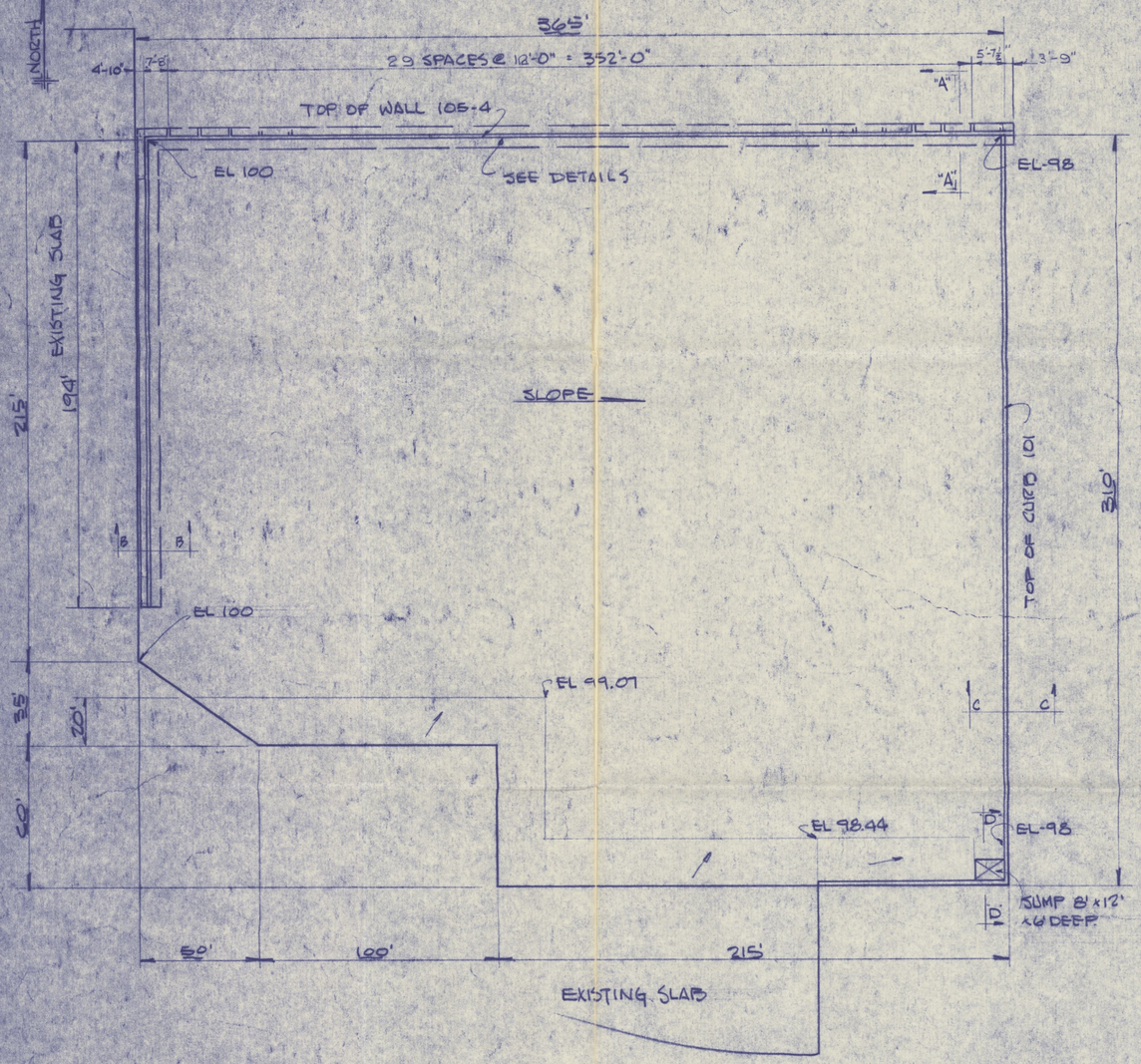
NOT FOR CON

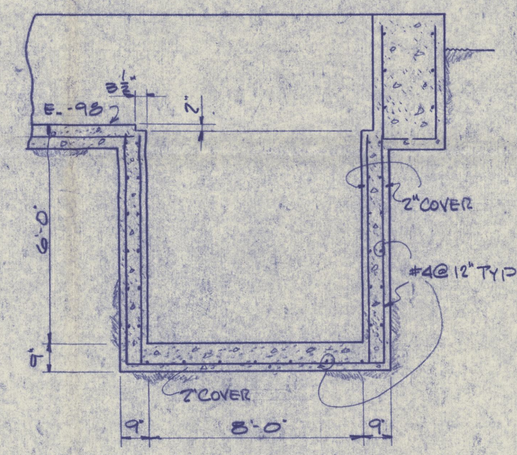
FOUNDRY
SLAG GRANULAT
LAYOUT

REV	DESCRIPTION	DATE	CHEMICO MI
			DRAWN WFM / SCALE 1/8"
			CHECKED
			APPROVED / L-1

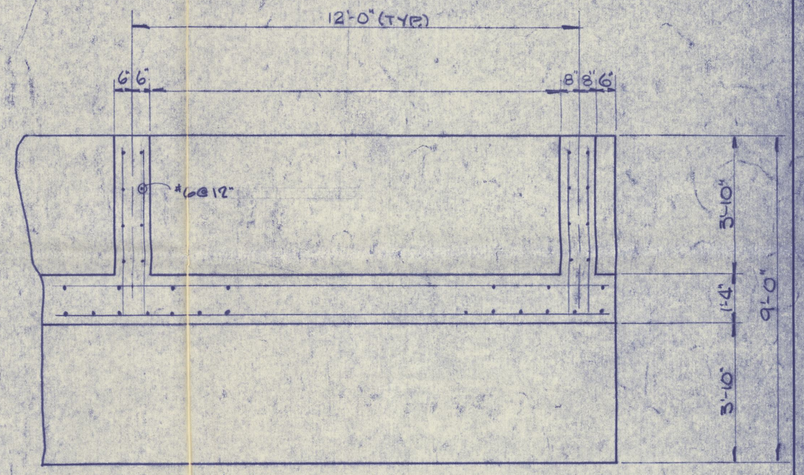
S 80°-31'-30" E
AIR SAMPLER
NE 1/4 SEC 16-4-9
NORTH LINE 1/4 SEC 16-4-9
SE 1/4 SEC 16-4-9
26 THICKNER
GRIZZLY
SAMPLING
FOUNDRY FINISH FLOOR EL 43'-0"
PUMP HOUSE
NORTH 10" PIPE
NO 1 WELL LINE (12) FOUNDRY
475'-3" TO (5) LINE
234'-0"
PROPERTY LINE
OFFICE 130'-36"
MELTING PIT
6" LINE
100' EASEMENT TO ILLINOIS POWER COMPANY
227' TO LINE (FOUNDRY)
DISPOSAL FIELD
WATER TANK
ELECT SHOP
265'-0"
ANODE CASTING
ELECTROLYSIS
PARKING LOT
OIL SUMP
GAS PUMP
WATER TO OFFICE
BOILER HOUSE
PURIFICATION PLANT
265'-0"
REPAIR SHOP
STORE ROOM
SLIME BUNKER
GAS SUPPLY
GAS METER
GAS SUBSTATION
12 MRPG GAS LINE
SCALE 1" = 40 F
SITE PLAN
CHEMICO ME
DRAWN
CHECKED
APPROVED
SCALE
L-

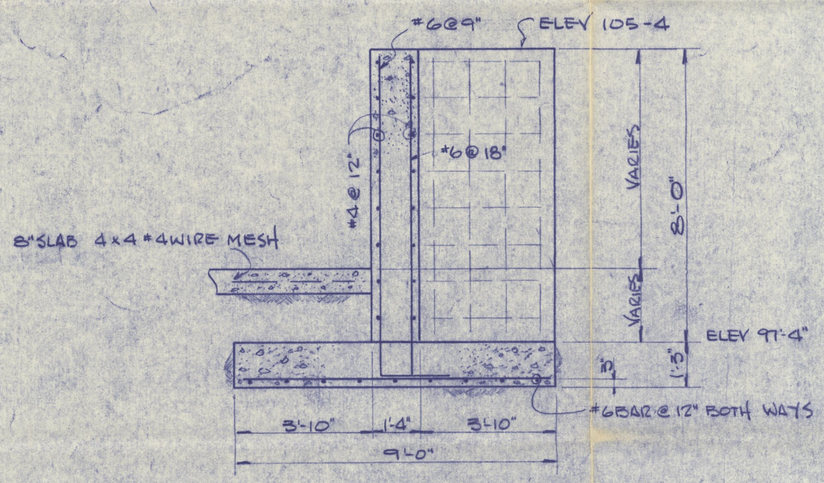

9800N
9600N
9400N
9200N
9000N
8800N
8600N
WATER
MW15
MW 2&2B
MW 4&4A
MW 5&5A
MW 7&7A
H1
H2
430.39
430.1
430.5
432.5
WALKER & ASSOCIATES, INC.
Photogrammetric Services
1650 Headland Drive Fenton, MO 63026
(314) 343-6111
1"=40' 1' CONTOURS
DASHED CONTOURS ARE APPROXIMATE
PHOTOS FLOWN 8-14-86



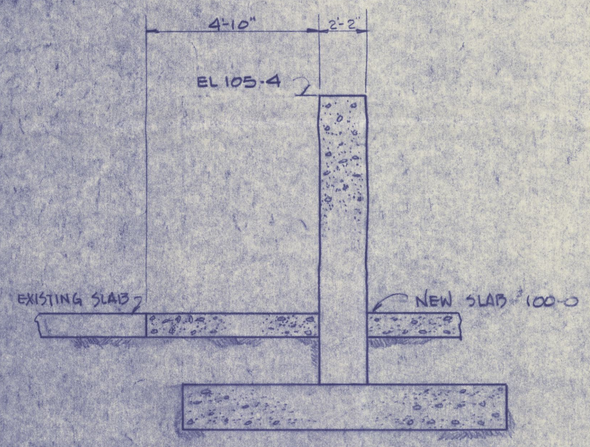


SECTION "DD"

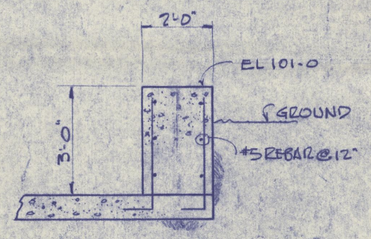




SECTION "AA"
TYPICAL REBAIR



SECTION "BB"
FOR REBAIR SEE "AA"



SECTION "CC"

NOTE!
ADDITIONAL WALLS HAVE BEEN ADDED (NOT SHOWN), JULY '85

REVISIONS		
NO.	DESCRIPTION	DATE
1	GENERAL	4/4/84
2	REMOVE KEYWAY	4/9/84
3	ADD SECTION DD	5/7/84

CHEMETCO

MAIN TITLE: GENERAL PLANT
SUBTITLE: MATERIAL HANDLING
DETAIL NAME: NORTH STORAGE SLABS

SCALE: 1/8"
DRAWN BY: WFM
TRACED BY:
CHECKED BY:
APPROVED BY:
DATE: 3/28/84
FILE:
DWG. NO.: H-4500-2662

APPENDIX N

BRUNING 40-107 50527-1

US EPA RECORDS CENTER REGION 5
1000314

SUMMARY OF THE COMPREHENSIVE PROPOSAL BY CHEMETCO INC. FOR RESOLVING RCRA CONCERNS

INTRODUCTION

A. Chemetco's RCRA Part B application apparently has caused some confusion concerning current handling of materials used or generated in Chemetco's smelting and other operations.

B. Chemetco has become particularly aware of this confusion as the result of recent discussions with both Illinois EPA and U.S. EPA Region 5 in conjunction with various inspections and investigations.

C. Chemetco's decision to file its Part B application and to retain interim status was largely a function of Chemetco's desire to be in a position in the future to receive, store and process manifested materials in its reclamation and recycling operations.

D. To eliminate any unnecessary confusion and to clarify the circumstances surrounding Chemetco's current operations, Chemetco has decided to revise the pending Part A and Part B of its RCRA permit application.

E. Chemetco has concluded, following an internal analysis of its operations with the assistance of ERT, that it does not currently operate any hazardous waste treatment, storage or disposal processes.

F. Consequently, Chemetco's decision to revise its RCRA permit application to reflect current operations means that Chemetco will withdraw its RCRA application and discontinue interim status.

G. Chemetco seeks the concurrence of IEPA and USEPA with this conclusion. Accordingly, Chemetco is filing a Proposal to withdraw its application for a RCRA hazardous waste storage facility permit.

I. SUMMARY OF CHEMETCO'S PROPOSAL TO WITHDRAW ITS RCRA PERMIT APPLICATION

A. Chemetco's Proposal to withdraw its RCRA permit application has been prepared and is being filed

with IEPA to provide a comprehensive framework within which Chemetco can resolve with IEPA and with USEPA all questions and concerns relating to Chemetco's handling at its facility of any materials that are or might be considered to be hazardous wastes.

B. Accordingly, Chemetco's Proposal identifies each area of concern that has been raised by one of the agencies or that seems likely to pose questions, and explains how the pertinent concerns will be addressed under Chemetco's proposed comprehensive RCRA compliance program.

C. The areas identified as presenting some concern, at least in the past, involve a number of specific products of Chemetco's current operations and a number of specific units at the facility that one agency or the other has identified as a potential past or present hazardous waste management unit.

D. At present, Chemetco's copper smelting and other processes produce anode copper, crude lead-tin solder, slag and zinc oxide. Both IEPA and USEPA have expressed concerns about Chemetco's handling of the slag and the zinc oxide. The Proposal explains separately how Chemetco plans to deal with current and future production of slag and zinc oxide and what Chemetco will do with its inventories from past production presently stored at the site.

E. In addition, the Proposal explains what has been done to close the cooling water canal, the dirt pits and the former zinc oxide storage pile. The Proposal also describes the steps that have been planned to determine what further actions may be necessary to close out the floor-wash impoundment.

F. Finally, the Proposal summarizes the ground water monitoring and assessment plan that has been developed and submitted to IEPA and USEPA Region 5 for review and approval. This plan is being implemented for the ongoing monitoring of ground water as Chemetco is carrying out the other steps described in the Proposal, and to determine the need for any further remedial action on ground water.

II. SLAG MANAGEMENT

A. Current and Future Slag Production.

1. Chemetco currently is installing the necessary equipment to granulate all of its slag production for sale as shingle coating material.

2. The Proposal details this production, process which will not generate any hazardous waste. Production is scheduled to begin in January 1987.

3. Pursuant to a recent agreement, Southern Agri-Minerals will purchase in granulated form all of the slag produced in Chemetco's smelting operation. Production is estimated at 75,000 net tons per year.

B. Existing Slag Inventory

1. Chemetco has received firm offers to purchase the slag currently stored at the plant for use as embankment material in the construction of overpasses on Poag Road and Interstate 255. The Proposal describes how the slag will be used in the highway construction process.

2. IEPA apparently has objected to the use of Chemetco's slag as embankment material.

3. Chemetco believes that the objection interposed by IEPA is unfounded. If IEPA will withdraw its objection, however, Chemetco is willing to conduct a study to verify that the slag used in this highway construction will pose no significant risk to human health or the environment.

4. If slag may be used as highway embankment material, depletion of the existing slag inventory is expected to be completed within 3 years, and possibly sooner.

III. ZINC OXIDE MANAGEMENT

A. Current and Future Zinc Oxide Production

1. Chemetco has two existing contracts under which all zinc oxide currently produced at the plant is sold either to Exmet or to several European customers.

2. Current shipments to Exmet average 100 tons per week. The Exmet process recovers materials from the zinc oxide to use in the production of commercial fertilizers.

3. Current shipments to European customers, including Hydro Metal, Vielle Montague, and Metallurgy Hoboken Overpelt, also average 100 tons per week. The zinc oxide is recycled to reclaim zinc, zinc chemicals and other metals.

B. Existing Zinc Oxide Inventory

1. Current requirements for zinc oxide will increase soon to a level that cannot be met entirely by current zinc oxide production, and shipments will be made from inventory. All shipments to Exmet will be made exclusively from current production. Orders from other customers will be filled from inventory.

2. By April 1987, total monthly shipments are expected to reach 1200-1500 tons. At this rate, the entire existing inventory should be depleted by 1992.

3. In addition, Chemetco is actively exploring other sales options for the existing zinc oxide inventory.

4. Chemetco is also pursuing a research program to develop a process to produce a pure zinc oxide product that would be marketed directly by Chemetco.

IV. CLOSURE OF THE DIRT PITS, STORAGE PILE AND COOLING WATER CANAL

A. The zinc oxide pits, the zinc oxide storage, and the cooling water canal have all been closed.

The zinc oxide material and zinc oxide residues have been removed from each of these process or storage units and have been placed in inventory for future sale as recyclable zinc oxide material.

B. Pursuant to a request from IEPA, closure plans were filed for these units, but IEPA has found the submissions from Chemetco deficient and has requested Chemetco to file revised plans.

C. Since Chemetco believes that each of these three closures has been completed satisfactorily, Chemetco proposes to file a closure documentation report for each to be reviewed by IEPA and USEPA.

D. To provide an example of the form of closure documentation report that Chemetco proposes to file, a draft report for the closure of the zinc oxide pits has been prepared and is being submitted today.

E. This closure documentation report will be finalized, and additional reports for the zinc oxide storage pile and cooling water canal will be prepared and filed within 45 days.

F. The reports will describe the closures performed and the cleanup criteria applied and will propose appropriate cleanup criteria for determining what, if any, further action should be taken.

V. FLOOR-WASH IMPOUNDMENT AREA SITE INVESTIGATION STUDY

A. Past operating practices and current conditions

1. Prior to 1980, electrolyte on the floor of the Tank House was washed into the floor-wash impoundment for storage. The electrolyte contained sulfuric acid, copper, nickel, calcium, and silica.

2. Subsequently, the floor-wash impoundment was closed and backfilled to grade.

3. Beginning in 1981, Chemetco has installed groundwater monitoring wells, up and down gradient of the former floor-wash impoundment area. These wells have been sampled on a monthly basis.

B. Ground Water Assesssment and Remedial Activities

1. Following initial assessment of ground water quality data, Chemetco installed an interceptor system in mid-1984. Contaminated ground water is collected and pumped to the plant where it is recycled.

2. In mid-1986 Chemetco prepared a Ground Water Assessment Plan. This plan presents a brief interpretive discussion of current hydrogeolgic and ground water quality conditions in the area up and down gradient from the floor-wash impoundment. Based upon this evaluation of existing information it was determined that contaminated ground water is confined to the upper (shallow) sand lens in the vicinity of the former floor-wash impoundment.

3. Therefore, the assessment plan made recommendations to focus on further definition of the shallow sand lens. Activities recommended include:

   a. completion of a resistivity survey to deliniate the boundries of the shallow-sand lens;

   b. based upon results of a resistivity study, an exploratory boring program to define and document the extent of the sand lens; and,

   c. installation of additional monitoring wells with continued sampling and analysis.

4. This additional infomation and data will be reviewed and evaluated for use as a basis for future design and implementation of corrective action, if necessary.

5. Chemetco completed a resistivity study in July 1986. The purpose of this study, in addition to deliniating the shallow sand lens, was to determine more accurately the extent of soil and ground water contamination. Although the results of this study are inconclusive, they did indicate ground water flow anomalies within the area

of the floor-wash impoundment and interceptor trench. This indicates the need for further study and investigation.

6. In conjunction with above activities and at the request of IEPA, Chemetco prepared and submitted to IEPA a Ground Water Monitoring Program to comply with any applicable state and federal regulatory requirements. This program complies with all potentially applicable ground water monitoring requirements relating to closure, including well placement and construction, sampling and analysis methods, and necessary record keeping and reporting. This program will be incorpoated by reference into any closure plans and will fulfill any need for ground water monitoring at Chemetco in conjunction with any closure activities.

C. Proposed Work Plan for a Site Investigation Study

1. Both IEPA and USEPA have expressed concern about Chemetco's closure of the floor-wash impoundment, the extent and nature of apparent ground water contamination, and the need to address and mitigate contaminated ground water.

2. The proposal being submitted today presents Chemetco's initial work plan to develop and implement a Site Investigation Study which will identify local hydrogeological characteristics and the extent and nature of soil, ground water and surface water contamination in and around the former floor-wash impoundment. This study will also identify and evaluate alternative corrective actions which may be implemented to mitigate any impact caused by past operations of the floor-wash impoundment.

PROPOSAL BY CHEMETCO, INC. TO WITHDRAW
HAZARDOUS WASTE MANAGEMENT FACILITY
RCRA PERMIT APPLICATION

On November 7, 1980, Chemetco, Inc. filed a Part A application for a permit under the Resource Conservation and Recovery Act (RCRA) to operate a hazardous waste management facility engaged in the storage of hazardous wastes. The application listed four process units for which a permit was sought -- a surface impoundment, a waste pile, a tank and a container. The application also listed eight hazardous wastes as being stored at the facility. Subsequently, in August 1983, Chemetco announced in a letter to the Illinois Environmental Protection Agency (IEPA) that Chemetco does not generate, treat, store or dispose of any hazardous wastes at its facility in Hartford, Illinois.

On November 8, 1985, Chemetco filed another RCRA Part A application listing nine different storage or treatment units and numerous hazardous wastes. Chemetco's second Part A application was filed after Chemetco had staunchly resisted any efforts to characterize any part of its operations as the storage or treatment of a hazardous waste and after Chemetco had declined to file the Part B of its previous RCRA Part A application. Both IEPA and the United States Environmental Protection Agency (USEPA), Region 5, have indicated that these seemingly inconsistent actions have caused some confusion over the current status of operations at the Chemetco plant. This confusion has come to light during recent inspections and

investigations of Chemetco being conducted by one agency or the other.

Chemetco regrets that its actions have caused any confusion over the status of current operations at the plant. Much of this confusion has been caused by Chemetco's desire to ensure that its current operating units, which are not now treating or storing hazardous wastes, will not be prevented from handling certain materials that Chemetco needs or desires to handle in the future just because those materials must be labeled and handled as hazardous wastes. Chemetco had concluded that it would be necessary to file a RCRA Part B application and to retain interim status as a treatment and storage facility in order to avoid this dilemma. Accordingly, the RCRA Part B filed by Chemetco listed a number of existing and proposed process units as hazardous waste units under the mistaken impression that this step was necessary in order to preserve Chemetco's ability to receive and use in its smelting and other operations materials manifested as hazardous wastes that are recyclable materials from which copper and other metals or chemicals can be recovered.

Now that Chemetco recognizes that its largely protective and prospective application has caused considerable confusion, Chemetco has decided to revise its pending Part A and Part B applications to reflect only the extent to which materials actually are handled in current operations at the Hartford plant. Following careful examination of its current

operations and consideration of the RCRA regulations, especially those relating to recyclable materials as reflected in EPA's March 1986 Guidance Document, Chemetco has concluded that the appropriate action at this time is to withdraw its pending RCRA application because no hazardous waste treatment storage or disposal processes are being operated at the plant. Accordingly, Chemetco is filing this proposal to withdraw its RCRA permit application.

This proposal is intended to aid in resolving the uncertain status of Chemetco's handling of materials generated or used in its operations. The review undertaken in this proposal will also clarify Chemetco's status under the RCRA regulations. In particular, the process units that were described in Chemetco's previous RCRA Part A applications do not currently involve the treatment, storage or disposal of hazardous wastes. The reasons for this result are that some of the units have been closed, some listed units were prospective and have never been put into operation and the materials treated or stored in the remaining units either do not constitute wastes or are not hazardous.

In this proposal Chemetco will discuss each process unit listed in its original and revised Part A applications, and describe the current circumstances as they relate to the Part A description in question.

1. <u>The Original Part A Application</u>

Chemetco's original Part A application was dated November 17, 1980. Line 1 of Part III of the application lists

the process code S04, storage surface impoundment, having a design capacity of 1,271,792 gallons. This listing comprised several earthen impoundments in existence at the time which were used as settling units in the zinc oxide production process. The zinc oxide and water slurry produced by the tandem, double quencher/venturi scrubber system was routed to these units so that a more concentrated zinc oxide material could settle out. Of the total capacity listed for these zinc oxide pits, approximately 70 percent represented zinc pits that were then being used but are now closed. The remaining 30 percent of the capacity listed on line 1 actually represented a zinc pile that was later replaced by the present concrete zinc oxide storage bunker.

All of the dirt-lined zinc oxide pits have now been closed. Closure occurred from January 4, 1985 through February 8, 1985. The pits were no longer needed for separation of the zinc oxide since that process is now accomplished in concrete units. The pits were closed "clean." Contaminated material from the pits was removed to the concrete zinc oxide bunker. Although this zinc oxide material is sometimes EP toxic for lead and cadmium, it is not a solid waste because it will be sold for reclamation of its metal content.

Line 2 of Part III of the original Part A application lists the process code S03, storage waste pile, and a process design capacity of 6296 cubic yards. The material involved in

this process was "pot slag", which did not constitute waste since it was totally recycled by charging to the furnaces and was not hazardous waste.

Line 3 of Part III of the original Part A application lists the process code S02, storage tank, and a process design capacity of 20,000 gallons. The contents of the tank were referred to as "black acid" or "spent acid (electrolyte)." Since electrolysis has been discontinued, the unit is no longer in use. Even when in use, however, the black acid stored there was not a waste.

Line 4 of Part III of the original Part A application lists the process code S01, storage container, and a process design capacity of 110 gallons. This listing referred to two drums of trichloroethylene, a solvent which is no longer used. In the past it was completely used.

2. Revised Part A Application

The revised Part A application, which was dated November 7, 1985, lists nine process units. None of the units presently involves the storage, treatment or disposal of hazardous waste.

Line 1 of Part III of the revised Part A application lists process code S01, storage container, and a process design capacity of 2,000 cubic yards. This entry refers to tote boxes which are used for solids generally. The totes were not and are not used for handling hazardous waste. They were listed to allow their use in processing manifested materials.

Line 2 of Part III of the revised Part A application lists process code S02, storage tank, and a process design capacity of 700,000 gallons. This entry represents the former cooling water canal the function of which is now performed by a cooling tower. The canal was referred to as a tank because at one time there were plans to convert the open canal into concrete lined tankage for use in collecting storm water runoff and possibly as a process storage unit. This conversion was not undertaken, however, and the canal will be completely closed instead. Closure of the canal on a "clean" basis is now essentially completed. All zinc oxide material which had accumulated in the canal (some tested EP toxic for lead) was placed in the concrete-lined zinc oxide storage bunker. This material, which is not a waste, will either be sold or reprocessed to recover its metal content.

Line 3 of Part III of the revised Part A application lists process code S03, storage waste pile, and a process design capacity of 1,000 cubic yards. This entry represents a proposed waste pile that never existed.

Line 4 of Part III of the revised Part A application lists process code S04, storage surface impoundment, and a process design capacity of 3,000,000 gallons. This entry represents the concrete-lined zinc oxide storage bunker which was built to replace the now closed unlined zinc storage pile. Closure of the storage pile involved removal of zinc oxide and contaminated earth for storage in the concrete zinc oxide

storage bunker. The concrete bunker contains zinc oxide, zinc oxide mixed with soil, and zinc oxide mixed with slag. The zinc oxide in the bunker will either be sold or reprocessed for metals recovery. The contents of the bunker are not considered hazardous waste.

Line 5 of Part III of the revised Part A application lists process code T01, treatment tank, and a process design capacity of 576,000 gallons per day. This entry pertains to a proposed "tank farm" consisting of 6 units, each containing 6 12,000-gallon tanks. The tank farm was never constructed. The listing on line 5 also includes other tanks that existed at the time of the application. None of them has ever been used for treatment or storage of hazardous waste.

Line 6 of Part III of the revised Part A application lists process code T02, treatment surface impoundment, and a process design capacity of 576,000 gallons per day. The entry represents the concrete pits for treatment of zinc oxide-laden water from the wet scrubbers. This unit is not used for handling hazardous waste.

Line 7 of Part III of the revised Part A application lists process code T04, treatment: other, and a process design capacity of 100 tons per hour. This process unit is further described as constituting the belt filter, plate filter and centrifuge. The purpose of these machines is the dewatering of the zinc oxide produced by the scrubbers. No centrifuge has been used from 1980 to the present. The belt filter, also

called the belt press, was an experimental machine which is no longer in use. Chemetco currently uses filter presses for dewatering the zinc oxide. The filter presses are used in the production of zinc oxide, which is destined for reclamation and, therefore, not a hazardous waste.

Line 8 of Part III of the revised Part A application, which lists process code T04, treatment: other, and a process design capacity of 20,000 gallons per day, refers to evaporators which were entirely prospective and have never been installed. Similarly, Line 9, listing process code T04 and a capacity of 100 tons per hour, refers to the prospective solidifier that was never installed.

From the preceding discussion it can be seen that the process units that formed the basis for the Part A application no longer exist, were never installed or do not involve the handling of hazardous waste. The remaining units are used to process zinc oxide, which is not a hazardous waste within the regulatory definition.

3. The Status of Zinc Oxide

It is Chemetco's position that the zinc oxide in inventory is not a waste and is therefore not subject to regulation under Subtitle C of RCRA. The zinc oxide is the primary product of Chemetco's zinc oxide production unit. As such it does not constitute garbage, refuse or sludge. Nor is it a by-product, discarded material, or a material that has served its purpose. The zinc oxide is thus classified as

"other" and not subject to regulation because it is not within the regulatory definition of "solid waste." 40 C.F.R. §261.2(a)(1).

Even if the zinc oxide were considered a solid waste, it is nevertheless not subject to regulatory permit requirements. The zinc oxide will be reclaimed by Chemetco itself or by other metals reclaimers. By-products having a characteristic of hazardous waste are not solid wastes when they are reclaimed. 40 C.F.R. §261.2(c)(3) and Table 1. No part of the stored zinc oxide will be used in a manner constituting disposal that would bring it within the definition of solid waste. §261.2(c)(1).

Current production of zinc oxide is sold to Exmet for reclamation. Exmet uses the zinc oxide to produce zinc chemicals for use in fertilizer production. None of the zinc oxide used in this way will be stored by Chemetco for more than 90 days, however, and as a consequence, Chemetco is not required to obtain a RCRA treatment, storage or disposal facility permit or to have interim status. §262.34(a).

Because the zinc oxide is not a by-product the material is not a solid waste, even though it arguably may meet the definition of a material "accumulated speculatively" merely because less than 75 percent of the amount accumulated has not been recycled in the calendar year. There is good reason for low sales levels. A depressed world market for zinc severely limited opportunities for sales of the material. As a

consequence Chemetco estimates that approximately 45,000 tons of zinc oxide have been accumulated.

At the present time there are significantly better opportunities to market the zinc oxide. Chemetco's agreement with Exmet calls for Exmet to purchase all of Chemetco's current production of zinc oxide amounting to approximately 350 tons per month. In addition, sales to John Goldschmidt, Ltd. and other European customers are expected to reduce the accumulated zinc oxide pile by 800 tons per month. Chemetco's own reclamation efforts will further reduce the present inventory.

Chemetco has also taken important precautions to prevent loss of the material or environmental contamination during the time that will elapse before all of the accumulated zinc oxide can be sold. Among these steps are the building of the concrete-lined storage bunker, installation of runoff and run-on control systems and reduction of loss of the material to wind.

Chemetco has made a sufficient showing to obtain a determination that the zinc oxide is not a hazardous waste under 40 C.F.R. §260.31(a). Recycling is likely to occur since buyers have made commitments to take the zinc oxide and a significant reduction in the amount stored is expected in the next year. §260.31(a)(1). Sufficient reason for the accumulation has been shown. §260.31(a)(2). No significant additional accumulation is expected before recycling since

current production is being sold and removed. §260.31(a)(3). In addition, Chemetco has instituted significant measures to minimize loss of the materials. §260.31(a)(4). The requested variance should therefore be granted. Granting of the variance would obviate the need for a permit or interim status with respect to Chemetco's zinc oxide production.

4. The Status of Slag

Some concern has also been expressed by IEPA concerning the slag pile which contains the by-product of the secondary smelting process. Chemetco believes that the slag is not a hazardous waste because it is not hazardous. A sophisticated sampling and testing program designed with the assistance of Professors Elliot and Levin of Southern Illinois University at Edwardsville demonstrated with a high degree of confidence that the slag is not EP toxic.

Chemetco proposes that it be allowed to sell the slag for use in highway construction. In this application the slag would serve as an effective embankment material. When used as construction aggregate the slag would be placed underground and covered with soil which constitutes the remainder of the road embankment. A concrete slab forming the road surface will serve to cap the buried aggregate.

Used in this way, the slag will not be exposed to those factors that are intended to be simulated by the EP toxicity test. The slag would not be subjected to the usual landfill conditions that might cause leaching of the toxic

substances. Rigid application of the EP toxicity test is therefore inappropriate.

Even if it is assumed that the slag is hazardous it would not constitute solid waste as defined in the regulations when recycled for use as construction aggregate. Materials are not solid wastes when they are recycled through use as effective substitutes for commercial products. §261.2(e)(1)(ii). The slag would constitute an effective substitute for the commercial limestone that would otherwise be used for this purpose. Slag sold for this use would thus not constitute a solid waste under the regulations.

Similar reasoning applies to Chemetco's proposal to sell granulated slag and the finer particles removed by washing for use as coating for asphalt shingles and as abrasive grit. In this application the slag would similarly be used as an effective and indeed superior substitute for commercial products. §261.2(e)(1)(ii).

In summary, the slag is not hazardous and consequently is not a hazardous waste. Nor does the slag constitute a solid waste, since the proposed uses of the slag do not bring the material within the regulatory definition of a solid waste. Accordingly, the slag is not subject to RCRA regulation and no permit or interim status is required.

0069W

Please print or type in the unshaded areas only
(fill—in areas are spaced for elite type, i.e., 12 characters/inch).

Form Approved OMB No. 158-R0175

FORM 1 GENERAL

EPA

U.S. ENVIRONMENTAL PROTECTION AGENCY

GENERAL INFORMATION

Consolidated Permits Program

(Read the "General Instructions" before starting.)

I. EPA I.D. NUMBER

F I L D 0 4 8 8 4 3 8 0 9 D

LABEL ITEMS

I. EPA I.D. NUMBER

III. FACILITY NAME

V. FACILITY MAILING ADDRESS

VI. FACILITY LOCATION

PLEASE PLACE LABEL IN THIS SPACE

GENERAL INSTRUCTIONS

If a preprinted label has been provided, affix it in the designated space. Review the information carefully; if any of it is incorrect, cross through it and enter the correct data in the appropriate fill—in area below. Also, if any of the preprinted data is absent *(the area to the left of the label space lists the information that should appear)*, please provide it in the proper fill—in area(s) below. If the label is complete and correct, you need not complete Items I, III, V, and VI *(except VI-B which must be completed regardless)*. Complete all Items if no label has been provided. Refer to the instructions for detailed item descriptions and for the legal authorizations under which this data is collected.

II. POLLUTANT CHARACTERISTICS

INSTRUCTIONS: Complete A through J to determine whether you need to submit any permit application forms to the EPA. If you answer "yes" to any questions, you must submit this form and the supplemental form listed in the parenthesis following the question. Mark "X" in the box in the third column if the supplemental form is attached. If you answer "no" to each question, you need not submit any of these forms. You may answer "no" if your activity is excluded from permit requirements; see Section C of the instructions. See also, Section D of the instructions for definitions of bold—faced terms.

SPECIFIC QUESTIONS	MARK 'X' YES	MARK 'X' NO	MARK 'X' FORM ATTACHED	SPECIFIC QUESTIONS	MARK 'X' YES	MARK 'X' NO	MARK 'X' FORM ATTACHED
A. Is this facility a **publicly owned treatment works** which results in a **discharge** to waters of the U.S.? (FORM 2A)		X		B. Does or will this facility *(either existing or proposed)* include a **concentrated animal feeding operation** or **aquatic animal production facility** which results in a **discharge** to waters of the U.S.? (FORM 2B)		X	
C. Is this a facility which currently results in discharges to waters of the U.S. other than those described in A or B above? (FORM 2C)		X		D. Is this a proposed facility *(other than those described in A or B above)* which will result in a discharge to waters of the U.S.? (FORM 2D)		X	
E. Does or will this facility treat, store, or dispose of **hazardous wastes**? (FORM 3)	X			F. Do you or will you inject at this facility industrial or municipal effluent below the lowermost stratum containing, within one quarter mile of the well bore, underground sources of drinking water? (FORM 4)		X	
G. Do you or will you inject at this facility any produced water or other fluids which are brought to the surface in connection with conventional oil or natural gas production, inject fluids used for enhanced recovery of oil or natural gas, or inject fluids for storage of liquid hydrocarbons? (FORM 4)		X		H. Do you or will you inject at this facility fluids for special processes such as mining of sulfur by the Frasch process, solution mining of minerals, in situ combustion of fossil fuel, or recovery of geothermal energy? (FORM 4)		X	
I. Is this facility a proposed stationary source which is one of the 28 industrial categories listed in the instructions and which will potentially emit 100 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)				J. Is this facility a proposed stationary source which is NOT one of the 28 industrial categories listed in the instructions and which will potentially emit 250 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)			

III. NAME OF FACILITY

1 SKIP C H E M E T C O , I N C .

IV. FACILITY CONTACT

A. NAME & TITLE *(last, first, & title)*	B. PHONE *(area code & no.)*
2 M c K E L L , J O E L P L A N T E N G I N E E R	6 1 8 2 5 4 4 3 8 1

V. FACILITY MAILING ADDRESS

A. STREET OR P.O. BOX

3 P . O . B O X 1 8 7

B. CITY OR TOWN	C. STATE	D. ZIP CODE
4 A L T O N	I L	6 2 0 0 2

VI. FACILITY LOCATION

A. STREET, ROUTE NUMBER, OR OTHER SPECIFIC IDENTIFIER

5 R O U T E 1 , B O X 1 0 0 0 , E M E R A L D R O A D

B. STATE	C. ZIP CODE	D. COUNTY CODE (if known)
I L	6 2 0 4 8	

CONTINUED FROM THE FRONT

VII. SIC CODES (4-digit, in order of priority)

A. FIRST	B. SECOND
7 3144 (specify) Secondary Copper Smelter	7 (specify)
C. THIRD	**D. FOURTH**
7 (specify)	7 (specify)

VIII. OPERATOR INFORMATION

A. NAME: 8 CHEMETCO, INC.

B. Is the name listed in Item VIII-A also the owner? ☐ YES ☒ NO

C. STATUS OF OPERATOR (Enter the appropriate letter into the answer box; if "Other", specify.)
F = FEDERAL
S = STATE
P = PRIVATE
M = PUBLIC (other than federal or state)
O = OTHER (specify)

P (specify)

D. PHONE (area code & no.): A 618 254 4381

E. STREET OR P.O. BOX: P.O. BOX 187

F. CITY OR TOWN: 8 ALTON

G. STATE: IL

H. ZIP CODE: 62002

IX. INDIAN LAND

Is the facility located on Indian lands? ☐ YES ☒ NO

X. EXISTING ENVIRONMENTAL PERMITS

A. NPDES (Discharges to Surface Water): 9 N L0025747	D. PSD (Air Emissions from Proposed Sources): 9 P
B. UIC (Underground Injection of Fluids): 9 U	E. OTHER (specify): 9 119801 (specify) Air Permit (Construciton)
C. RCRA (Hazardous Wastes)	E. OTHER (specify): 9 (specify)

XI. MAP

Attach to this application a topographic map of the area extending to at least one mile beyond property bounderies. The map must show the outline of the facility, the location of each of its existing and proposed intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all springs, rivers and other surface water bodies in the map area. See instructions for precise requirements.

XII. NATURE OF BUSINESS (provide a brief description)

XIII. CERTIFICATION (see instructions)

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME & OFFICIAL TITLE (type or print)	B. SIGNATURE	C. DATE SIGNED
Thomas G. McRaven, Treasurer	Thomas G. McRaven	November 7, 1985

COMMENTS FOR OFFICIAL USE ONLY

Please print or type in the unshaded areas only
(fill-in areas are spaced for elite type, i.e., 12 characters/inch).

Form Approved OMB No. 158-S80004

FORM 3 RCRA

EPA

U.S. ENVIRONMENTAL PROTECTION AGENCY

HAZARDOUS WASTE PERMIT APPLICATION

Consolidated Permits Program

(This information is required under Section 3005 of RCRA.)

I. EPA I.D. NUMBER

F L D 0 4 8 4 3 5 0 9 1

OFFICIAL USE ONLY

APPLICATION APPROVED	DATE RECEIVED (yr., mo., & day)	COMMENTS

II. FIRST OR REVISED APPLICATION

Place an "X" in the appropriate box in A or B below (mark one box only) to indicate whether this is the first application you are submitting for your facility or a revised application. If this is your first application and you already know your facility's EPA I.D. Number, or if this is a revised application, enter your facility's EPA I.D. Number in Item I above.

A. FIRST APPLICATION *(place an "X" below and provide the appropriate date)*

[X] 1. EXISTING FACILITY *(See instructions for definition of "existing" facility. Complete item below.)*

FOR EXISTING FACILITIES, PROVIDE THE DATE *(yr., mo., & day)* OPERATION BEGAN OR THE DATE CONSTRUCTION COMMENCED *(use the boxes to the left)*

C	YR.	MO.	DAY
8	6 9	0 6	0 1

[ ] 2. NEW FACILITY *(Complete item below.)*

FOR NEW FACILITIES, PROVIDE THE DATE *(yr., mo., & day)* OPERATION BEGAN OR IS EXPECTED TO BEGIN

YR.	MO.	DAY

B. REVISED APPLICATION *(place an "X" below and complete Item I above)*

[X] 1. FACILITY HAS INTERIM STATUS

[ ] 2. FACILITY HAS A RCRA PERMIT

III. PROCESSES – CODES AND DESIGN CAPACITIES

A. PROCESS CODE – Enter the code from the list of process codes below that best describes each process to be used at the facility. Ten lines are provided for entering codes. If more lines are needed, enter the code(s) in the space provided. If a process will be used that is not included in the list of codes below, then describe the process *(including its design capacity)* in the space provided on the form *(Item III-C)*.

B. PROCESS DESIGN CAPACITY – For each code entered in column A enter the capacity of the process.

1. AMOUNT – Enter the amount.
2. UNIT OF MEASURE – For each amount entered in column B(1), enter the code from the list of unit measure codes below that describes the unit of measure used. Only the units of measure that are listed below should be used.

PROCESS	PROCESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
Storage:		
CONTAINER *(barrel, drum, etc.)*	S01	GALLONS OR LITERS
TANK	S02	GALLONS OR LITERS
WASTE PILE	S03	CUBIC YARDS OR CUBIC METERS
SURFACE IMPOUNDMENT	S04	GALLONS OR LITERS
Disposal:		
INJECTION WELL	D79	GALLONS OR LITERS
LANDFILL	D80	ACRE-FEET *(the volume that would cover one acre to a depth of one foot)* OR HECTARE-METER
LAND APPLICATION	D81	ACRES OR HECTARES
OCEAN DISPOSAL	D82	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	D83	GALLONS OR LITERS

PROCESS	PROCESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
Treatment:		
TANK	T01	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	T02	GALLONS PER DAY OR LITERS PER DAY
INCINERATOR	T03	TONS PER HOUR OR METRIC TONS PER HOUR OR GALLONS PER HOUR OR LITERS PER HOUR
OTHER *(Use for physical, chemical, thermal or biological treatment processes not occurring in tanks, surface impoundments or incinerators. Describe the processes in the space provided; Item III-C.)*	T04	GALLONS PER DAY OR LITERS PER DAY

UNIT OF MEASURE	UNIT OF MEASURE CODE	UNIT OF MEASURE	UNIT OF MEASURE CODE	UNIT OF MEASURE	UNIT OF MEASURE CODE
GALLONS	G	LITERS PER DAY	V	ACRE-FEET	A
LITERS	L	TONS PER HOUR	D	HECTARE-METER	F
CUBIC YARDS	Y	METRIC TONS PER HOUR	W	ACRES	B
CUBIC METERS	C	GALLONS PER HOUR	E	HECTARES	Q
GALLONS PER DAY	U	LITERS PER HOUR	H		

EXAMPLE FOR COMPLETING ITEM III *(shown in line numbers X-1 and X-2 below)*: A facility has two storage tanks, one tank can hold 200 gallons and the other can hold 400 gallons. The facility also has an incinerator that can burn up to 20 gallons per hour.

C DUP T/A C 1

LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT (specify)	B. PROCESS DESIGN CAPACITY 2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY	LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT	B. PROCESS DESIGN CAPACITY 2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY
X-1	S 0 2	600	G		5	T 0 1	576,000	U	
X-2	T 0 3	20	E		6	T 0 2	576,000	U	
1	S 0 1	2,000	Y		7	T 0 4	100	D	
2	S 0 2	700,000	G		8	T 0 4	20,000	U	
3	S 0 3	1,000	Y		9	T 0 4	100	D	
4	S 0 4	3,000,000	G		10				

Continued from the front.

III. PROCESSES *(continued)*

C. SPACE FOR ADDITIONAL PROCESS CODES OR FOR DESCRIBING OTHER PROCESSES *(code "T04")*. FOR EACH PROCESS ENTERED HERE INCLUDE DESIGN CAPACITY.

OTHER PROCESSES

Line # 7 - T04 - Belt Filter, Plate filter, Centrifuge

Line # 8 - T04 - Evaporators

Line # 9 - T04 - Solidifier

IV. DESCRIPTION OF HAZARDOUS WASTES

A. EPA HAZARDOUS WASTE NUMBER — Enter the four—digit number from 40 CFR, Subpart D for each listed hazardous waste you will handle. If you handle hazardous wastes which are not listed in 40 CFR, Subpart D, enter the four—digit number*(s)* from 40 CFR, Subpart C that describes the characteristics and/or the toxic contaminants of those hazardous wastes.

B. ESTIMATED ANNUAL QUANTITY — For each listed waste entered in column A estimate the quantity of that waste that will be handled on an annual basis. For each characteristic or toxic contaminant entered in column A estimate the total annual quantity of all the non—listed waste*(s)* that will be handled which possess that characteristic or contaminant.

C. UNIT OF MEASURE — For each quantity entered in column B enter the unit of measure code. Units of measure which must be used and the appropriate codes are:

ENGLISH UNIT OF MEASURE	CODE	METRIC UNIT OF MEASURE	CODE
POUNDS	P	KILOGRAMS	K
TONS	T	METRIC TONS	M

If facility records use any other unit of measure for quantity, the units of measure must be converted into one of the required units of measure taking into account the appropriate density or specific gravity of the waste.

D. PROCESSES

1. PROCESS CODES:
   For listed hazardous waste: For each listed hazardous waste entered in column A select the code*(s)* from the list of process codes contained in Item III to indicate how the waste will be stored, treated, and/or disposed of at the facility.
   For non—listed hazardous wastes: For each characteristic or toxic contaminant entered in column A, select the code*(s)* from the list of process codes contained in Item III to indicate all the processes that will be used to store, treat, and/or dispose of all the non—listed hazardous wastes that possess that characteristic or toxic contaminant.
   Note: Four spaces are provided for entering process codes. If more are needed: (1) Enter the first three as described above; (2) Enter "000" in the extreme right box of Item IV-D(1); and (3) Enter in the space provided on page 4, the line number and the additional code*(s)*.

2. PROCESS DESCRIPTION: If a code is not listed for a process that will be used, describe the process in the space provided on the form.

NOTE: HAZARDOUS WASTES DESCRIBED BY MORE THAN ONE EPA HAZARDOUS WASTE NUMBER — Hazardous wastes that can be described by more than one EPA Hazardous Waste Number shall be described on the form as follows:

1. Select one of the EPA Hazardous Waste Numbers and enter it in column A. On the same line complete columns B,C, and D by estimating the total annual quantity of the waste and describing all the processes to be used to treat, store, and/or dispose of the waste.
2. In column A of the next line enter the other EPA Hazardous Waste Number that can be used to describe the waste. In column D(2) on that line enter "included with above" and make no other entries on that line.
3. Repeat step 2 for each other EPA Hazardous Waste Number that can be used to describe the hazardous waste.

EXAMPLE FOR COMPLETING ITEM IV *(shown in line numbers X-1, X-2, X-3, and X-4 below)* — A facility will treat and dispose of an estimated 900 pounds per year of chrome shavings from leather tanning and finishing operation. In addition, the facility will treat and dispose of three non—listed wastes. Two wastes are corrosive only and there will be an estimated 200 pounds per year of each waste. The other waste is corrosive and ignitable and there will be an estimated 100 pounds per year of that waste. Treatment will be in an incinerator and disposal will be in a landfill.

LINE NO.	A. EPA HAZARD. WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)	D. PROCESSES 2. PROCESS DESCRIPTION (If a code is not entered in D(1))
X-1	K054	900	P	T03 D80	
X-2	D002	400	P	T03 D80	
X-3	D001	100	P	T03 D80	
X-4	D002				*Included with above*

CONTINUE ON PAGE 3

Continued from page 2.
NOTE: Photocopy this page before completing if you have more than 26 wastes to list.

Form Approved OMB No. 158-S80004

EPA I.D. NUMBER (enter from page 1)	FOR OFFICIAL USE ONLY
W I L D 0 4 8 8 4 3 8 0 9 — C: 1	W DUP — C: 2 DUP

DESCRIPTION OF HAZARDOUS WASTES (continued)

LINE NO.	A. EPA HAZARD. WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)	D. PROCESSES 2. PROCESS DESCRIPTION (If a code is not entered in D(1))
1	D006			S01 S03 S04 T04	
2	D008				included with above
3	D011				included with above
4	D006			S01 S02 S04 000	
5	D008				included with above
6	D002			S01 S02 T01 T04	
7	D006				included with above
8	D008				included with above
9	D004			S01 S03 T01 T02	
10	D006				included with above
11	D008				included with above
	D011				included with above
13	D001			S01	
14	F003				included with above
15	F004				included with above
16	F005				included with above
17	F001			S01	
18	F002				included with above
19	D006			S01 S02 S03 000	
20	D007				included with above
21	D008				included with above
22	D010				included with above
23	D011				included with above
24					
26					

EPA Form 3510-3 (6-80)

CONTINUE ON REVERSE

Continued from the front.

IV. DESCRIPTION OF HAZARDOUS WASTES *(continued)*

E. USE THIS SPACE TO LIST ADDITIONAL PROCESS CODES FROM ITEM D(1) ON PAGE 3.

4. T01, T02, T04 (plate and belt presses)

9. S04, T01, T02, T04 (plate and belt presses)

EPA I.D. NO. *(enter from page 1)*

F 6

V. FACILITY DRAWING

All existing facilities must include in the space provided on page 5 a scale drawing of the facility *(see instructions for more detail).*

VI. PHOTOGRAPHS

All existing facilities must include photographs *(aerial or ground—level)* that clearly delineate all existing structures; existing storage, treatment and disposal areas; and sites of future storage, treatment or disposal areas *(see instructions for more detail).*

VII. FACILITY GEOGRAPHIC LOCATION

LATITUDE *(degrees, minutes, & seconds)*	LONGITUDE *(degrees, minutes, & seconds)*

VIII. FACILITY OWNER

☐ A. If the facility owner is also the facility operator as listed in Section VIII on Form 1, "General Information", place an "X" in the box to the left and skip to Section IX below.

B. If the facility owner is not the facility operator as listed in Section VIII on Form 1, complete the following items:

1. NAME OF FACILITY'S LEGAL OWNER	2. PHONE NO. *(area code & no.)*
E	

3. STREET OR P.O. BOX	4. CITY OR TOWN	5. ST.	6. ZIP CODE
F	G		

IX. OWNER CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME *(print or type)*	B. SIGNATURE	C. DATE SIGNED
Thomas G. McRaven	Thomas G. McRaven	Nov 7 1985

X. OPERATOR CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME *(print or type)*	B. SIGNATURE	C. DATE SIGNED
Thomas G. McRaven	Thomas G. McRaven	Nov 7 1985

CONTINUE ON PAGE 5

Continued from page 2.
NOTE: Photocopy this page before completing if you have more than 26 wastes to list.

Form Approved OMB No. 158-S80004

EPA I.D. NUMBER (enter from page 1)	FOR OFFICIAL USE ONLY
W I L D 0 4 8 8 4 3 8 0 9 T/A C 1	W DUP T/A C 2 DUP

. DESCRIPTION OF HAZARDOUS WASTES (continued)

LINE NO.	A. EPA HAZARD. WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)	D. PROCESSES 2. PROCESS DESCRIPTION (If a code is not entered in D(1))
1	D002			S01 S02 T02	
2	D004				included with above
3	D005				included with above
4	D006				included with above
5	D008				included with above
6	D010				included with above
7	D004			S01 S02 S04 000	
8	D005				included with above
9	D006				included with above
10	D008				included with above
11	D010				included with above
12	D011				included with above
13	D002			S01 S02 T01 T04	
14	D004				included with above
15	D005				included with above
16	D006				included with above
17	D008				included with above
18	D010				included with above
19	D011				included with above
20	D006			S01 S03 T01 T04	
21					
22					
23					
24					
25					
26					

EPA Form 3510-3 (6-80)

CONTINUE ON REVERSE

Continued from the front.

IV. DESCRIPTION OF HAZARDOUS WASTES *(continued)*

E. USE THIS SPACE TO LIST ADDITIONAL PROCESS CODES FROM ITEM D(1) ON PAGE 3.

7. T01, T04 (plate and belt filter presses)

EPA I.D. NO. *(enter from page 1)*

F 6

V. FACILITY DRAWING

All existing facilities must include in the space provided on page 5 a scale drawing of the facility *(see instructions for more detail).*

VI. PHOTOGRAPHS

All existing facilities must include photographs *(aerial or ground—level)* that clearly delineate all existing structures; existing storage, treatment and disposal areas; and sites of future storage, treatment or disposal areas *(see instructions for more detail).*

VII. FACILITY GEOGRAPHIC LOCATION

LATITUDE *(degrees, minutes, & seconds)*	LONGITUDE *(degrees, minutes, & seconds)*

VIII. FACILITY OWNER

☐ A. If the facility owner is also the facility operator as listed in Section VIII on Form 1, "General Information", place an "X" in the box to the left and skip to Section IX below.

B. If the facility owner is not the facility operator as listed in Section VIII on Form 1, complete the following items:

1. NAME OF FACILITY'S LEGAL OWNER	2. PHONE NO. *(area code & no.)*
E	

3. STREET OR P.O. BOX	4. CITY OR TOWN	5. ST.	6. ZIP CODE
F	G		

IX. OWNER CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME *(print or type)*	B. SIGNATURE	C. DATE SIGNED
Thomas G. McRaven	Thomas G. McRaven	Nov 7 1985

X. OPERATOR CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME *(print or type)*	B. SIGNATURE	C. DATE SIGNED
Thomas G. McRaven	Thomas G. McRaven	Nov 7 1985

 CONTINUE ON PAGE 5

Continued from page 2.
NOTE: Photocopy this page before completing if you have more than 26 wastes to list.

Form Approved OMB No. 158-S80004

EPA I.D. NUMBER (enter from page 1)	FOR OFFICIAL USE ONLY
W I L D 0 4 8 8 4 3 8 0 9 — T/A C: 1	W DUP — T/A C: 2 DUP

DESCRIPTION OF HAZARDOUS WASTES (continued)

LINE NO.	A. EPA HAZARD. WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)	D. PROCESSES 2. PROCESS DESCRIPTION (If a code is not entered in D(1))
1	D004			S01 S03 T01 T02	
2	D005				included with above
3	D006				included with above
4	D008				included with above
5	D010				included with above
6	D011				included with above
7	D004			S01 S02 T01 T04	
8	D005				included with above
9	D006				included with above
10	D007				included with above
11	D008				included with above
12	D010				included with above
13	D011				included with above
14					
15					
16					
17					
18					
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22					
23					
24					
25					
26					

EPA Form 3510-3 (6-80)

CONTINUE ON REVERSE

Continued from the front.

IV. DESCRIPTION OF HAZARDOUS WASTES *(continued)*

E. USE THIS SPACE TO LIST ADDITIONAL PROCESS CODES FROM ITEM D(1) ON PAGE 3.

EPA I.D. NO. *(enter from page 1)*

F I L D 0 4 8 8 4 3 8 0 9 T/N 6

V. FACILITY DRAWING

All existing facilities must include in the space provided on page 5 a scale drawing of the facility *(see instructions for more detail).*

VI. PHOTOGRAPHS

All existing facilities must include photographs *(aerial or ground—level)* that clearly delineate all existing structures; existing storage, treatment and disposal areas; and sites of future storage, treatment or disposal areas *(see instructions for more detail).*

FACILITY GEOGRAPHIC LOCATION

LATITUDE *(degrees, minutes, & seconds)*	LONGITUDE *(degrees, minutes, & seconds)*

VIII. FACILITY OWNER

☐ A. If the facility owner is also the facility operator as listed in Section VIII on Form 1, "General Information", place an "X" in the box to the left and skip to Section IX below.

B. If the facility owner is not the facility operator as listed in Section VIII on Form 1, complete the following items:

1. NAME OF FACILITY'S LEGAL OWNER	2. PHONE NO. *(area code & no.)*
E CHEMETCO, INC.	6 1 8 - 2 5 4 - 4 3 8 1

3. STREET OR P.O. BOX	4. CITY OR TOWN	5. ST.	6. ZIP CODE
F P. O. Box 187	G Alton	I L	6 2 0 0 2

IX. OWNER CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME *(print or type)*	B. SIGNATURE	C. DATE SIGNED
Thomas G. McRaven	Thomas G. McRaven	Nov 7 1985

X. OPERATOR CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

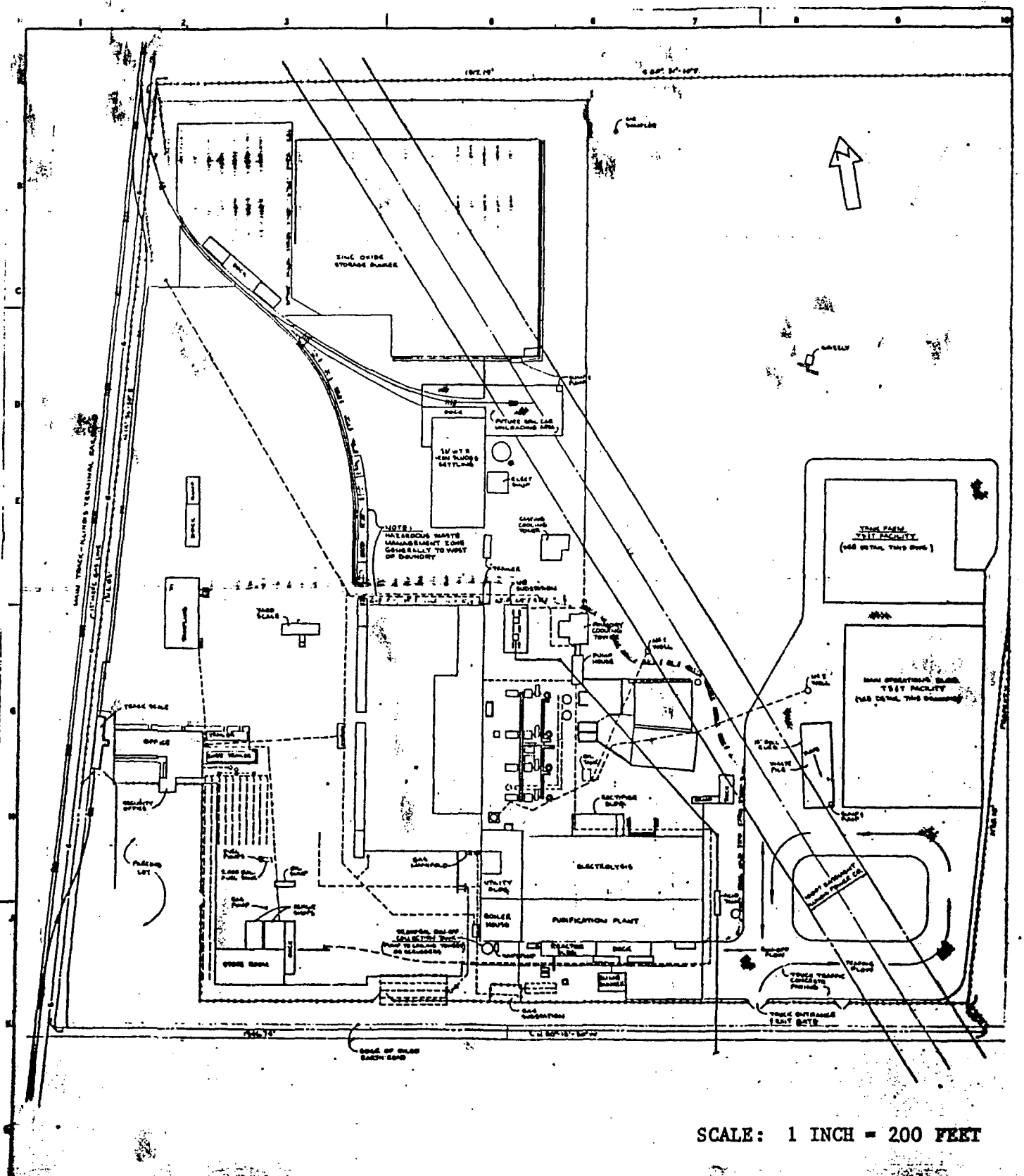
A. NAME *(print or type)*	B. SIGNATURE	C. DATE SIGNED
Thomas G. McRaven	Thomas G. McRaven	Nov 7 1985

 CONTINUE ON PAGE 5

Continued from page 4.

Form Approved OMB No. 158-S80004

V. FACILITY DRAWING *(see page 4)*



SCALE: 1 INCH = 200 FEET

CHEMETCO INC.
HARTFORD, IL.

II. SLAG MANAGEMENT

Chemetco generates approximately 217 tons per day of an iron faylite material called "slag" from its copper smelting operation. This product is a hard, dense material, which if produced by the "Slow Cool" method, generates a material with the second physical properties that will allow it to function as an economical construction and roadbuilding material.

Slag is sampled and analyzed, during routine process control, on a per batch basis, approximately 9 times per day. An example of the chemical analyses performed is shown in Exhibit A. The sampling procedure is shown in Exhibit B.

Once each week a comprehensive composite sample is taken from the process cooling area for additional analysis. The sampling procedure is explained in Exhibit C. The analytic methods are explained in Exhibit D, and the laboratory quality control methods are explained in Exhibit E.

Product inventories are controlled, daily by the production supervisor (Exhibit A), and on an annual basis by an aerial photogrammetric survey. From this survey 2 sets of volume determinations are made using 2 different ground control offsets to verify accuracy. See Exhibit F.

October 26, 1986

A. Current and Future Slag Production

Chemetco has entered into a contract with Southern Agri-Minerals Corporation of Hartford, Alabama, for the purchase of all of the slag produced at the Chemetco plant. Southern has agreed to purchase all of the slag in the form of granules. Delivery of the slag to Southern will begin as soon as the necessary processing equipment and units have been installed or constructed.

The slag granules will be used as granules for asphalt roofing shingles and also as abrasive grit. Copper slag granules are desireable for roofing applications because they are more dense (higher specific gravity) than granules from coal-fired boilers and therefore make a heavier, superior shingle. Copper slag granules are desireable as abrasive grit because of the absence of free silica.

When the production of granulated slag begins, the process will be carried out in the following manner. Molten slag will be removed from the foundry in 450 cubic foot pots carried by the Kress Slag Hauler.

The Kress will back into position at the granulation station. The Kress operator will tilt the pot by means of the hydraulic cylinders on the Kress. Molten slag will flow from the pot into an intermediate catch box, then overflow the catch box into the granulation trough. The purpose of the catch box is to channel the molten slag into a narrow stream (approximately 6 inches wide).

As the molten slag flows into the granulation trough it is granulated and cooled by a high pressure spray (4000 GPM at 60 PSI). This quantity of water is sufficient to cool the liquid slag to below its melting point and the resulting granules of solidified slag are "transported" by an additional 8000 GPMI of water to a holding tank.

After the pot of slag has been poured and granulated, the holding tank will be rapidly drained of water and the slag granules removed by a rubber-tired front-end loader that will drive down into the tank.

The size of the granules produced are controlled by the rate of pouring of the molten slag and the volume of water used in the granulation.

B. Existing Slag Inventory

Chemetco's slag has physical properties that make it a particularly appropriate material for use in the construction of highway embankments. This has been confirmed in a recent letter from the Illinois Department of Transportation to Luhr Bros., Inc., a company engaged in the construction of a portion of Poag Road in Madison County. (See Exhibit G.) Inquiries concerning the use of Chemetco's slag in highway construction also have been received from companies that will be engaged in the nearby construction work on Interstate 255.

Approval to use Chemetco's slag in these highway construction applications has been withheld solely on the

grounds that the slag is considered to be a hazardous waste product by IEPA. Yet a comprehensive testing program carried out by Chemetco (see Exhibit H) and confirmed by a laboratory designated by USEPA Region 5 shows that Chemetco's slag is not toxic under the EP Toxicity test.

Moreover, neither IEPA nor USEPA regulations should preclude the use of Chemetco's slag as an embankment material in highway construction even if it were "a hazardous waste product" because it would pose no significant risk to human health or the environment. Accordingly, Chemetco respectfully requests and petitions IEPA to withdraw its objection to this use of Chemetco's slag.

WORKSTATION 14 - USER JOE - MCKELL, JOEL 228MC

8:59:21 AM SATURDAY OCTOBER 25, 1986

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****          1         2         3         4         5         6         7         8 ****
**** 12345678901234567890123456789012345678901234567890123456789012345678901234567890 ****
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*  *                                                                                  *  *
* 1*                                SLAG ANALYSIS REPORT                               * 1*
* 2*                                                                                  * 2*
* 3*    DATE  F HEAT FRM WEIGHT TEMP   CU    FE    PE    SN    ZN   SIO2  CAO  AL2O3  * 3*
* 4*    80186 3  531 RON 100000        .12 37.06   .53   .21  6.38 28.52  5.10  1.39  * 4*
* 5*    80186 1  498 JRT 140000 1900   .14 34.36  1.68   .21  7.00 27.60  3.56  5.45  * 5*
* 6*    80186 3  534 CLE 120000 2000   .25 39.40   .87   .14  5.28 26.98  3.15  3.05  * 6*
* 7*    80186 4  754 CLE  70000 2100   .45 31.54   .57   .14  5.40 27.67  4.50  6.58  * 7*
* 8*    80186 3  536 RON 100000        .16 41.56   .78   .26  2.96 27.80  5.72  2.03  * 8*
* 9*    80286 1  500 RON  70000        .42 28.03   .43   .14  8.09 29.52  4.17 10.28  * 9*
*10*    80286 2  668 RON  70000        .55 30.69   .55   .15  6.74 27.65  3.31  7.25  *10*
* 1*    80286 1  501 RON  70000        .69 31.94   .34   .09  4.54 29.55  3.81 12.61  * 1*
* 2*    80286 2  669 RON  70000        .68 26.56   .38   .14  6.59 30.79  4.50 15.62  * 2*
* 3*    80286 3  538 BWH 140000        .12 35.55   .69   .15  4.86 30.35  5.25  2.49  * 3*
* 4*    80286 2  670 BWH  70000        .28 32.29   .43   .12  5.55 28.52  3.91  9.51  * 4*
* 5*    80286 1  502 BWH  70000        .47 32.89   .18   .10  6.17 27.84  4.42 11.64  * 5*
* 6*    80286 1  503 CLE 140000 2000   .55 25.01   .73   .21  6.80 27.39  2.84  7.87  * 6*
* 7*    80286 2  672 CLE  50000 2150   .89 27.09  1.24   .62  7.75 37.29  2.43  3.65  * 7*
* 8*    80286 3  540 CLE 140000 2000   .19 38.20   .63   .19  5.84 24.79  3.53  1.66  * 8*
* 9*    80286 1  504 JRT  60000 1800   .55 28.04   .60   .22  8.42 27.59  3.50  6.42  * 9*
*20*    80386 1  505 JRT  45000 1800   .29 28.75  1.89   .29 13.70 25.63  4.83  1.66  *20*
* 1*    80386 3  542 RRL 150000 2100   .13 35.65   .72   .11  5.54 30.76  4.47  1.20  * 1*
* 2*                                                                                  * 2*
* 3*   WEIGHTED AVG     1675000        .33 33.36   .75   .18  6.18 28.47  4.06  5.45  * 3*
* 4*                                PRESS ENTER TO PAGE                               * 4*
*  *                                                                                  *  *
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****          1         2         3         4         5         6         7         8 ****
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EXHIBIT A

WORKSTATION 14 - USER JOE - MCKELL, JOEL 228MC

8:59:34 AM SATURDAY OCTOBER 25, 1986

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****          1         2         3         4         5         6         7         8 ****
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*  *                                                                                *  *
* 1*                                SLAG ANALYSIS REPORT                            * 1*
* 2*                                                                                * 2*
* 3*    DATE  F HEAT FRM WEIGHT TEMP   CL    FE    PE    SN    ZN   SIO2  CAO  AL2O3  * 3*
* 4*    80386 2  674 RRL  70000 2100   .43 30.35  1.01   .16  8.76 26.74  3.77  5.72  * 4*
* 5*    80386 1  507 RRL 140000 2100   .08 39.44   .43   .06  5.03 29.93  4.33  2.10  * 5*
* 6*    80386 2  675 RRL  60000 2100   .42 35.67   .30   .12  5.96 26.20  4.04  5.49  * 6*
* 7*    80386 2  676 CLE  70000 2100   .48 31.25   .46   .14  6.98 28.89  4.46  9.74  * 7*
* 8*    80386 2  677 CLE  80000 2100   .59 23.99   .54   .21  6.24 21.79  3.36  3.80  * 8*
* 9*    80486 3  545 JRT 140000 1900   .16 35.47   .74   .18  7.66 26.18  3.98  2.78  * 9*
*10*    80486 1  510 JRT  70000 1800   .27 34.17  1.32   .19  7.03 25.06  3.72  3.94  *10*
* 1*    80486 4  761 RRL  50000 2000   .52 30.02  1.37   .19  9.62 27.73  3.13  6.18  * 1*
* 2*    80486 3  547 RRL 200000 2160   .20 37.25   .89   .17  7.75 25.99  4.82  3.29  * 2*
* 3*    80486 2  679 RRL  50000 2100   .37 33.15   .34   .07  5.11 29.01  4.46  8.63  * 3*
* 4*    80486 1  511 CLE  70000 2000   .62 28.22   .57   .17  7.74 27.19  3.61  6.84  * 4*
* 5*    80486 3  549 CLE 120000 2100   .29 42.28  1.44   .23  5.44 26.18  1.53  2.72  * 5*
* 6*    80486 4  763 JRT 140000 1800   .67 29.90  1.33   .22 11.59 26.53  2.55  3.86  * 6*
* 7*    80586 2  682 JRT  50000 1800   .49 30.75   .80   .31  5.55 28.69  4.14  8.62  * 7*
* 8*    80586 1  513 JRT 140000 1900   .15 40.37   .72   .19  3.69 29.94  3.93  3.51  * 8*
* 9*    80586 2  683 RRL  65000 2100   .38 29.95   .40   .13  6.00 27.23  3.99  9.19  * 9*
*20*    80586 1  514 RRL  60000 2100   .19 36.40   .42   .10  5.25 27.99  3.63  6.58  *20*
* 1*    80586 3  552 RRL 130000 2100   .11 39.91   .47   .06  5.57 24.78  3.72  1.87  * 1*
* 2*                                                                                * 2*
* 3*   WEIGHTED AVG     3380000        .32 34.17   .77   .17  6.48 27.69  3.90  4.94  * 3*
* 4*                                PRESS ENTER TO PAGE                             * 4*
*  *                                                                                *  *
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EXH A

14112 G.B.

WORKSTATION 14 - USER JOE - MCKELL, JOEL 228MC

8:59:42 AM SATURDAY OCTOBER 25, 1986

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*  *                                                                        *  *
* 1*                          SLAG ANALYSIS REPORT                          * 1*
* 2*                                                                        * 2*
* 3*   DATE  F HEAT FRM WEIGHT TEMP   CL    FE    FE    SN    ZN   SIO2  CAO  AL2O3 * 3*
* 4*  80586 1  515 JHM  60000 2060  .57 27.57  .58  .18  5.80 31.50  4.65  8.57 * 4*
* 5*  80586 3  554 JHM 120000 2030  .22 38.17  .54  .18  7.01 24.56  5.13  1.79 * 5*
* 6*  80586 4  766 JRT 100000 1800  .54 28.01  .84  .24  8.16 31.06  4.26  8.25 * 6*
* 7*  80686 1  516 JRT  70000 1800  .55 29.21 1.68  .20  9.52 28.42  3.53  5.53 * 7*
* 8*  80686 1  517 JRT  50000 1800  .68 33.12  .75  .19 12.31 23.70  2.17  2.49 * 8*
* 9*  80686 2  686 CLE  70000 2100  .69 29.64 2.33  .21  8.64 26.63  2.82  6.42 * 9*
*10*  80686 1  520 JHM 120000 2000  .11 42.22  .41  .15  5.84 27.31  4.23  1.99 *10*
* 1*  80786 2  688 JRT  40000 1800  .37 26.50 1.39  .18  8.10 22.82  3.14  3.68 * 1*
* 2*  80786 1  522 JRT 150000 1950  .17 36.53  .33  .17  9.85 26.02  5.22  1.67 * 2*
* 3*  80786 2  689 JRT  60000 1800  .70 26.77  .81  .19  6.92 32.83  3.55  8.92 * 3*
* 4*  80786 1  524 CLE 130000 2100  .08 34.94  .29  .16 10.30 26.88  4.26  2.35 * 4*
* 5*  80786 4  770 CLE 120000 2000  .56 27.41 1.10  .24  6.54 37.25  3.39  7.26 * 5*
* 6*  80886 2  692 RRL 210000 2100  .09 33.72  .68  .14  9.24 25.49  4.53  1.31 * 6*
* 7*  80886 1  526 RRL 120000 2130  .37 34.54 1.08  .15  6.97 24.82  3.64  3.81 * 7*
* 8*  80886 2  693 CLE  70000 2000  .32 24.46  .42  .11  5.84 32.15  5.64  9.88 * 8*
* 9*  80886 2  694 JHM  70000 2010  .51 30.54  .89  .16  7.91 28.50  3.65  8.07 * 9*
*20*  80886 1  528 JHM 130000 1980  .09 36.09  .24  .06  6.71 26.98  6.32  1.16 *20*
* 1*  80886 2  695 JHM  50000 2160  .45 25.24  .29  .10  3.74 36.10  4.89 18.24 * 1*
* 2*                                                                        * 2*
* 3*  WEIGHTED AVG     5120000      .32 33.67  .76  .17  6.96 27.83  4.05  4.81 * 3*
* 4*                          PRESS ENTER TO PAGE                           * 4*
*  *                                                                        *  *
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Exh A

WORKSTATION 14 - USER JOE - MCKELL, JOEL 228MC

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* 2*                                                                         * 2*
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* 4*  80986 1  529 RRL  70000 2000  .25 27.91  .51  .11  8.01 31.72 4.97  8.70 * 4*
* 5*  80986 2  696 RRL  30000 2000  .96 28.69 3.24  .24 10.08 27.41 3.55  3.18 * 5*
* 6*  80986 3    3 RRL 100000 2100  .21 31.86  .59  .17  6.65 30.06 5.08  3.49 * 6*
* 7*  80986 4  774 RRL 100000 2100  .36 36.19 1.44  .16  5.99 27.68 3.25  5.34 * 7*
* 8*  80986 1  530 RRL  50000 2050  .61 24.88  .49  .12  6.25 34.98 4.60 10.19 * 8*
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* 3*  80986 2  699 JHM  70000 2050  .29 27.08 1.24  .23  6.74 32.36 6.37  4.60 * 3*
* 4*  80986 3    7 JHM  80000 2030  .09 30.58  .33  .15  3.97 35.89 6.58  1.52 * 4*
* 5*  80986 2  700 JHM  50000 2050  .26 28.45  .48  .13  5.43 28.12 4.94  6.67 * 5*
* 6*  80986 1  533 RRL  90000 2100  .33 32.92  .91  .16  8.32 27.04 3.84  3.35 * 6*
* 7*  81086 2  701 RRL  50000 2100  .28 30.38  .66  .18  7.51 24.48 3.67  3.58 * 7*
* 8*  81086 3    9 JRT 100000 1900  .07 38.61  .35  .13  3.25 28.18 6.77  1.48 * 8*
* 9*  81086 3   11 JRT  70000 1800  .39 30.32 1.32  .10  6.50 24.09 3.62  4.39 * 9*
*20*  81086 1  535 JRT 130000 1900  .13 37.62  .91  .23  5.81 25.84 4.56   .77 *20*
* 1*  81086 2  703 JHM  70000 2020  .53 28.40  .23  .13  7.60 33.35 4.04  6.02 * 1*
* 2*                                                                         * 2*
* 3*  WEIGHTED AVG     6490000      .32 33.23  .82  .17  6.88 28.14 4.20  4.66 * 3*
* 4*                          PRESS ENTER TO PAGE                            * 4*
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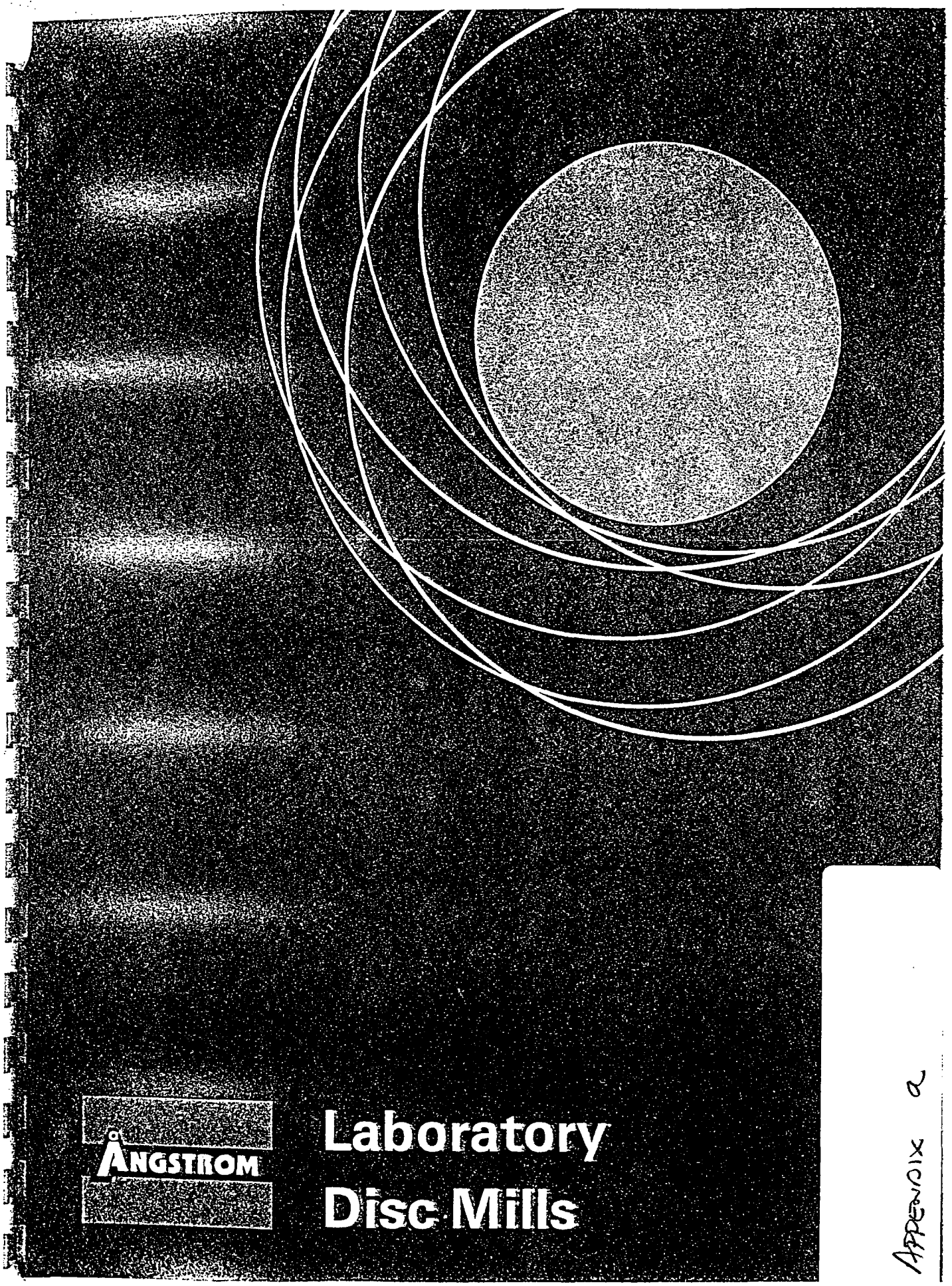


ANGSTROM

Laboratory Disc Mills

APPENDIX a

ÅNGSTROM

OPERATED IN 70 COUNTRIES

FOR THE SIZE REDUCTION OF: ORE

ADVANTAGES:

- Intensive Grinding
- Dust-proof Operation, no pollution of atmosphere, no loss of material
- Considerably shorter grinding time as compared with other processes
- Highly wear resistant grinding elements
- Quick locking device enables simple and quick inter-changing of grinding barrels, easy cleaning
- Simple installation anywhere

INTENSIVE GRINDING

in the LABORATORY DISC MILL is obtained by the frictional and vibratory grinding effect, resulting in quick size reduction of the material. The grinding container is dust proof and sealed with an o-ring so that no material is lost.

HIGHLY WEAR RESISTANT GRINDING ELEMENTS

The pick-up from the grinding elements is reduced to a minimum by using such wear-resistant materials as hardened chrome steel, colmonoy, Widia (Tungsten Carbide), and Agate. Therefore quality samples can be ground in this mill without contamination.

SHORT GRINDING TIME

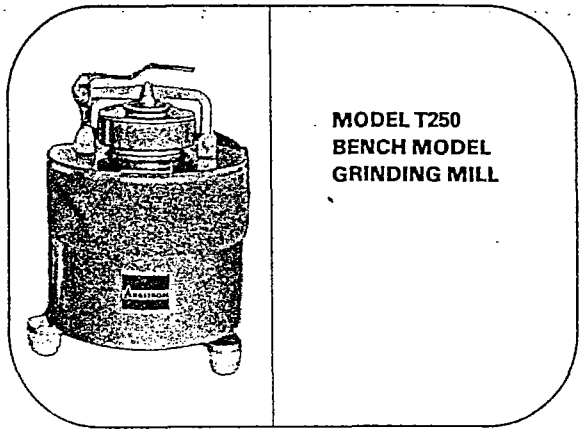
The short grinding time and the quick interchanging and cleaning of the grinding containers enable the processing of large quantities of different materials in the shortest time.

SUITABLE FOR ALL ANALYTICAL PROCESSES

LABORATORY DISC MILLS grind samples in the small amount of time to the fineness required for wet analysis, spectrographic analysis or X-Ray fluorescence analysis. Dry grinding is the general rule. If the material tends to cake — especially when grinding to a fineness of some microns — wet grinding is preferable. (e.g. in Freon)

BENCH-TYPE LABORATORY DISC MILLS

These mills are available in three types, each designed for a specific function. The Model T100 utilizes grinding barrels with a net capacity of 100cc, 50cc, 20cc and 10cc. The Model T250 utilizes grinding barrels with a net capacity of 250cc, 100cc, 50cc, 20cc and 10cc. The Model T110 mill features a slower motor speed specifically designed for agate grinding barrels with a capacity of 100cc and 50cc (although these containers can also be used on all models).



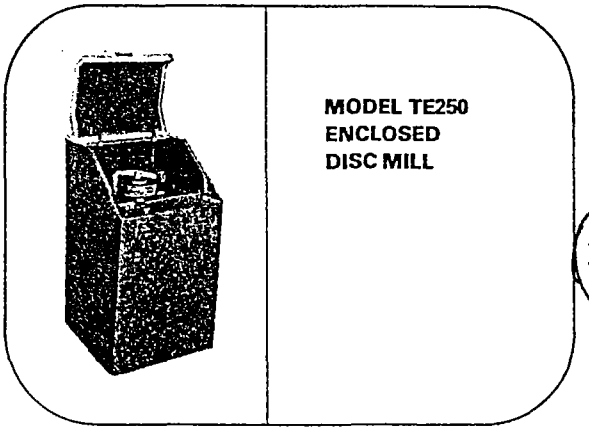
MODEL T250 BENCH MODEL GRINDING MILL

LABORATORY DISC MILL IN SOUND-PROOF ENCLOSURE

A further development is the sound-proof enclosure with an automatic timer. In this new execution, the oscillating top part is mounted in a solid box lined with sound absorbing material. The grinding sound is reduced to a minimum (below 75db).

The automatic timer enables the adjustment to a certain grinding time and switches off the mill automatically after grinding. The 3-phase motor and the time switch are protected against overloading and power cuts by fuses and relays.

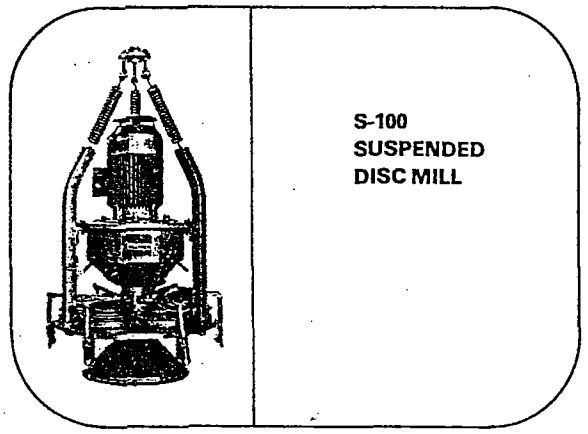
Two types available: Model TE250 utilizing grinding barrels with a net capacity of 250cc, 100cc, 50cc, 20cc and 10cc; and Model TE110 for use with agate grinding barrels of 100cc and 50cc net capacity.



MODEL TE250 ENCLOSED DISC MILL

SUSPENDED PRODUCTION MILL

For current sampling in production control or if large quantities are to be ground, the 6-pot mill, Model S-100 is recommended. This processes 6 samples simultaneously, utilizing grinding barrels with a net capacity of 100cc, 50cc, 20cc and 10cc.

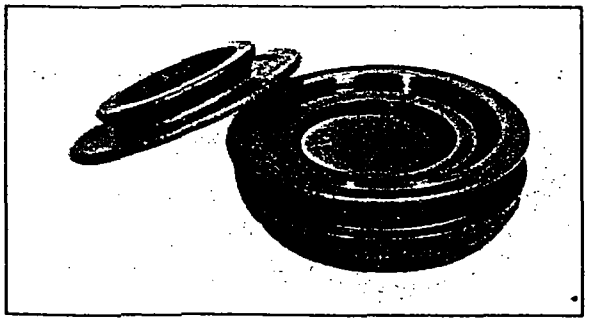


S-100
SUSPENDED
DISC MILL

DISC MILL CONTAINERS

DISC MILL CONTAINERS are manufactured in four different materials. Each material has its advantages and its own applications. The following describes each material:

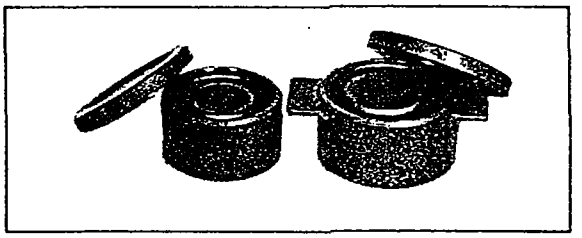
HARD CHROME STEEL — A 1% Cr/Fe alloy with a Rockwell "C" Hardness between 63 and 65. Containers made from chrome steel are the most widely used and the least expensive. They are used for all applications where a trace of Fe contamination can be tolerated.



T 100-1 — 100CC
HARD CHROME STEEL CONTAINER
(GRINDING BARREL)

COLMONOY — This alloy consists of 70% Ni, 15% Cr, 3% B and is coated on a steel container. The coating on all parts is no less than 3mm thick and has a Rockwell "C" between 55 and 57. Containers made with a colmonoy coating are in the medium price range. Colmonoy containers are sometimes used in the cement industry when analyzing for trace amounts of Fe. They are not suitable for grinding materials which contain very hard particles.

TUNGSTEN CARBIDE — The Tungsten Carbide alloy contains 6% Cobalt. Tungsten Carbide containers have the hardest surface of all the Angstrom containers. This extremely hard surface extends dish life and makes it possible to grind even the hardest materials. The greater mass of the elements cuts the already fast grinding time. These containers are used in almost all applications where cost is not a factor.



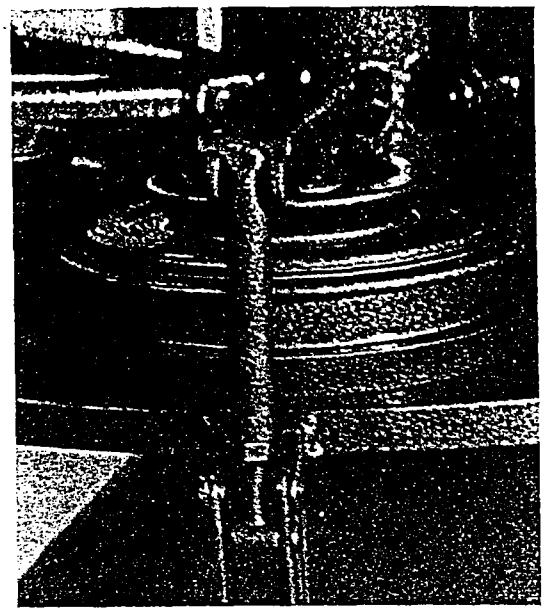
10CC (T100-6) AND 20CC (T100-7)
TUNGSTEN CARBIDE CONTAINERS

AGATE — A natural mineral often found in jewelry. This surface is long wearing, but fragile. It is used for soft to medium hard samples where no metallic contamination can be tolerated.

(T110-1) 100CC AGATE CONTAINER

ANGSTROM

Refer to charts on back



QUICK ACTION LOCKING CLAMP

Laboratory Disc Mills grind samples in the shortest time to a fineness required for wet spectrographic or x-ray fluoresence analysis. Dry grinding is the general rule. If the material tends to cake-especially when grinding to a fineness of a few microns - wet grinding is preferred.

The pick-up from the grinding elements is reduced to a minimum by using such wear resistant materials as hardened chrome steel, colmonoy (nickel-chrome alloy) and tungsten carbide. Therefore quality samples can be ground without contamination.

CONTAINERS AVAILABLE FOR S-100

Material of Construction	Chrome Steel	Colmonoy	Tungsten Carbide
Container Size	10CC (T100-4) 100CC (T100-1)	10CC (T100-5) 100CC (T100-2)	10CC (T100-6) 20CC (T100-7) 50CC (T100-8)

DIMENSIONS

HEIGHT: 40"
DIAMETER: 24"
WEIGHT: 300 lbs.
POWER REQUIREMENTS: 208, 220, 380, 420, 550 VAC
3Ø 50 or 60 HZ

MORE DETAILED INFORMATION CAN BE OBTAINED BY CALLING OR WRITING TO OUR SUPPLY CENTER.

ANGSTROM-WEST
600 Fig. Ave.
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A.C. 213-359-6688

ANGSTROM

Angstrom, Inc.
Chicago, Illinois

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JANUARY 1983

LABORATORY DISC MILLS PRICE LIST

T100/250 LABORATORY DISC MILL- consisting of a completely enclosed driving motor with the drive shaft running in self-aligning roller bearings; eccentric weights for producing vibratory action; quick-lock clamping assembly; vibratory insulated helical-spring mounted base. Does not include grinding containers. 1 H.P., 1000 RPM, 230/460 V, 60 Hz., 3 Phase. $ 4,975.00

Add $250.00 for voltage requirements other than listed. Requires proper adapter (See Reverse) for use with containers less than 250cc.

TE100/250 LABORATORY DISC MILL- same as above, but with soundproof, hinged enclosure and timer (0-100 min.) control panel. Does not include grinding containers. 1 H.P., 1000 RPM, 230/460 V, 60 Hz., 3 Phase. 6,900.00

Add $250.00 for voltage requirements other than listed. Requires proper adapter (See Reverse) for use with containers other than 250cc.

T110 LABORATORY DISC MILL- same as Model T100/250 Disc Mill, but including specially formed container support, and operated at 820 RPM for exclusive use with agate grinding containers (not included). 3/4 H.P., 820 RPM, 230/460 V, 60 Hz, 3 Phase. 5,150.00

Add $250.00 for voltage requirements other than listed. Requires adapter (See Reverse) for use with 50cc containers.

TE110 LABORATORY DISC MILL- same as above, but with soundproof, hinged enclosure and timer (0-100 min.) control panel. Does not include grinding containers. 3/4 H.P., 820 RPM, 230/460 V, 60 Hz., 3 Phase. 6,975.00

Add $250.00 for voltage requirements other than listed. Requires adapter (See Reverse) for use with 50cc containers.

S100 SUSPENDED TYPE PRODUCTION MILL- consisting of an enclosed driving motor with the drive shaft running in self-aligning roller bearings; eccentric weights for producing vibratory action; support frame for six steel grinding containers suspended on three helical springs and hanger for mounting on a supporting structure. Includes six T100-1 grinding containers. 1 H.P., 750 RPM, 230/460 V, 60 Hz., 3 Phase. 9,950.00

Add $250.00 for voltage requirements other than listed. Requires adapter (See Reverse) for use with containers less than 100cc.

CONTAINERS, ADAPTERS AND ACCESSORIES ON REVERSE

5

GRINDING CONTAINERS

PART NO.	COMPOSITION	NET CONTENTS	PRICE
T250-1	Hard Chrome Steel Alloy	250 cc	$ 1,725.00
T100-1	Hard Chrome Steel Alloy	100 cc	850.00
T100-9	Hard Chrome Steel Alloy	50 cc	725.00
T100-4	Hard Chrome Steel Alloy	10 cc	425.00
T250-2	Colmonoy on ST 37 Alloy	250 cc	3,500.00
T100-2	Colmonoy on ST 37 Alloy	100 cc	1,800.00
T100-5	Colmonoy on ST 37 Alloy	10 cc	850.00
T250-3	Tungsten Carbide	250 cc	WILL ADVISE
T100-3	Tungsten Carbide	100 cc	6,125.00
T100-8	Tungsten Carbide	50 cc	5,350.00
T100-7	Tungsten Carbide	20 cc	3,100.00
T100-6	Tungsten Carbide	10 cc	2,050.00
T110-1	Agate	100 cc	5,075.00
T110-2	Agate	50 cc	2,950.00

"Continuous" Grinding Container (250 cc) for use with Model T100/250 Laboratory Disc Mill, made of Hard Chrome Steel Alloy. 3,650.00

ADAPTERS

NOTE: 250 cc and Agate containers require no adapters.

PART NO.	CONTAINER	PRICE
T250A	T100-1, 2, 3	$ 150.00
T250B	T100-4	150.00
T250C	T100-5, 6	150.00
T250D	T100-7	150.00
T250E	T100-9	150.00
T250F	T100-8	150.00

SPECIAL ADAPTERS
(Order by Description)

For adapting three 10 cc containers for simultaneous processing. (Please specify container composition.)	WILL ADVISE
For adapting four 10 cc containers for simultaneous processing. (Please specify container composition.)	WILL ADVISE
For adapting six 10 cc containers for simultaneous processing. (Please specify container composition.)	WILL ADVISE
For adapting Bleuler containers to any Angstrom Mill.	50.00

FOB: Belleville, Michigan

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

1/83

US

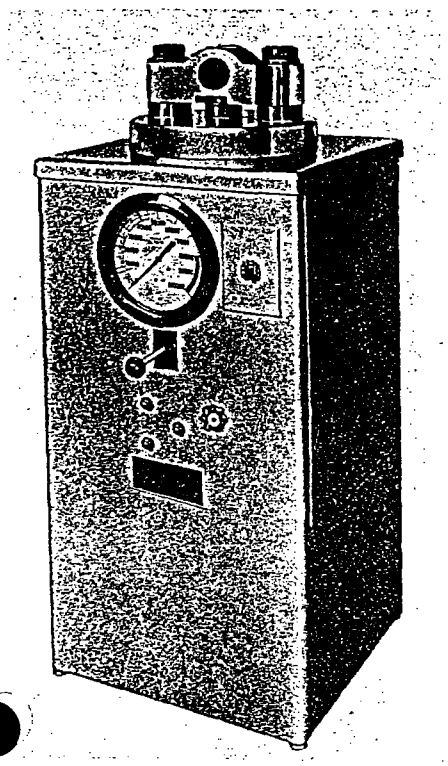
SPECIMEN BRIQUETTING PRESS

ANGSTROM

ANGSTROM, INC.

AUTOMATIC

Model 4451A



Hydraulic motor powered specimen briquetting presses with suitable molds for both X-Ray and Optical Spectroscopy.

These presses are designed as heavy duty units consisting of a hydraulic operated pressure system and a mold assembly for forming briquets or pellets.

A hydraulic pump operated by a 3 H.P. motor provides pressure up to 200,000 PSI with the 1/2" mold assembly. The hydraulic system includes a pressure control valve, a relief valve and an oil strainer. Pressures can be preset for a particular mold size and material combination. The automatic pressure regulator insures briquets of uniform density. The applied load is indicated on a direct reading calibrated dial.

A variety of molds are available to produce all sizes of pellets including 1-1/4", 1-3/8" and 40 mm which are used primarily for X-Ray fluorescence techniques. Non-metallic samples, powdered metals and drillings or millings can be satisfactorily briquetted into suitable specimens for analysis.

SPECIFICATIONS

Cylinder		7"
Pump		2000 PSI
Power		3 H.P.
Thrust		80,000 lbs.
Safe Loading	1/4" Mold	8000 lbs. 160,000 PSI
	1/2" Mold	40,000 lbs. 200,000 PSI
	1" Mold	80,000 lbs. 100,000 PSI
	1-3/8" Mold	80,000 lbs. 54,000 PSI
Input	220 V or 440 V 60 Cycle AC Single or 3 Phase	
Dimensions	22" x 22" x 50" high	
Net Weight		610 lbs.
Shipping Weight		750 lbs.

SPECIMEN MOLDS

4451-1/4S	Steel — 1/4" Diameter
4451-1/2S	Steel — 1/2" Diameter
4451-1/2C	Carbide lined 1/2" Diameter
4451-1S	Steel — 1" Diameter
4451-1C	Carbide lined 1" Diameter
4451-1 1/4S	Steel — 1.235" Diameter
4451-1 1/4SCC	Steel Mold — Carbide faced cap, 1.235"
4451-1 1/4C	Carbide lined — 1.235" Diameter
4451-1 1/4CCC	Carbide lined — Carbide faced cap, 1.235"
4451-1 3/8S	Steel — 1-3/8" Diameter
4451-1 3/8C	Carbide lined 1-3/8" Diameter
4451-40S	Steel 40 mm Diameter
4451-40SCC	Steel Carbide Cap
4451-40CCC	Carbide Mold — Carbide Cap
Large Diameter Molds are available with provision for evacuating mold chamber.	

APPENDIX H

MODEL 4452

CONTROLLED PRESSURE RATE

ACCESSORY

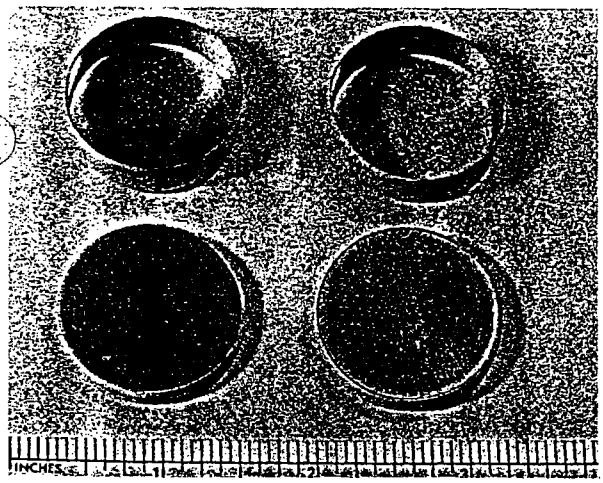
For model 4451 Briquetting Press

The 4452 Accessory is designed to permit a controlled rate of pressure loading and unloading. This variation in rate of loading is often necessary and desirable when briquetting certain types of material with the 4451 standard Briquetting Press.

The 4452 Controlled Pressure Rate Accessory can be installed on all existing 4451 Briquetting Presses in the customer's plants. Detailed instructions are furnished.

HANDY-KAPS

A New and Practical Way to Form Briquets for X-ray and Optical Emission Spectrochemistry



- Rugged and easy to handle
- Ideal for preservation as standards
- Easy to identify by writing on the painted surface
- Simple to store
- Useful with non-metallic and metallic powders
- Available in sizes for use with either 1-1/4", 1-3/8" or 40 mm Molds

HANDY-KAPS, a development of the Alcoa Research Laboratories, are thin walled aluminum cups in which powdered samples are briquetted. Samples are loaded, generally without weighing, then pressed in the mold assembly. The formed briquet is thus reinforced with aluminum on the sides and bottom. HANDY-KAPS ARE DESIGNED TO ELIMINATE THE USE OF BINDERS AND BACKING MATERIALS. They are painted on the outside to eliminate mold sticking.

SEE OTHER SIDE for information on Angstrom's Molds and Briquetting Press.

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Angstrom, Inc.

Chicago, Illinois

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SPECIMEN BRIQUETTING PRESS

4451A Automatic Briquetting Press - A 3 HP Motor drives the enclosed hydraulic pumping system to provide pressure up to 80,000 PSI. Complete with gauge, pressure control, start/stop switch, mold assembly support and swing-away anvil assembled in a floor-mounted heavy duty cabinet. Suitable for preparation of pellets ranging between 1/4 inch and 40mm in diameter. Does NOT include Mold Assemblies.

220V, 60 Hz, 3 Phase	$ 6,475.00
440V, 60 Hz, 3 Phase	6,675.00
220V, 50 Hz, 3 Phase	6,875.00
440V, 50 Hz, 3 Phase	7,000.00
220V, 50/60 Hz, 1 Phase	7,125.00

NOTE: 4451A Briquetting Press also available for 550V applications. 440V and 550V Models include Motor Control Starter.

4452 Programmed Loading Accessory - permits a controlled rate of pressure loading and unloading for Model 4451A. 4,375.00

SPECIMEN MOLDS - Includes: Mold, Cap, Plunger and Retainer.

ORDER #	MOLD SIZE	COMPOSITION MOLD	COMPOSITION CAP	
4451-1/4S	1/4"	Steel	Steel	370.00
4451-1/4C	1/4"	Carbide	Steel	630.00
4451-1/2S	1/2"	Steel	Steel	385.00
4451-1/2C	1/2"	Carbide	Steel	725.00
4451-1S	1"	Steel	Steel	450.00
4451-1C	1"	Carbide	Steel	885.00
4451-1-1/4S	1-1/4"	Steel	Steel	550.00
4451-1-1/4C	1-1/4"	Carbide	Steel	1000.00
4451-1-1/4SCC	1-1/4"	Steel	Carbide	755.00
4451-1-1/4CCC	1-1/4"	Carbide	Carbide	1205.00
4451-1-3/8S	1-3/8"	Steel	Steel	575.00
4451-1-3/8C	1-3/8"	Carbide	Steel	1050.00
4451-1-3/8SCC	1-3/8"	Steel	Carbide	850.00

- CONTINUED -

SPECIMEN MOLDS - CONTINUED -

ORDER #	MOLD SIZE	COMPOSITION MOLD	CAP	PRICE
4451-1-3/8CCC	1-3/8"	Carbide	Carbide	$ 1325.00
4451-40mm S	40mm	Steel	Steel	690.00
4451-40mm C	40mm	Carbide	Steel	1215.00
4451-40mm SCC	40mm	Steel	Carbide	920.00
4451-40mm CCC	40mm	Carbide	Carbide	1445.00

Molds are available with provision for evacuating mold chamber. Please call for current prices.

HANDY KAPS

PRICE LISTING EFFECTIVE -

ORDER #	DIAMETER	HEIGHT	FOR BRIQUET SIZE	QUANTITY PER BOX
2500	30 mm	8 mm	1-1/4"	4000
2600	33 mm	8 mm	1-3/8"	3600
2700	33 mm	16 mm	1-3/8"	6400
2800	38 mm	8 mm	40 mm	4800
2900	38 mm	16 mm	40 mm	4000

PRICE PER BOX

ORDER #	1	2	3	4	5+	Less than one box
2500	$160.00	$155.00	$150.00	$145.00	$140.00	5.00C
2600	144.00	139.50	135.00	130.50	126.00	5.00C
2700	288.00	279.00	270.00	261.00	252.00	5.65C
2800	288.00	279.00	270.00	261.00	252.00	5.65C
2900	360.00	360.00	360.00	360.00	360.00	11.25C

NOTE: No price break available for #2900

20-1345 AB Desicator Specimen Cabinet - for storing standard diffraction of fluorescence samples, includes six trays equipped to store 432 specimens 1-3/8" or 1 1/2" in diameter, 600 specimens 1 1/4" in diameter. $500.00

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

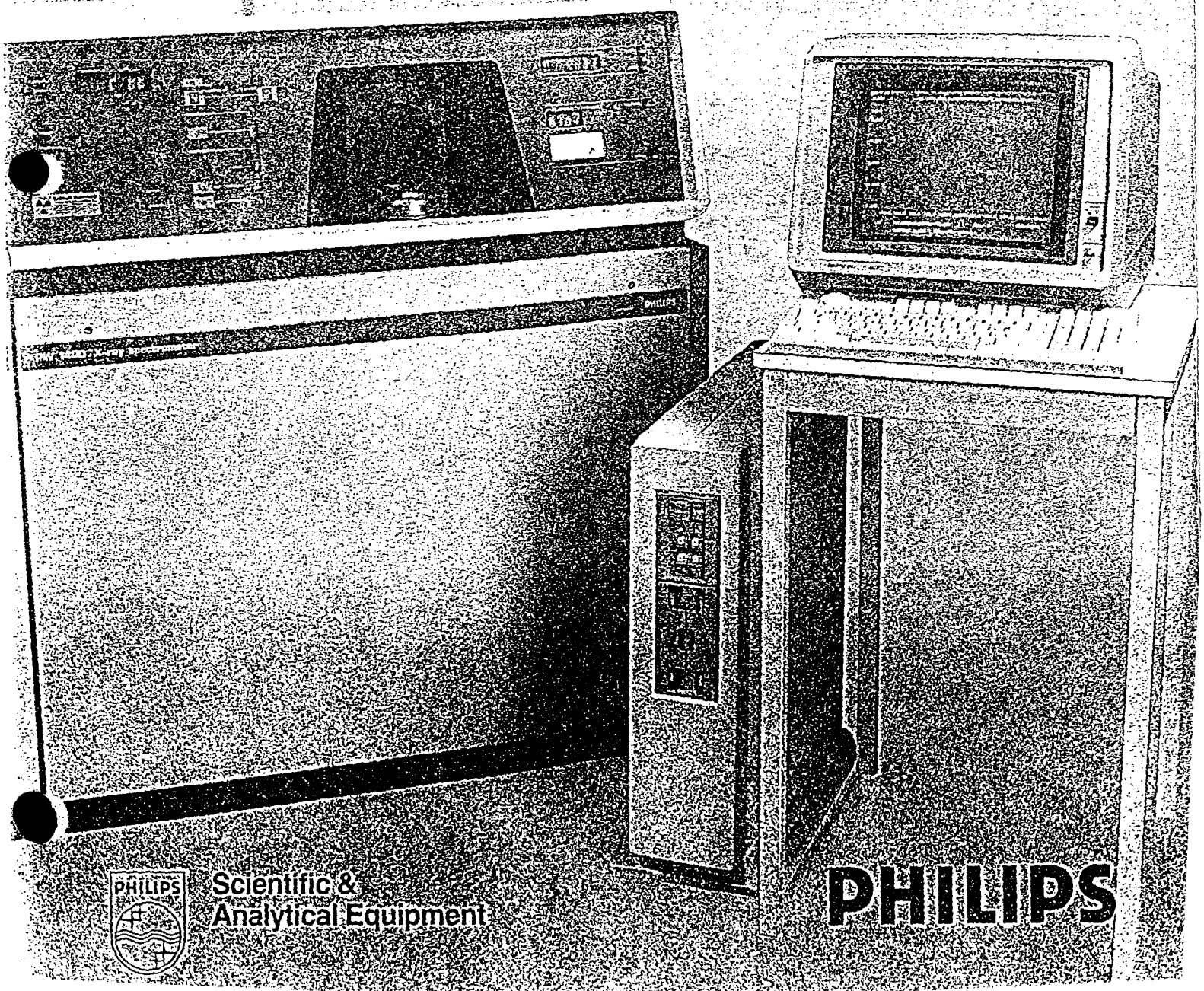
Minimum Order: $25.00

FOB: Belleville, Michigan

12-15-82

Extra performance features for the PW 1400 x-ray spectrometer

Appendix C



PHILIPS Scientific & Analytical Equipment

PHILIPS

Increased capability across the element range

Outstanding performance and simple operation have made the Philips PW 1400 sequential x-ray spectrometer by far the most successful of its kind to date.

With more than 500 instruments being used in industrial and research laboratories throughout the world, vast experience has been gathered in solving all kinds of analytical problems. This in turn has enabled development of the system to meet an ever-increasing range of demands.

And now, Philips Analytical has introduced yet more new features that extend capability even further - especially in the determination of elements of low atomic number.

New "crystal" improves light element sensitivity

By replacing the conventional TIAP crystal with a new material, PX-1, PW1400 users can obtain significant improvements in light element sensitivity.

Known as a multilayer, PX-1 is made using semiconductor manufacturing techniques to deposit alternating layers of heavy and light element atoms on a silicon substrate. The carefully controlled layers, measuring just nanometers in thickness, form a crystal-like repeating structure that acts as a monochromator for the x-ray fluorescence generated in the spectrometer.

This device gives a more than three-fold intensity increase when measuring fluorine, sodium and magnesium. With the additional gain in light element intensities obtained from the scandium side-window tube (see opposite), a six- to eight-fold overall improvement can be achieved.

Other advantages of the multilayer over TIAP are its non-toxicity and the fact that it virtually eliminates high order reflections. For example, the third order Ca Kα reflection commonly encountered when using TIAP is reduced by a factor of 30 with PX-1. Also, because it is a stable structure, it eliminates the risk of progressive deterioration that can occur when the TIAP crystal is exposed to radiation and sample vapours.

Carbon attachment delivers promising results

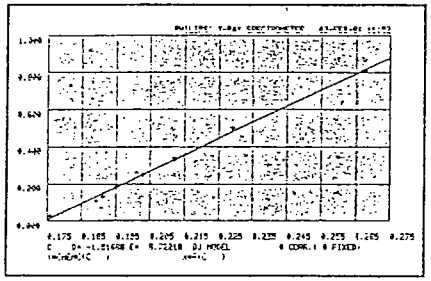
A special attachment now available from Philips on a project basis makes carbon and boron analysis a real possibility with the PW 1400. This development also incorporates a special X-ray monochromator. In addition, it requires minor optical and electronic modifications to the spectrometer - but these have no effect on the spectrometer's high performance for other types of measurement.

The attachment gives an improvement in carbon and boron sensitivities of 5 - 10 times, compared to a normal lead stearate crystal. As with PX-1, optimum results are achieved with the aid of a scandium tube.

In fact, the sensitivities are similar to those obtained using the total reflector method - but background is much reduced and line overlap problems are eliminated.

Typical performance figures for the analysis of carbon in low alloy steel show:

Sensitivity	85 cps/%
Lower limit of detection (100 sec)	0.04 %
Standard deviation (for the range 0 - 0.8 % C in steel)	0.015 %
Background	125 cps



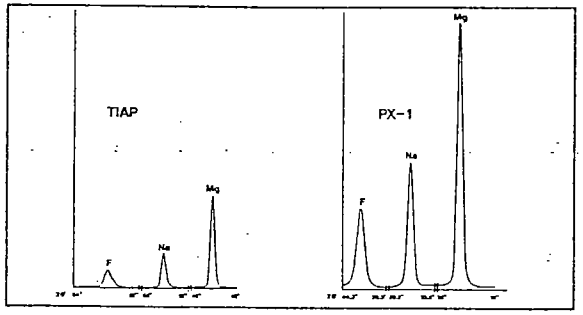
This table (below) and graph (above) show the results achieved for carbon analysis in a low-alloy steel, using the PW 1400 spectrometer equipped with a carbon attachment and Sc x-ray tube.

The figures shown are obtained using standard argon-methane counting gas. Other spectrometer manufacturers are obliged to employ a special gas such as helium/carbon dioxide to achieve acceptable results. However, this necessitates a time-consuming gas changeover and restabilisation of the system before the analysis of heavier elements - e.g. calcium, titanium and iron - can be resumed with the aid of the flow counter.

Philips therefore chose to base its design on what can be regarded as a practical system for the working laboratory. This enables the PW 1400 to handle such applications as the measurement of surface carbon on steels, as part of a normal routine test programme.

NR	INTENSITY	CHEMICAL	CALCULATED	DIFF.	CHEMICAL	CALCULATED	IDENTIF.
1	0.195	0.10000	0.10519	0.00519	0.10000	0.10519	CKD101 PW1400 WITH
2	0.212	0.34000	0.33415	-0.00585	0.34000	0.33415	CKD102 SC-TUBE +
3	0.191	0.13000	0.15088	0.02088	0.13000	0.15088	CKD152 40 KV/70MA
4	0.268	0.81000	0.81830	0.00830	0.81000	0.81830	CKD153 CARBON-ATTACH
5	0.201	0.26000	0.23435	-0.02565	0.26000	0.23435	CKD154 FC + P-10 GAS
6	0.176	0.03000	0.01764	-0.01236	0.03000	0.01764	CKD155 LL15-UL90
7	0.212	0.33000	0.33083	0.00083	0.33000	0.33083	CKD157 1 MU PP
8	0.195	0.19000	0.18659	-0.00341	0.19000	0.18659	CKD158 60GRID CORUND
9	0.189	0.11000	0.12835	0.01835	0.11000	0.12835	CKD159 35MM CH. MASK
10	0.229	0.50000	0.48066	-0.01934	0.50000	0.48066	CKD160 100 SEC
11	0.203	0.25000	0.25557	0.00557	0.25000	0.25557	CKD161 HDK

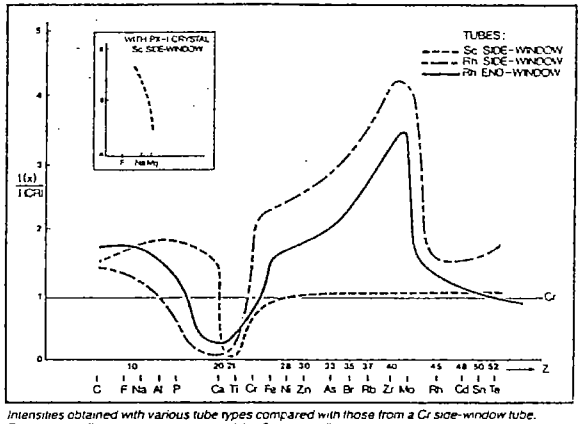
Measurement of Na, F and O using the PW1400 spectrometer. The spectra show the intensity improvement obtained when using the PX-1 multilayer and Sc tube.



Performance comparison of the Sc and Rh side-window tubes for the analysis of various elements in low-alloy steels.

ELEMENT		SCANDIUM			RHODIUM		
Spectral line	Conc. %	Sens. cps/%	Bkgd. cps	LLD (ppm) (T = 100s)	Sens. cps/%	Bkgd. cps	LLD (ppm) (T = 100s)
13 Al Kα	.05–.5	3930	210	11	1750	37	10
14 Si Kα	0–.9	9930	280	5.3	3900	360	14
15 P Kα	.012–.1	13500	170	2.9	5100	142	8.6
22 Ti Kα	0–.4	7220	300	7.2	16300	290	3.1
24 Cr Kα	0–2.6	14000	560	5.0	35300	960	2.6
27 Co Kα	0–.035	28100	1750	4.5	68600	3910	2.7
33 As Kα	.005–.06	8830	540	7.9	30100	490	2.1
42 Mo Kα	0–1.5	8300	1000	12	51400	1070	1.9
50 Sn Kα	0–.05	7440	400	8.1	7980	710	10

Tube choice allows optimised excitation



Intensities obtained with various tube types compared with those from a Cr side-window tube. These graphs illustrate the superiority of the Sc tube for light elements – particularly when used with the PX-1 multilayer. It can also be seen that the Rh side-window tube outperforms the end-window type over most of the element range.

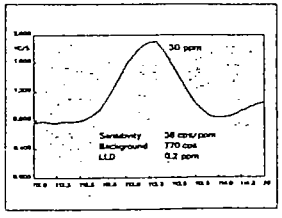
Side-window X-ray tubes are the logical choice for sequential X-ray spectrometry because they offer an outstanding combination of economic and performance advantages.

They are cheaper to purchase, less costly in use - and their compact end-cap dimensions have enabled the PW1400 to be designed with very close coupling between the tube and optics. This improved geometry enables maximum advantage to be taken of the available output, which more than outweighs some of the theoretical advantages claimed for the more bulky end-window tubes. Thus, for example, the Philips rhodium side-window tube outperforms the end-window type over most of the element range.

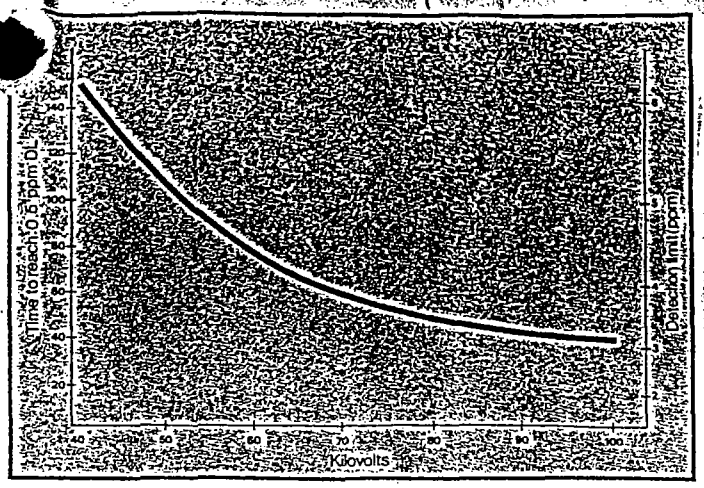
In a sequential spectrometer, there is no need to make the compromises necessary in a simultaneous instrument, where one tube must give reasonable excitation of all elements within the measuring range. Philips' series of seven different anode materials therefore enables the operator to select just the right model for any analytical application.

In particular, the recently introduced scandium side-window tube offers real advantages for the detection of elements with atomic numbers below 21. It also compares well with the chromium tube for heavy elements - and is the preferred choice where chromium and manganese need to be determined.

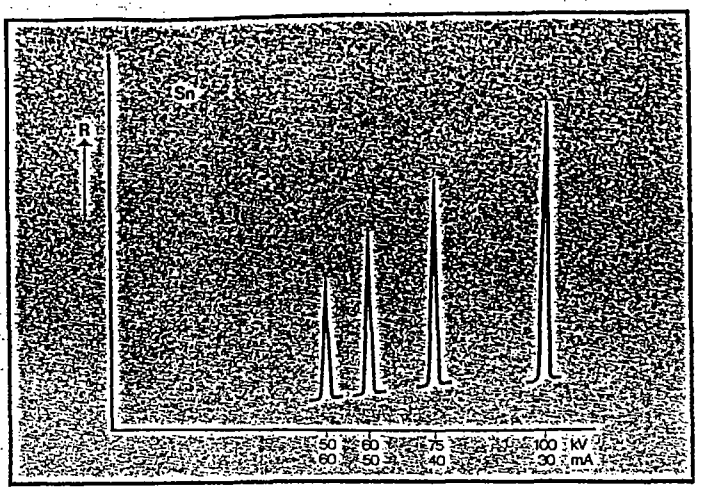
Spectral peak for 30 ppm of Ca in steel, produced on the PW 1400 spectrometer with the aid of an Sc tube.



Programmable voltage aids heavy element analysis



Measurements made on a rock sample containing Mo at 2000 ppm show how detection limits are improved as kV increases.



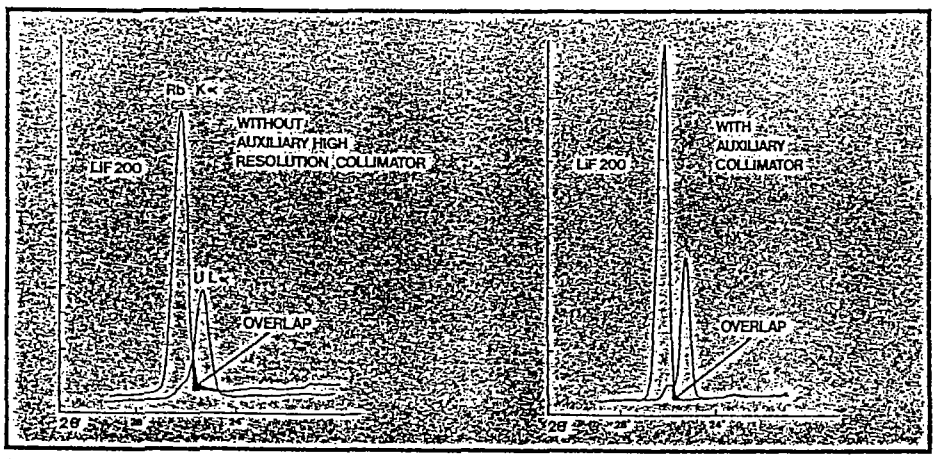
The effect of kV on excitation is indicated by the increasing intensities obtained when measuring this Sn Kα peak at different voltages.

Optical design brings high resolution

Most analytical laboratories need to deal with a highly complex and widely varying workload. The spectrometer itself must therefore provide both high sensitivity and sufficient resolution to avoid line overlap problems.

The advanced optics and precision construction of the PW 1400 make it an ideal system to handle even the most difficult analyses. In particular, the inclusion of an auxiliary, high resolution collimator is extremely valuable in heavy element determinations - where it is frequently necessary to resolve closely-spaced lines in a complex spectrum, for sample constituents occuring at only low trace levels in the presence of interfering elements at high concentrations.

With continuing advances, plus the expert applications support available from Philips Analytical, PW 1400 users are assured of a long, useful life from this versatile and reliable instrument.



Two spectra from the same sample containing U in the presence of Rb demonstrate how the incorporation of an auxiliary collimator in the PW 1400 reduces line overlap problems when analysing heavy elements.

The ability to programme the PW 1400 up to 100 kV brings real benefits in heavy element determination. This is only possible with side-window tubes, since end-window spectrometer designs limit voltage to about 60 kV.

When the Philips side-window rhodium tube is used to optimise heavy element performance, sensitivity is improved by up to a factor of two over that of a comparable end-window system.

9498.302.05911

Printed in the Netherlands
Data subject to alteration without notice

EXHIBIT C

CHEMETCO INC
HARTFORD IL.

SLAG COOLING AREA
SAMPLING PROCEDURE

Chemetco has 3 "Slow Cooling" areas for its slag material. They are designated, from a west to east direction, No. 1, No. 2, and No. 3. Each area is approximately 50' wide (east-west direction), by 90' long (north-south direction). Each area accumulates approximately 2 1/2 days of slag production.

The following procedure to obtain a representative sample from each cooling area is used:

1. Obtain a clean 3 gallon container from the sampling department and proceed to the appropriate cooling area.
2. "Mentally" divide both the 50' and 90' dimensions in "fourths," - this will yield 16 sample areas, approximately 12.5' X 22.5'.
3. From each of the 16 sample areas, randomly select 4 samples.
4. Samples should weigh a minimum of 1/4 pound, and a maximum of 2 pounds, so that the composite will be disportionately influenced by any one sample.

The above procedure is to be coordinated with the actual removal of material from the cooling areas.

After the entire sample is collected, use a permanent marker to write the following information on the container:

Date

Area No.

No. of Trucks (To Excavate Area)

Take containers to "IMS" office.

Receiving sampler will pick up sample from "IMS" office and verify that container is properly labeled. He will also verify and that the sample contents are in the acceptable size range and number of pieces. The contents will also be inspected for the presence of any foreign material.

If the sample is approved by the receiving sampler, he will transport it to the "Sample Trailer" and list the container on the "Daily Sample List Report".

The sample trailer subsequently will be transported to the laboratory for analysis.

xrayana

X-RAY ANALYSIS

THE SAMPLE TO BE ANALYZED IS PLACED IN THE SAMPLE HOLDER. IT IS THEREFORE AUTOMATICALLY CONVEYED TO THE ANALYSIS POSITION IN THE VACUUM CHAMBER THROUGH AN AIR-LOCK. THE SAMPLE IS EXPOSED TO CHROMIUM X-RADIATION. FLUORESCENT X-RAYS FROM THE SAMPLE ARE FOCUSED THROUGH A COLLUMATOR ONTO THE ANALYZING CRYSTAL. THREE CRYSTALS ARE COMPUTER SELECTALBE TO CAUSE OPTIMUM WAVELENGTH SEPARATION OF THE X-RAYS OF THE ELEMENTS BEING ANALYZED. THE X-RAYS OF VARIOUS WAVELENGTHS ARE DIFFRACTED FROM THE CRYSTAL AT SPECIFIC ANGLES WHICH ARE READILY CALCULATABLE. THE SEPARATED X-RAYS ENTER THE GONIOMETER WHICH MOVES THE X-RAY COUNTING DETECTORS TO THE PROPER ANGLE. TWO DETECTORS ARE AVAILABLE- A SCINTILLATION DETECTOR FOR HI-ENERGY X-RAYS, AND A GAS FLOW COUNTER FOR LOW-ENERGY X-RAYS. THE X-RAY INTENSITIES MEASURED BY THESE DETECTORS ARE USED BY THE COMPUTER TO CALCULATE THE ELEMENTAL ANALYSIS.

EXHIBIT D

xrayqc

ANALYSIS QUALITY CONTROL:
PW1400 X-RAY SPECTROMETER

1) CALIBRATION AND STANDARDS: THE PW1400 IS CALIBRATED FROM STANDARDS WHICH HAVE BEEN SELECTED FROM THE PROCESS TO BE REPRESENTATIVE OF THE FULL RANGE OF COMPOSITIONS FOR EACH OF OUR SIX BASIC PROCESS MATERIAL. EACH STANDARD IS ANALYZED BY THREE INDEPENDENT LABORATORIES. NO STANDARD IS USED UNTIL TWO LABS CONFIRM THE CHEMICAL ANALYSIS. THE CALIBRATION IS PERFORMED USING THE PHILIPS ANALYITICAL SOFTWARE.

2) DAILY QUALITY CHECKS: EACH DAY A SERIES OF SIX STANDARDS, ONE OF EACH MATERIAL TYPE, ARE RAN AS UNKNOWNS. THE ANALYSIS SOFTWARE HAS LIMITS SET FOR CERTAIN ELEMENTS SPECIFICALLY FOR EACH OF THESE SIX STANDARDS. THESE LIMITS ARE SET SO AS TO INFORM THE OPERATOR OF INSTRUMENTAL DRIFT OR MALFUNCTION. SHOULD THE SOFTWARE REPORT A RESULT OUT OF LIMITS, THE RECALIBRATION PROGRAM FOR THAT SAMPLE TYPE IS RUN. THE CHECK LIMITS ARE SELECTED TO DETECT ANY INSTRUMENTAL MALFUNCTION OR VARIANCE.

3) RECALIBRATION: SHOULD THE DAILY CHECK SHOW THE NEED FOR RECALIBRATION, A SET OF TWO OR THREE STANDARDS IS USED TO RESET THE CALIBRATION CURVE TO CORRECT FOR INSTRUMENTAL DRIFT. IN THIS ROUTINE ALL ELEMENTS ARE RECALIBRATED FOR THE PARTICULAR SAMPLE TYPE EVEN THOUGH ONLY ONE ELEMENT MAY HAVE NEEDED CORRECTION.

AFTER EACH ROUTINE PREVENTITIVE MAINTENANCE OR REPAIR VISIT, THE ALLIGNMENT OF ALL X-RAY OPTICS AND RESOLUTION OF COUNTING ELECTRONICS IS CHECKED. ALSO THE 2Θ LOCATION OF EACH ELEMENT IS CHECKED WITH PURE ELEMENTS.

4) CHEMICAL ANALYSIS CHECKS: ALL SAMPLE TYPES ARE CHECKED AGAINST WET CHEMICAL ANALYSIS. ANODE AND SOLDER METALS ARE 100% CHECKED, WHILE ALL OTHER SAMPLES ARE RANDOMLY SELECTED FOR WET ANALYSIS COMPARISON.

5) A RECORD OF ALL CHECKS AND RECALIBRATION IS KEPT.

DIANO XRD 8575 X-RAY SPECTROMETER:

1) THIS UNIT USES THE SAME STANDARDS AS THE PW1400.

2) CHECKS AND RECALIBRATIONS ARE UNIFIED IN THIS SOFTWARE. THIS UNIT IS USED ONLY AS A BACK-UP TO THE PW1400. WHEN IT IS IN USE, IT IS CHECKED/RECALIBRATED ONCE EACH SHIFT. WHEN NOT IN USE, IT IS CHECKED ONCE A WEEK.

3) WHEN IN USE, THE SAME WET CHEMICAL CHECKS APPLY HERE.

EXHIBIT E

WALKER & ASSOCIATES, INC.
Photogrammetric Services
1650 Headland Drive
FENTON, MISSOURI 63026

(314) 343-6111

DATE 9-25-86

SUBJECT 86-8-18
material inventory at Alton

TO Joel McKell
Chemetco

> 1 general map sheet at 1" = 40' with 1' contours.
5 graph sheets of end section plots.
2 computer printouts of volume calculations.

You will note that the volume are -
North Stations (west offsets) - 4,822,757 cubic feet = 178620 CUBIC YARDS
West Stations (north offsets) - 4,863,361 cubic feet = 180124 CUBIC YARDS

SIGNED Ed Fortner

☐ PLEASE REPLY ☐ NO REPLY NECESSARY

APPENDIX L

Illinois Department of Transportation
Division of Highways/District 8
9300 St. Clair Avenue/Fairview Heights, Illinois/62208

September 26, 1986

Mr. Bill Gardner
Luhr Bros., Inc.
P.O. Box 69
Columbia, IL 62236

Dear Bill:

This letter is in regards to your inquiry concerning the use of the waste slag pile at the CHEMETCO plant near Hartford, for embankment material on the Poag Road job in Madison County.

The material is satisfactory as far as size and gradation; however, in conversation with the Illinois Environmental Protection Agency, the material is, at this time, considered a hazardous waste product and we cannot approve it for embankment.

Very truly yours,

Dale L. Klohr
District Engineer

Thomas A. McCarthy
Thomas A. McCarthy
District Materials Engineer

TAM:rah/0584J

cc: Mr. John Suarez, CHEMETCO
File

MEMO

TO Chemetco

DATE October 2, 1986

FROM E. W. Golisch

SUBJECT Tentative Slag Market

1/2" x 3/16"	Chips	Estimated tonnage per year = 25,000 tons at $4.00 per ton = $100,000
1/2" x 2 1/2"	Ballast	Estimated tonnage per year = 30,000 tons at $2.00 per ton = $ 60,000

Ed Golisch

Ed Golisch
Marketing/Aggregate Manager

EWG:ln

Center for Management Studies
Southern Illinois University at Edwardsville

SAMPLE DESIGN AND STATISTICAL ANALYSIS OF LEAD AND CADMIUM TEST RESULTS FOR CHEMETCO

Donald S. Elliott
Associate Professor of Economics
Southern Illinois University
at Edwardsville

Stanford L. Levin
Associate Professor of Economics
Southern Illinois University
at Edwardsville

March, 1985

SAMPLE DESIGN AND STATISTICAL ANALYSIS OF LEAD AND CADMIUM TEST RESULTS FOR CHEMETCO

This report presents a summary of the project undertaken to determine repesentative EP lead and cadmium leach test results for material comprising the Chemetco slag pile. The project was in two parts. The first was the design of the sampling plan to select samples for laboratory analysis from the slag pile. The second was the statistical analysis of the results of the EP leach tests from these samples.

The goal of designing the sampling technique was to use all of the available information, along with statistical theory, to select representative samples. This methodology also allowed Chemetco to specify in advance the desired degree of certainty of the results and the expected costs of sampling and analysis which they were willing to accept. The number of resulting samples, then, was the smallest number which could have been expected, in advance and subject to the above constraints, to give significant predictions as to whether the material in the slag pile as a whole violated EPA standards. After Chemetco sampled the sites in the slag pile identified by the above methodology and test results were obtained for each of the samples, the test results were used to calculate the expected lead and cadmium leach rates for the slag pile and the confidence intervals around both estimates at a given level of significance.

Sample Selection

In order to develop the sampling methodology, Chemetco was asked in July, 1984, to provide the following information.

1. The dimensions of the slag pile in sufficient detail to construct a three-dimensional model.

2. The results of the thirty EP leach tests already conducted before this new series of tests, including any information about the sites on the pile from which the samples were drawn, if known. (No information was available about the location of the samples.)

3. The estimated cost of one coring and of each additional coring (a coring is a vertical coring through the slag pile.)

4. The cost of an EP leach test for one 100 gram sample and the cost of each additional EP test, if different.

5. The EPA standard for acceptable lead and cadmium leach out.

6. A history of how the slag pile was constructed, e. g., layers, quadrants, linearly, etc., and any historical data that are available on the composition of the pile.

7. The size and shape of a typical load once it is dumped on the pile.

Following receipt of the above information, the alternative sampling plans in the table on the following page were presented to Mr. Joel McKell. In October, 1984, Mr. McKell chose alternative 1, to select twenty primary units with three samples per unit ($n = 20$, $m = 3$). It was also decided to identify an additional twenty primary units with three samples per unit as reserve observations to be used in sequential statistical analysis if necessary.

A two-stage sampling technique was applied. A topographical map of the slag pile provided by Mr. McKell was divided into 20' X 20' grids. Each grid contained 100 2' X 2' squares. The mean height of each grid and each square was estimated from the contour lines on the map. Because volume is proportionate to height when width and length are held constant, grids were selected for the sample by applying random numbers to a running sum of the heights for the grids. Once the 40 grids had been selected, random numbers were applied to the running sums of the heights of the 2' X 2' squares within each grid to select one square per grid. Then random numbers were used to select three depths within each square. Thus the initial sampling plan identified 20

TABLE 1

Alternative Sampling Plans

Notation:

C = estimated cost of procuring and processing the samples.
V = estimated variance.
$\sqrt{V}$ = estimated standard deviation.
n = number of sites to be samples.
$n \cdot m$ = number of samples.

Alternative	C	V	$\sqrt{V}$	n	$n \cdot m$	Estimated Upperbound $\alpha = .05$	Estimated Upperbound $\alpha = .10$
1	10,000	.495	.704	20	60	5.3	5.05
2	15,000	.33	.575	30	90	5.09	4.89
3	20,000	.25	.50	40	120	4.97	4.79
4	25,000	.20	.44	50	150	4.87	4.71

These alternative sampling plans were developed from sampling cost estimates and data from preliminary surface sampling provided by Mr. Joel McKell of Chemetco.

2' X 2' locations with three samples each to be taken at specified depths from the surface of the pile (Appendix A). The reserve sites, which consisted of 20 locations and 60 observations for sequential analysis, were similarly specified.

If a sequential test had been necessary, the sequential t developed by S. Rushton[1] would have been applied. Data from the laboratory analyses of the first 20 locations, however, were sufficient to reject the null hypotheses that the mean levels of either lead or cadmium exceeded the EPA standards.

Statistical Results

Appendix B contains the results of the laboratory tests for the sixty sites. These results were received by the authors in early March, 1985. The mean lead test result is 1.599. The standard error calculated from formula (11.29) in Cochrane[2] is .234. Applying the Central Limit Theorem with a significance level of .0001, the critical value for a one-tailed test for the population mean is 2.488. This can be interpreted as follows: the probability that the mean lead test result for the population (i.e., the average for the entire slag pile) exceeds 2.488 is only .0001; only one time out of ten thousand would one be wrong in stating that the expected lead test result for the entire Chemetco slag pile is less than or equal to 2.488. This is such a strong empirical result given the EPA standard that sampling the additional twenty sites for sequential statistical analysis was deemed unnecessary.

---

[1] S. Rushton, "On a Sequential t-test," Biometrika 37, 326-333.

[2] William G. Cochran, Sampling Techniques, 2nd edition, John Wiley & Sons, Inc., 1963.

Similarly, the mean cadmium test result is also very low at .152 based on data from the first twenty sites. These data, which are displayed in Appendix B, yield a standard error of .032. The critical value for a one-tailed test for the population mean applying the Central Limit Theorem with a significance level of .0001 is .274. This result can be interpreted as follows: the probability that the mean cadmium laboratory result for the population (i.e., the average for the entire slag pile) exceeds .274 is only .0001; one would be wrong only one time out of ten thousand in stating that the expected cadmium test result for the entire Chemetco slag pile is less than or equal to .274. Again, this is such a strong empirical result given the EPA standard that sampling the additional twenty sites for sequential statistical analysis was deemed unnecessary.

APPENDIX A

Sample Locations

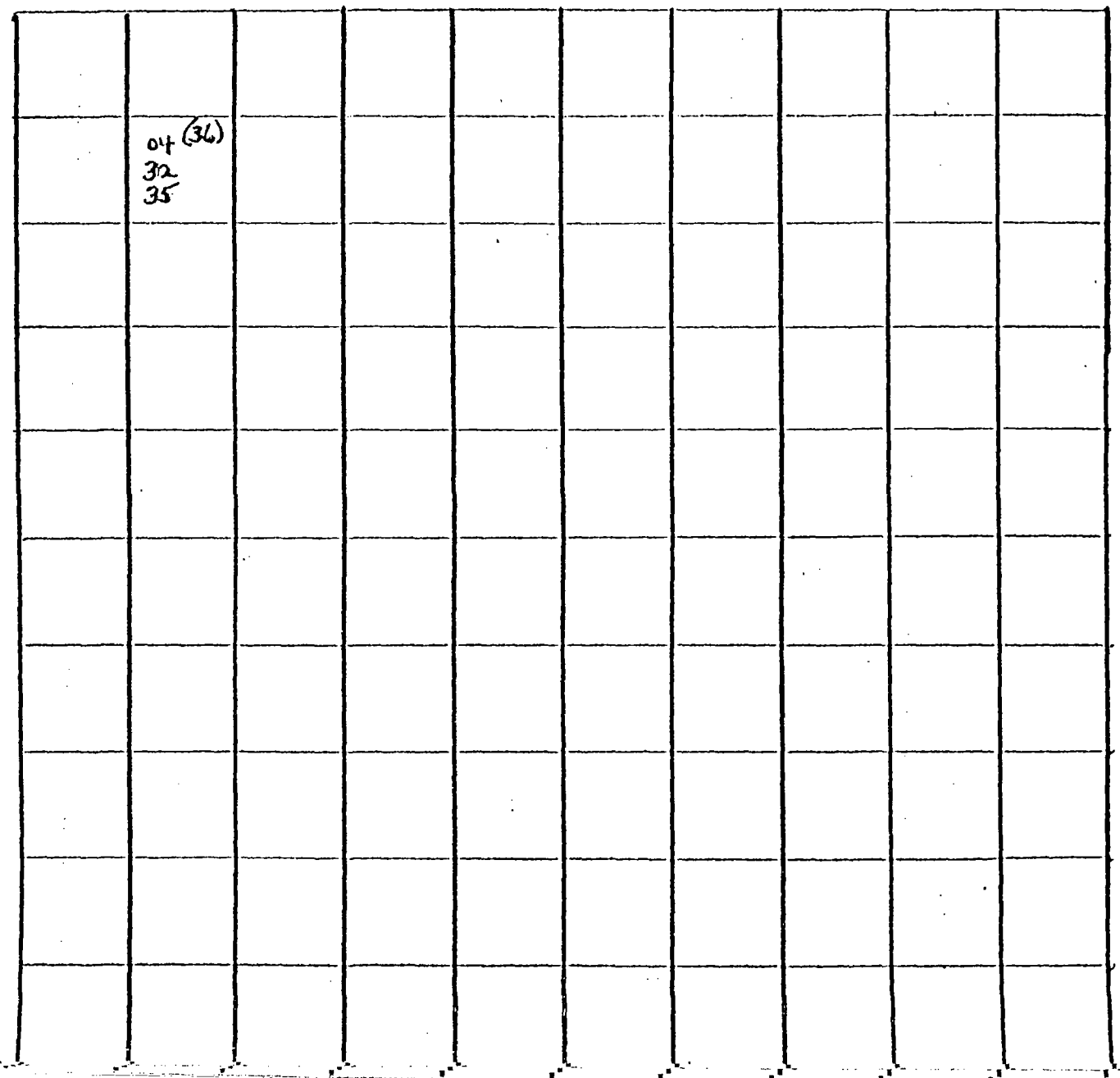
COORDINATES
25, E
Location
Group 1

HEIGHT OF PILE

SAMPLE DEPTHS

04 (36)
32
35

2'x2' GRID



25, E
Location
Group 1

	04 (36) 32 35								

29, M

Group 1

						02 (34) 18 30			

Location

23, W

Group 1

			17 (30) 26 28						

Location

13, Q

Group 1

-03 (16)
-04
-15

Location

25, L

Group 1

29 (41)
33
41

Location

3, P

Group 1

									(13) 01 04 12

Location
22, X

Group 1

							05 (10) 07 08		

Location

24, E

Group 1

10 (34) 25 33									

Location

7,0

Group 1

		04 (16) 09 10							

Location
32,T

Group 1

								06 (28) 18 21	

Location

7M

Group 1

				05 (16) 12 16					

11

Location
24,G
Group 1

						(33) 18 23 24			

12

Location

11, X

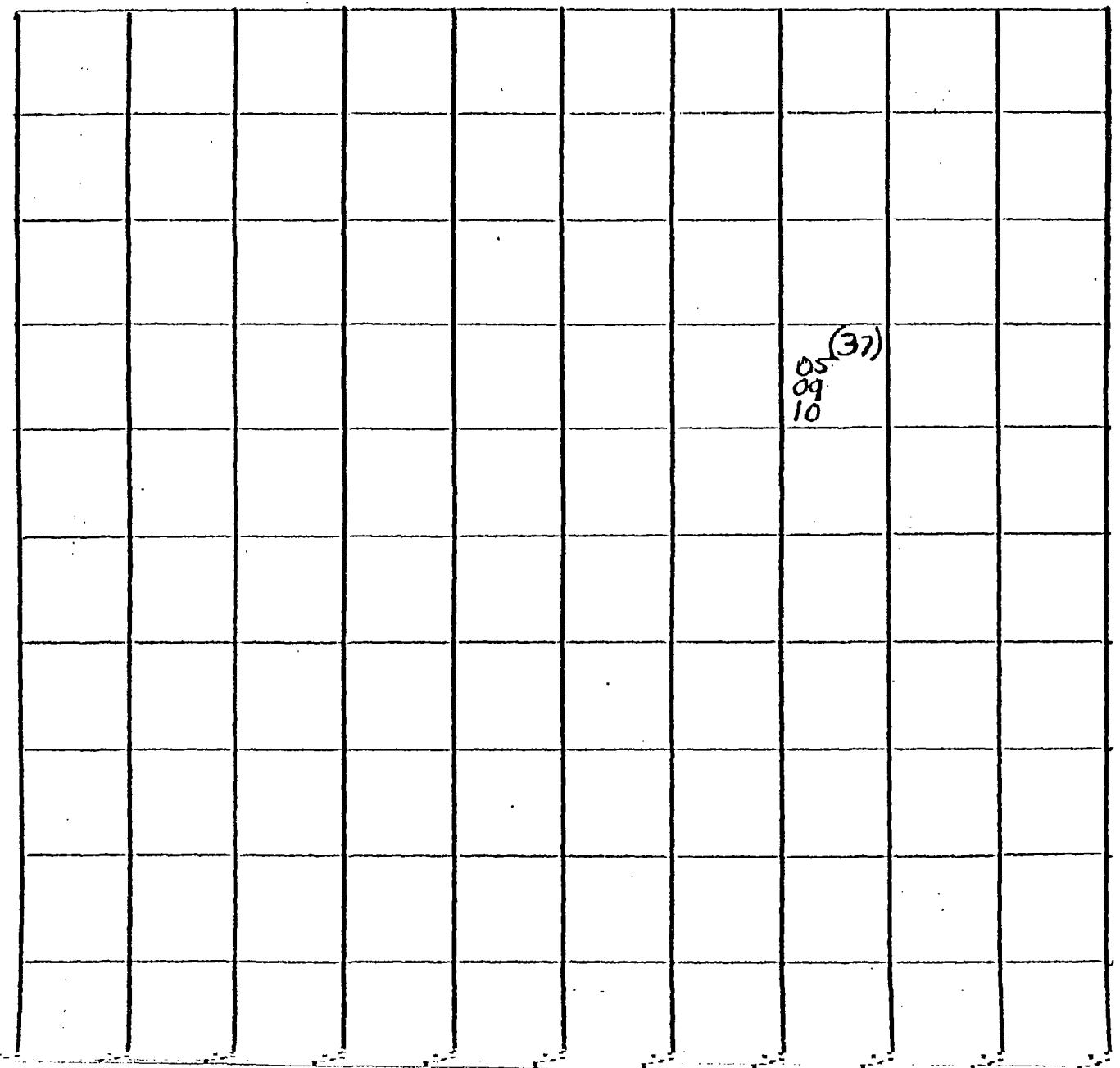
Group 1

									01 (21) 05 21

13

Location
28, K

Group I



14

Location

34, Q

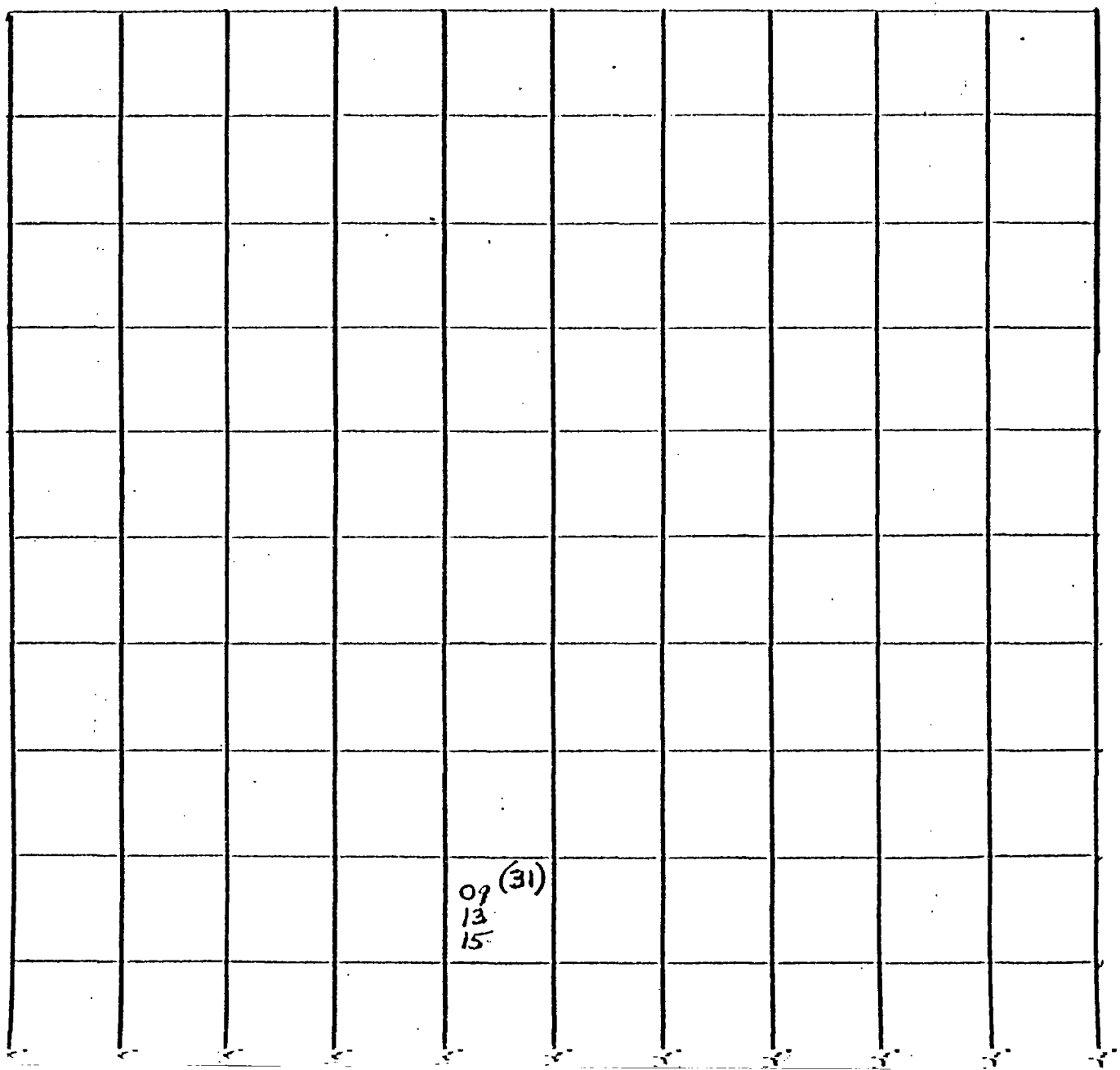
Group 1

08 (18)
09
12

Location

27, 0

Group 1



16

Location

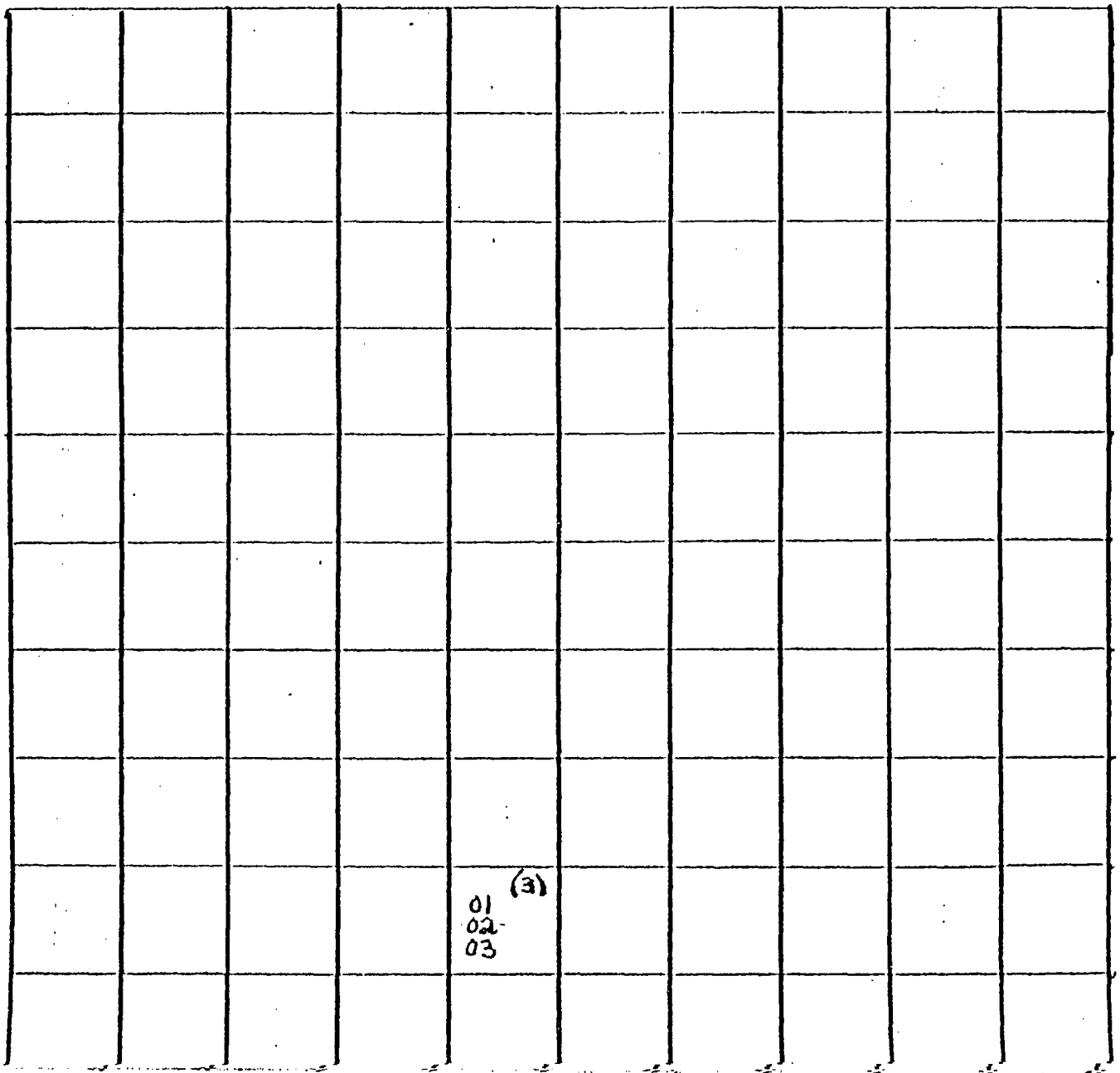
26, K

Group 1

		02 (46) 15 33							

11

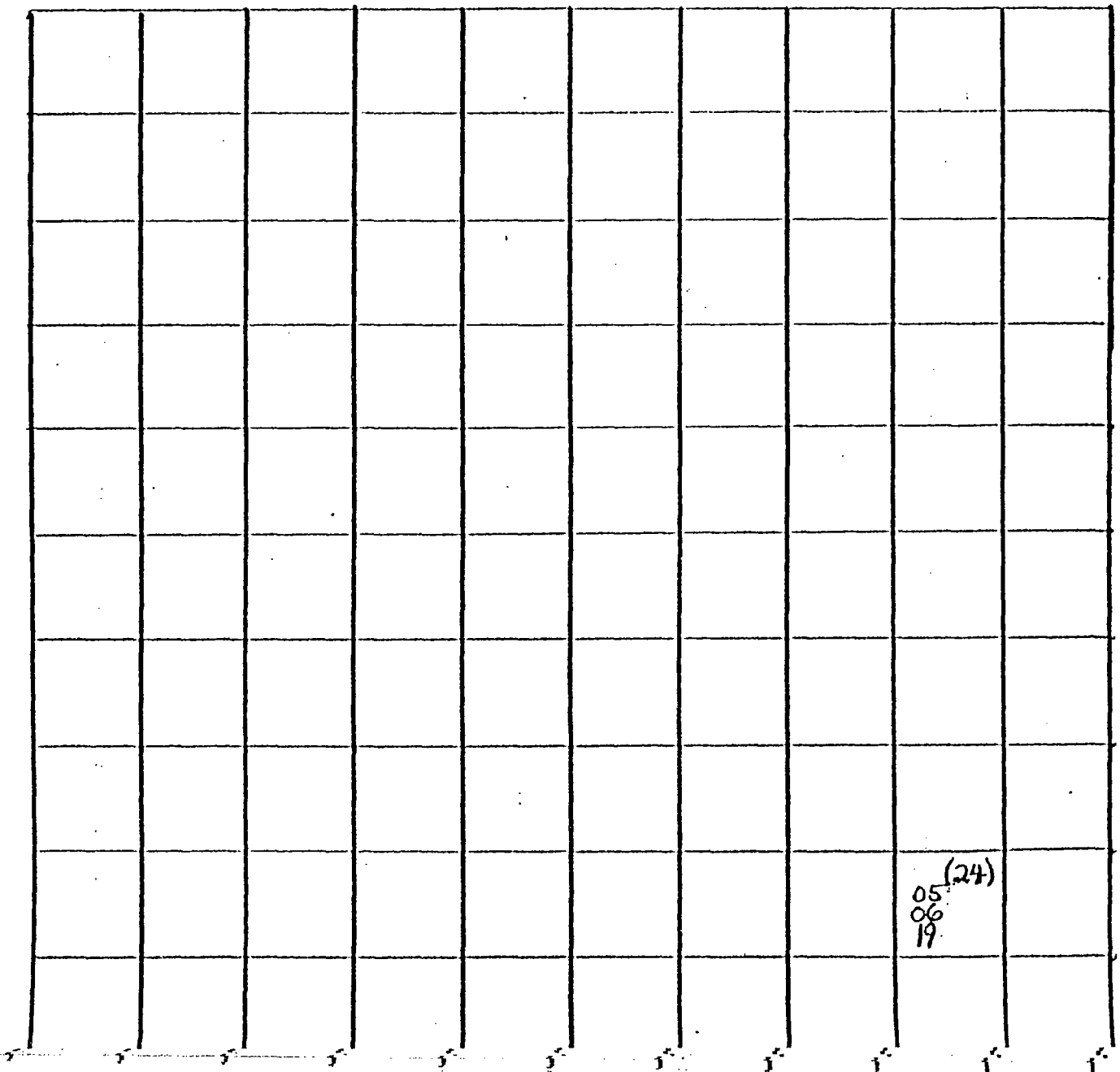
Location
25, AA
Group 1



18

Location
21, I

Group 1



Location
24, R

Group 1

				19 (29) 25 26					

Location

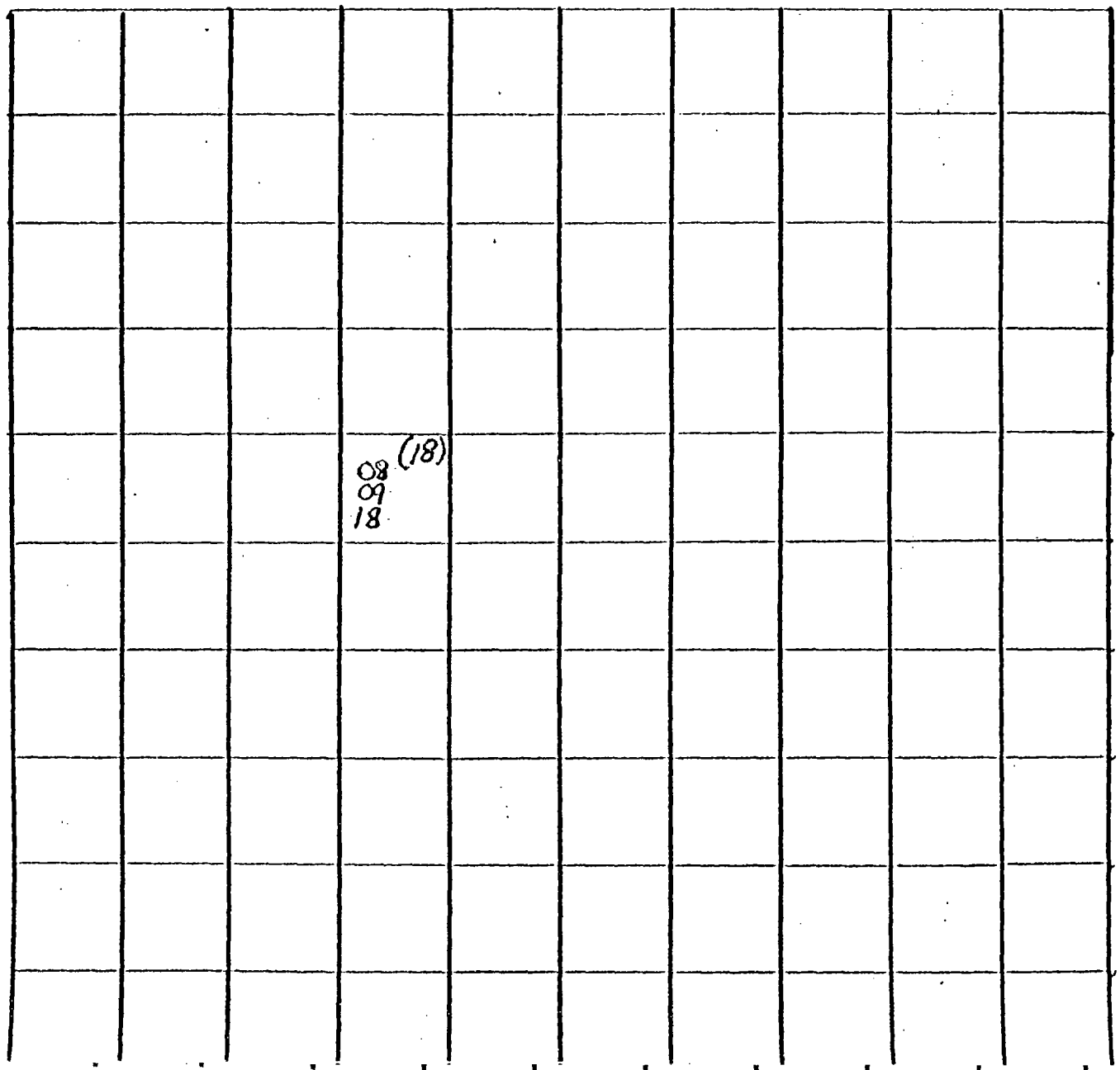
6, N

Group 2

03 (16)
08
13

Location
15, U

Group 2



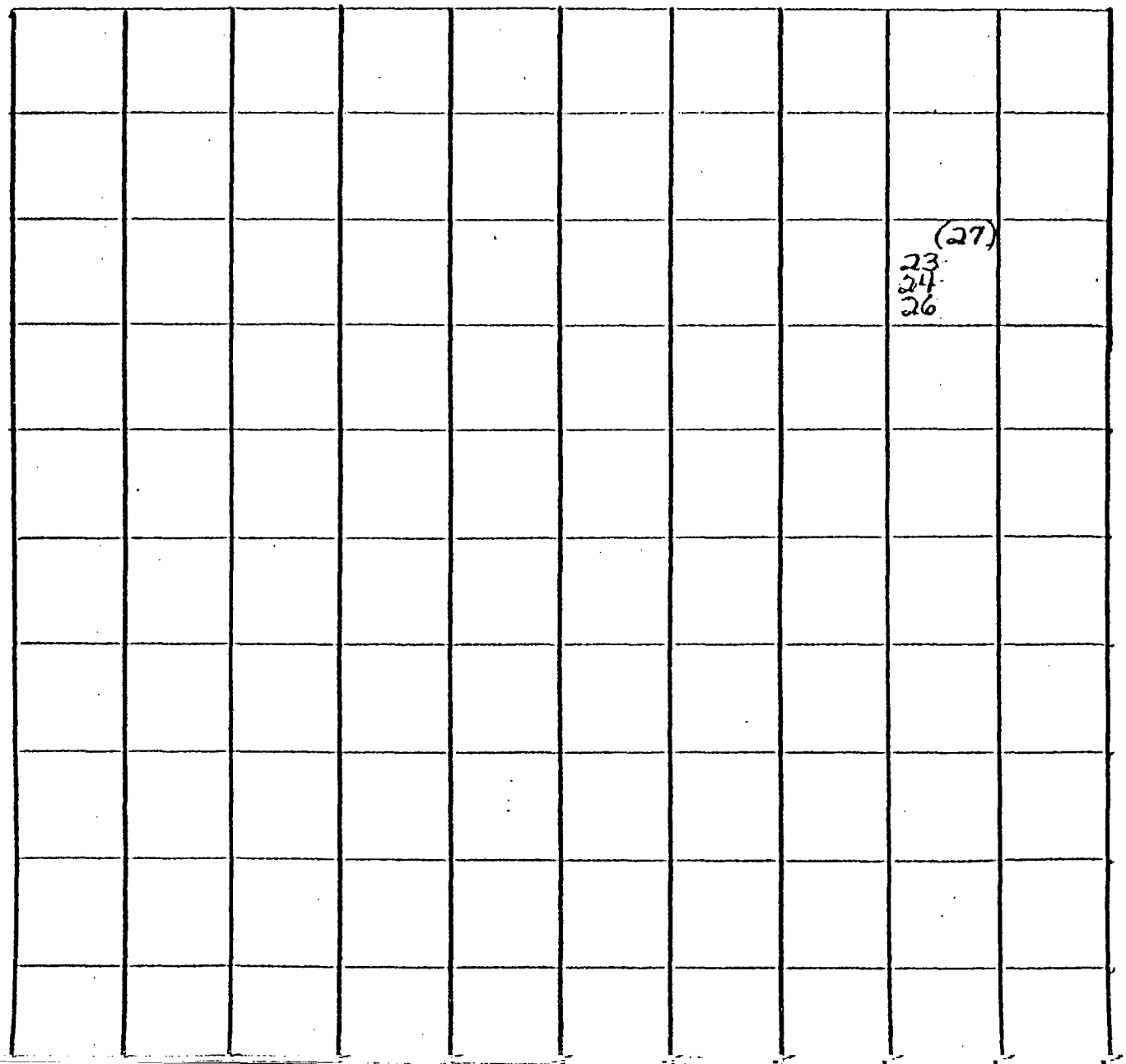
Location
9, Q

Group 2

									03 (17) 04 14

31, J

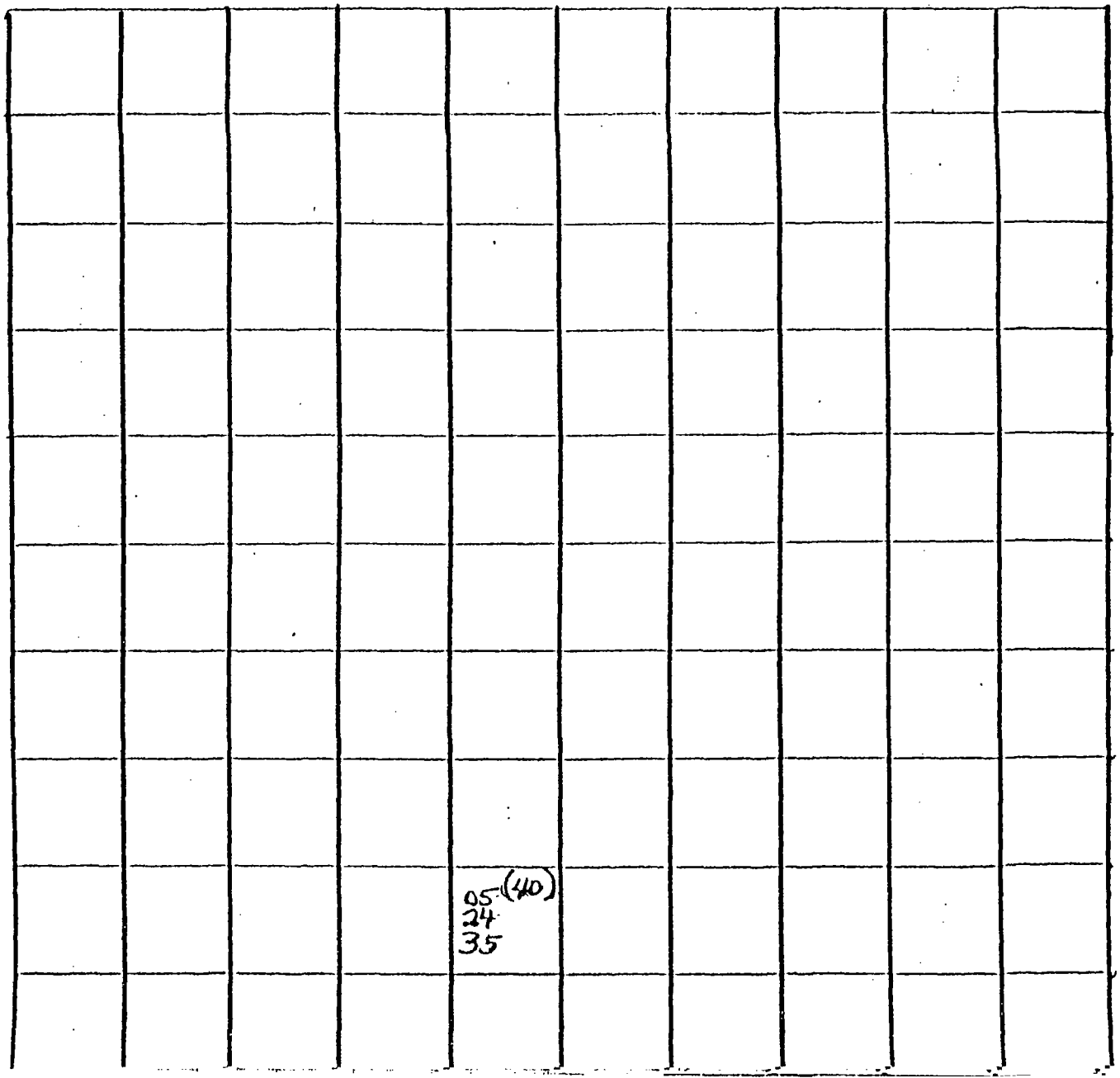
Group 2



Location

27, F

Group 2



Location
16, D

Group 2

08 (15)
11
14

19.C

Group 2

		14 (27) 15 19							

29, R

Group 2

04 (32)
09
21

26, H

Group 2

(47)
23
33
41

Location
23, Q
Group 2

			06 (25) 08 21						

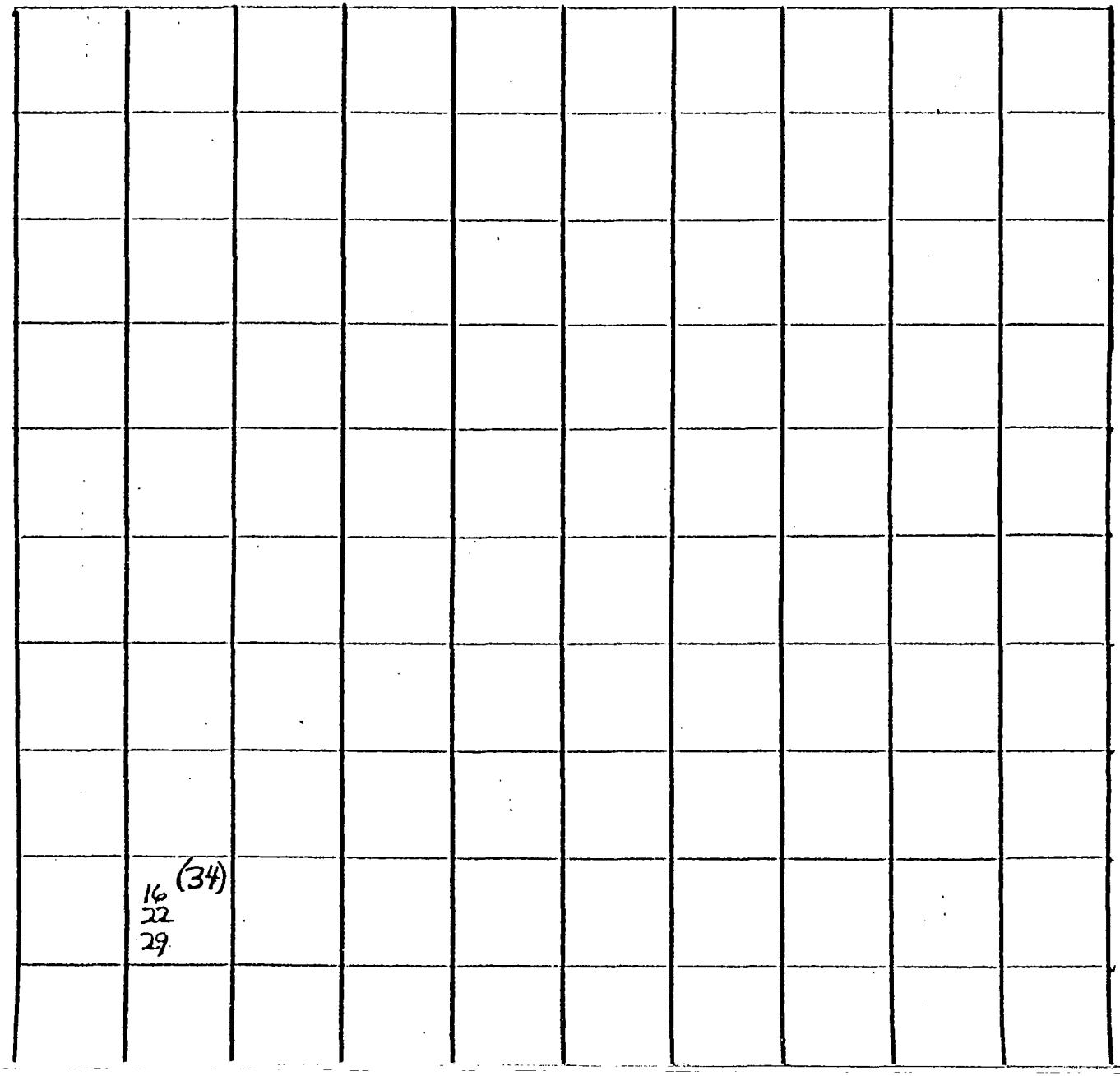
33,T

Group 2

(23)
04
13
19

Location
30, 0

Group 2



1, P
Location

Group 2

	04 (9) 06 09								

Location
7,T

Group 2

			18 (28) 22 24						

Location

29, Z

Group 2

	03 (6) 04 05								

Location

24, W

Group 2

					01 02 17 (34)				

Location
30, K

Group 2

					01 (36) 09 27				

Location
30, V

Group 2

								18 (35)	
								21	
								25	

Lecture
30.T

Group 2

						02 (3.5) 04 09.			

APPENDIX B

Results of Laboratory Tests

RKSTATION 14 - USER JOE - MCKELL, EL 228MC

9:44:52 AM TUESDAY FEBRUARY 26, 1985

```
*****************************************************************************
****          1         2         3         4         5         6         7         8 ****
**** 12345678901234567890123456789012345678901234567890123456789012345678901234567890 ****
*****************************************************************************
*  *                                                                        *  *
* 1*                    * * *  CHEMETCO DUMP SLAG  * * *                   * 1*
* 2*                       REPRESENTATIVE SAMPLING                          * 2*
* 3*                     "EP TOX"  ANALYTICAL RESULTS                       * 3*
* 4*                                                                        * 4*
* 5*          LOCATION      COORDINATES      LEAD (UG/L)    CADMIUM (UG/L)   * 5*
* 6*             1           25 E  1          1.020           .133         * 6*
* 7*             1           25 E  2           .013           .032         * 7*
* 8*             1           25 E  3           .029           .020         * 8*
* 9*                                                                        * 9*
*10*             2           29 M  1           .325           .019         *10*
* 1*             2           29 M  2          1.210           .074         * 1*
* 2*             2           29 M  3          2.480           .038         * 2*
* 3*                                                                        * 3*
* 4*             3           23 W  1          4.130           .331         * 4*
* 5*             3           23 W  2          4.570           .368         * 5*
* 6*             3           23 W  3          4.780           .234         * 6*
* 7*                                                                        * 7*
* 8*             4           13 Q  1          2.610           .112         * 8*
* 9*             4           13 Q  2          3.408           .084         * 9*
*20*             4           13 Q  3           .803           .355         *20*
* 1*                                                                        * 1*
* 2*                                                                        * 2*
* 3*                    PRESS ENTER TO PAGE, PF 16 TO EXIT                  * 3*
* 4*                                                                        * 4*
*  *                                                                        *  *
*****************************************************************************
****          1         2         3         4         5         6         7         8 ****
**** 12345678901234567890123456789012345678901234567890123456789012345678901234567890 ****
*****************************************************************************
```

14112 G.B.

WORKSTATION 14 - USER JOE - MCKELL, JOEL 228MC

9:45:02 AM TUESDAY FEBRUARY 26, 1985

```
*****************************************************************************
****          1         2         3         4         5         6         7         8 ****
**** 12345678901234567890123456789012345678901234567890123456789012345678901234567890 ****
*****************************************************************************
*  *                                                                        *  *
* 1*                    * * *  CHEMETCO DUMP SLAG  * * *                   * 1*
* 2*                       REPRESENTATIVE SAMPLING                          * 2*
* 3*                     "EP TOX"  ANALYTICAL RESULTS                       * 3*
* 4*                                                                        * 4*
* 5*          LOCATION     COORDINATES     LEAD (UG/L)   CADMIUM (UG/L)      * 5*
* 6*             5          25 L  1          .348          .055             * 6*
* 7*             5          25 L  2          .001          .013             * 7*
* 8*             5          25 L  3         1.180          .063             * 8*
* 9*                                                                        * 9*
*10*             6          03 P  1         3.740          .539             *10*
* 1*             6          03 P  2         2.610          .335             * 1*
* 2*             6          03 P  3         4.370          .422             * 2*
* 3*                                                                        * 3*
* 4*             7          22 X  1         4.530          .362             * 4*
* 5*             7          22 X  2          .784          .115             * 5*
* 6*             7          22 X  3         1.070          .106             * 6*
* 7*                                                                        * 7*
* 8*             8          24 E  1         1.607          .001             * 8*
* 9*             8          24 E  2         3.620          .077             * 9*
*20*             8          24 E  3          .001          .062             *20*
* 1*                                                                        * 1*
* 2*                                                                        * 2*
* 3*                    PRESS ENTER TO PAGE, PF 16 TO EXIT                  * 3*
* 4*                                                                        * 4*
*  *                                                                        *  *
*****************************************************************************
****          1         2         3         4         5         6         7         8 ****
**** 12345678901234567890123456789012345678901234567890123456789012345678901234567890 ****
*****************************************************************************
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14112 G.B.
14112 G.B.

RKSTATION 14 - USER JOE - MCKELL, L 223MC

9:45:13 AM TUESDAY FEBRUARY 26, 1985

```
*****************************************************************************
****          1         2         3         4         5         6         7         8 ****
**** 12345678901234567890123456789012345678901234567890123456789012345678901234567890 ****
*****************************************************************************
*  *                                                                        *  *
* 1*                    * * *  CHEMETCO DUMP SLAG  * * *                    * 1*
* 2*                         REPRESENTATIVE SAMPLING                         * 2*
* 3*                       "EP TOX"  ANALYTICAL RESULTS                      * 3*
* 4*                                                                        * 4*
* 5*          LOCATION     COORDINATES     LEAD (UG/L)    CADMIUM (UG/L)      * 5*
* 6*             9          07 O  1          .846           .169             * 6*
* 7*             9          07 O  2         3.590           .350             * 7*
* 8*             9          07 O  3          .230           .217             * 8*
* 9*                                                                        * 9*
*10*            10          32 T  1          .233           .043             *10*
* 1*            10          32 T  2         3.990           .101             * 1*
* 2*            10          32 T  3          .851           .036             * 2*
* 3*                                                                        * 3*
* 4*            11          07 M  1         2.530           .039             * 4*
* 5*            11          07 M  2          .206           .057             * 5*
* 6*            11          07 M  3          .001           .061             * 6*
* 7*                                                                        * 7*
* 8*            12          24 G  1          .853           .018             * 8*
* 9*            12          24 G  2          .477           .036             * 9*
*20*            12          24 G  3          .381           .028             *20*
* 1*                                                                        * 1*
* 2*                                                                        * 2*
* 3*                    PRESS ENTER TO PAGE, PF 16 TO EXIT                  * 3*
* 4*                                                                        * 4*
*  *                                                                        *  *
*****************************************************************************
****          1         2         3         4         5         6         7         8 ****
**** 12345678901234567890123456789012345678901234567890123456789012345678901234567890 ****
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14112 G.B.
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WORKSTATION 14 - USER JOE - MCKELL, JOEL 228MC

9:45:25 AM TUESDAY FEBRUARY 26, 1985

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****          1         2         3         4         5         6         7         8 ****
**** 12345678901234567890123456789012345678901234567890123456789012345678901234567890 ****
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*  *                                                                        *  *
* 1*                    * * *  CHEMETCO DUMP SLAG  * * *                    * 1*
* 2*                        REPRESENTATIVE SAMPLING                          * 2*
* 3*                      "EP TOX"  ANALYTICAL RESULTS                       * 3*
* 4*                                                                        * 4*
* 5*          LOCATION      COORDINATES      LEAD (UG/L)    CADMIUM (UG/L)    * 5*
* 6*             13          11 X  1          4.370           .962          * 6*
* 7*             13          11 X  2          2.610           .221          * 7*
* 8*             13          11 X  3          1.210           .068          * 8*
* 9*                                                                        * 9*
*10*             14          28 K  1          1.202           .510          *10*
* 1*             14          28 K  2           .687           .033          * 1*
* 2*             14          28 K  3          1.090           .240          * 2*
* 3*                                                                        * 3*
* 4*             15          34 Q  1          1.530           .018          * 4*
* 5*             15          34 Q  2          1.920           .012          * 5*
* 6*             15          34 Q  3           .975           .009          * 6*
* 7*                                                                        * 7*
* 8*             16          27 O  1          2.019           .127          * 8*
* 9*             16          27 O  2          1.850           .071          * 9*
*20*             16          27 O  3           .471           .064          *20*
* 1*                                                                        * 1*
* 2*                                                                        * 2*
* 3*                    PRESS ENTER TO PAGE, PF 16 TO EXIT                  * 3*
* 4*                                                                        * 4*
*  *                                                                        *  *
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****          1         2         3         4         5         6         7         8 ****
**** 12345678901234567890123456789012345678901234567890123456789012345678901234567890 ****
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14112 G.B.
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WORKSTATION 14 - USER JOE - MCKELL, JOEL 228MC

9:45:37 AM TUESDAY FEBRUARY 26, 1985

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*****************************************************************************
*  *                                                                        *  *
* 1*                    * * *  CHEMETCO DUMP SLAG  * * *                   * 1*
* 2*                       REPRESENTATIVE SAMPLING                          * 2*
* 3*                     "EP TOX"  ANALYTICAL RESULTS                       * 3*
* 4*                                                                        * 4*
* 5*          LOCATION      COORDINATES      LEAD (UG/L)    CADMIUM (UG/L)   * 5*
* 6*             17          26 K  1          .722           .057           * 6*
* 7*             17          26 K  2          .237           .045           * 7*
* 8*             17          26 K  3          .958           .036           * 8*
* 9*                                                                        * 9*
*10*             18          25 AA 1         1.410           .437           *10*
* 1*             18          25 AA 2         3.570           .591           * 1*
* 2*             18          25 AA 3          .001           .090           * 2*
* 3*                                                                        * 3*
* 4*             19          21 I  1         3.080           .043           * 4*
* 5*             19          21 I  2          .133           .029           * 5*
* 6*             19          21 I  3          .001           .022           * 6*
* 7*                                                                        * 7*
* 8*             20          24 R  1         1.180           .078           * 8*
* 9*             20          24 R  2         1.130           .113           * 9*
*20*             20          24 R  3          .136           .037           *20*
* 1*                                                                        * 1*
* 2*                                                                        * 2*
* 3*                  PRESS ENTER TO PAGE, PF 16 TO EXIT                    * 3*
* 4*                                                                        * 4*
*  *                                                                        *  *
*****************************************************************************
****          1         2         3         4         5         6         7         8 ****
**** 12345678901234567890123456789012345678901234567890123456789012345678901234567890 ****
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Location
22, H
Group 2

					03 26 28 (29)				

eptoxsla

CHEMETCO INC
HARTFORD IL
EP-TOXICITY RESULTS
SLAG

SAMPLE DESCRIPTION	LEAD (ppm)	CADMIUM (ppm)	PIT NO.
2/12-2/15	2.73	0.021	
2/17-2/15	1.12	0.003	
2/24-3/1	2.92	0	
3/3-3/7	3.31	0.093	
3/10-3/13	2.48	0.042	
3/17-3/21	0.984	0.003	
QUENCH 662	0	0.037	
UNQUENCH 662	0.026	0.005	
QUENCH 931	1.65	0.024	
UNQUENCH 931	0.24	0	
QUENCH 74	0.707	0.09	
UNQUENCH 74	0.2	0.004	
QUENCH 934	0	0.007	
UNQUENCH 934	0	0	
QUENCH 941	0.005	0.016	
UNQUENCH 941	1.24	0.005	
QUENCH 605	0.236	0.013	
UNQUENCH 605	0	0.006	
QUENCH 613	0.136	0.098	
UNQUENCH 613	0.037	0.011	
QUENCH 868	0.286	0.027	
UNQUENCH 868	1.31	0.011	
QUENCH 45	0.084	0.071	
UNQUENCH 45	0	0.006	
QUENCH 610	0	0.013	
UNQUENCH 610	0.352	0.005	
QUENCH 877	0	0.021	
UNQUENCH 877	0.247	0	
QUENCH 867	0	0	
UNQUENCH 867	NO SAMPLE	NO SAMPLE	
QUENCH 662	0	0.037	
UNQUENCH 662	0.028	0.005	
QUENCH 668	0.177	0.011	
UNQUENCH 668	0.103	0	
QUENCH 675	0.162	0.021	
UNQUENCH 675	0.06	0	
QUENCH 925	0	0.005	
UNQUENCH 925	1.14	0	
QUENCH 608	1.37	0.012	
UNQUENCH 608	NO SAMPLE	NO SAMPLE	
QUENCH 609	2.45	0	
UNQUENCH 609	NO SAMPLE	NO SAMPLE	
QUENCH 872	0.407	0.038	
UNQUENCH 872	0.141	0	
QUENCH 846	2.69	0.073	
UNQUENCH 846	0.701	0.005	
UNQUENCH 932	1.64	0	

UNQUENCH 75	¦	0.093	0.02
PIT SLAG #1 4/18	¦	1.24	0
PIT SLAG #2 4/21	¦	0	0.019
PIT SLAG #2 5/7	¦	0.026	0
PIT SLAG #3 4/25	¦	0.098	0.025
PIT #1 4/30	¦	0.076	0
PIT #3 5/5	¦	0.096	0
PIT #1 5/19-20	¦	3.34	0.095
PIT #2 5/15	¦	1.8	0
PIT #1 5/12-13	¦	1.84	0
PIT #3 5/9	¦	1.88	0
PIT #2 5/22	¦	1.21	0.03
PIT #2 5/28	¦	2.45	0.005
PIT #3 5/31	¦	4.61	0
PIT #1 6/2	¦	4.06	0.003
PIT #2 5/6	¦	12	0.076
PIT #3 6/9	¦	3.77	0.003
PIT #1 A 6/12	¦	2.81	0
PIT #1 B 6/12	¦	1.71	0
PIT #3 6/23	¦	2.87	0.051
PIT SLAG 7/9	¦	0	0.049
PIT SLAG 7/10	¦	0	0.007
PIT #2 71	¦	1.2	0.026
PIT #2 7/2-3	¦	2.01	0.026
PIT #3 7/3	¦	4.06	0.016
PIT #1 7/7	¦	2.14	0
PIT SLAG 7/15	¦	1.85	0
PIT SLAG 7/14	¦	4.69	0.09
PIT SLAG 7/16	¦	1.48	0.04
PIT SLAG 7/21	¦	1.26	0.031
PIT SLAG 7/23	¦	1.28	0.022
PIT #3 7/7	¦	1.07	0.037
PIT SLAG 7/24	¦	0.637	0.01
PIT SLAG 7/23	¦	4.79	0.031
PIT #2 7/9	¦	3.04	0.01
PIT SLAG 7/28	¦	8.9	0.007
PIT SLAG 7/25	¦	1.42	0.054
PIT SLAG 7/29	¦	1.97	0.026
PIT SLAG 7/30	¦	0.869	0.008
PIT SLAG 7/28		0.453	0.007
PIT SLAG 8/5	¦	0.406	0.008
PIT SLAG 8/6	¦	0.991	0.083
PIT SLAG 8/11	¦	1.79	0.014
PIT SLAG 8/12	¦	1.87	0.009
PIT SLAG 8/13	¦	2.16	0.026
PIT SLAG 8/1	¦	0.912	0
PIT SLAG 8/4	¦	0	0
PIT SLAG 8/7-8	¦	0	0
PIT SLAG 8/12	¦	0.045	0.021
PIT SLAG 8/14	¦	1.6	0
PIT SLAG 8/15	¦	1.18	0
GRANULATED NASSAU	¦	0.483	0.167
PIT SLAG 8/18-19	¦	0.483	0.038
PIT SLAG 8/20	¦	0.095	0.015
PIT SLAG 8/23	¦	0.154	0.029
PIT SLAG 8/25	¦	0.233	0.005

PIT SLAG 8/27	0.416	0.024
PIT 9/8-9 EP	0.86	
PIT 9/2 EP	3.59	
GRAN 9/11 EP	0.322	
SLAG 6/23-24	1.05	0.024
SLAG 6/26-27	2.78	0.012
SLAG 7/9	0.95	0.01
SLAG 7/10	1.73	0.019
GRAN 9/9	0.012	0
PIT 8/29	0.014	0
GRAN EP BSC 2-818	1.71	0.084
GRAN EP BCS 1-678	3.48	0.005
GRAN EP BCS 3-206	0.01	0.055
GRAN EP 4-89	2.35	0.055
PIT 9/19 EP	0.984	0.067
PIT 9-11 EP	2.05	0.005

Southern Agri·Minerals
Corporation

September 4, 1986

Mr. Jim Roberts
Chemetco
P. O. BOX 187
Alton, Ill. 62002

Dear Jim:

It was a pleasure to meet with you and Denis and plan for the production and sale of your furnace slag as granulated copper slag. Also, I enjoyed the trip with you to Pawnee to inspect the new technical plant there which produces shingle granules from boiler slag. We have begun construction of a similar (but smaller) plant in Alabama which we expect to be in production by the first of 1987.

I have taken the samples you have sent me to three abrasive companys and three shingle companys. Judging from there response, I have no doubt that we can move all of the slag of this quality that you can produce up to 100,000 net tons per year. This, of course, is assuming that the price is competitive and that the major portion of this material would be shipped by barge.

It may be a little premature, but I am enclosing a draft of a sales contract similar to the ones we have negotiated with Southwire, Nassau, and Tennessee Copper for you consideration.

Sincerely,

Eric

Eric G. McGee
Chief Executive Officer

EGM/emm
Encl.

P.S. I timed my call on GAF in New Jersey to see the Alabama/ Ohio State game. Alabama looked a little shakey but Mike Shular pulled it out in the 4th Qtr. Yea! Yea!

Industrial Park • P.O. Box 8 • Hartford, Alabama 36344 • (205) 588-3210

Southern Agri-Minerals Corporation

SALES AGREEMENT

Southern Agri-Minerals Corporation desires to purchase and Chemetco, Inc., desires to sell all of the copper furnace granules (granulated slag) produced at the Alton, Illinois division of Chemetco.

MATERIAL: Granulated copper slag, wet screened to approximate size of minus 8 mesh plus 40 mesh. (U.S. Std.) Chemistry of slag shall be average as currently produced at Chemetco's Alton Plant, with following limitations:

	WEIGHT %	
	LOW	HIGH
Cu	.12	.91
Fe	19	43
Pb	.18	.2
Sn	.06	.50
SiO_2	27	35
CuO	2	6
Al_2O_3	3	10

No warranties, expressed or implied, are made by Chemetco.

QUANTITY: All available production specified above. Estimated as approximately 75,000 net tons per year.

DELIVERY: F.O.B. rail cars at Hartford, Illinois (rail address) or F.O.B. Barge closest available river loading point. Freight RR or Barge collect to buyer.

PRICE: _____ per N.T. FOB rail cars at Hartford Plant, and _____ per N.T. FOB Barge. (Price to be negotiated.)

CONTRACT PERIOD: Contract shall be in effect for three years from date of first shipment or January 1, 1987 thru December 31, 1989.

CONTRACT EXTENSION: Unless written notice is given by either party 90 days prior to the term of this contract, the contract will automatically be extended for successive two year periods at a renegotiated price agreed to by both parties.

Industrial Park • P.O. Box 8 • Hartford, Alabama 36344 • (205) 588-3210

CHEMETCO INC.
HARTFORD, IL.

III. ZINC OXIDE MANAGEMENT

Zinc oxide is the primary product of Chemetco's zinc oxide production process. It is sold to customers for use in a number of different applications, but primarily for use as a feedstock in a process for the production of zinc or zinc chemicals or in a process for the recovery of other metals. Thus, the zinc oxide produced by Chemetco should not be considered a "hazardous waste" because it is not a solid waste within the meaning of RCRA or the Illinois Hazardous Waste Management Regulations.

Chemetco's converters are operated in four process modes: smelting, refining, slag treatment and slag refining. Particulate emissions from these operations are captured by snorkel hoods and ducted to wet scrubbers for cleaning before being exhausted to the atmosphere through stacks. The wet scrubbers collect zinc oxide, which is dewatered by a filter press. The zinc oxide is contained in steel boxes waiting for loading in trucks, or containers. As discussed below, Chemetco has developed markets for this material and anticipates that its inventory of zinc oxide will gradually be reduced.

A. Current and Future Zinc Oxide Production

All of Chemetco's current production of zinc oxide is sold for immediate delivery to customers in the United States or Europe. The zinc oxide generated by Chemetco is used or

B. Existing Zinc Oxide Inventory

As a primary product of Chemetco's zinc oxide production process, the zinc oxide currently held in inventory in the zinc oxide storage bunker should not be subject to regulation under RCRA. Moreover, since this zinc oxide will be sold strictly for recycling and recovery of metals, it is not subject to regulation as a hazardous waste.

If for any reason, the zinc oxide held in inventory by Chemetco were determined to constitute a hazardous waste, Chemetco would apply to the Illinois Pollution Control Board for a determination under 35 Il. Adm. Code 720.130 through 720.133 that the zinc oxide is not a solid waste based on the grounds set forth in the remainder of this discussion.

The World Zinc Market was depressed for a considerable period, and Chemetco was unable to find buyers for its zinc oxide for almost three years. As a result, a substantial quantity of zinc oxide accumulated between October 1982 and July 1985, prior to the effective date of EPA's revised definition of solid waste. During this period, Chemetco constructed a concrete storage bunker to minimize the loss of zinc oxide, and zinc oxide was moved from the production unit and placed in the concrete storage bunker.

The zinc oxide that is presently stored in the concrete bunker consists of three fractions: 1) Uncontaminated zinc oxide; 2) zinc oxide mixed with dirt; 3) zinc oxide mixed with slag. Chemetco intends to separate the dirt and

slag before the zinc oxide is sold to zinc or zinc chemical producers. The washed dirt and washed slag will be used or disposed of in accordance with all applicable Illinois and federal regulations.

Chemetco has worked with Amax Zinc on a purification method for zinc solutions produced by Chemetco. These solutions would be electrodeposited at Amax Zinc to produce prime zinc metal. This project has been reopened for further study. Chemetco is studying with Berzelius of Germany, the application of the Berzelius reduction process in a walz furnance, to the zinc oxide produced by Chemetco. Those tests will serve as a base for a feasibility study for Chemetco to treat its accumulation of zinc oxide within a much shorter period and open possibilities for extracting pure metal from complex oxides.

Smaller quantities of zinc oxide are reclaimed directly by Chemetco. Some of the zinc oxide is resmelted for the recovery of metals. The estimated volume of zinc oxide which is resmelted would be a maximum of 350 tons/month. In the process of producing the zinc sulfate solution for sale, Chemetco is able to extract copper which can be readily resmelted at its facility. Chemetco anticipates that it will be able to reduce the existing zinc oxide stockpile by more than 500 tons/month.

Reason for Accumulation:

As noted above, the accumulation of zinc oxide resulted in large part from a depressed world zinc market. Chemetco was unable to sell significant quantities of zinc oxide between October 1982 and July 1985. Chemetco has compiled bibliography references to articles in trade periodicals that confirm the depressed zinc market. These are attached hereto as Exhibit E.

Quantity Accumulated:

Chemetco estimates that approximately 45,000 tons of zinc oxide has been accumulated. Approximately 350 tons are generated per month. Since Chemetco is shipping all of its current production and anticipates continuing to develop sales to more zinc oxide consumers, there will be a significant reduction of the stockpile. Once the stockpile is eliminated, Chemetco will only accumulate zinc oxide generated over a thirty day period in order to provide for economical transportation.

Material Handling to Minimize Loss:

Chemetco has taken a number of steps to minimize the loss of zinc oxide. Chemetco constructed a large concrete bunker for storage of zinc oxide in order to prevent mixture of zinc oxide with soil. Chemetco instituted a pumping system from the filter press to the storage area in order to minimize handling losses. Chemetco also periodically wets zinc oxide in the bunker to prevent loss of product. Chemetco is examining

the possibility of using surfactants other than water, but has not yet found a surfactant which does not make the zinc oxide more difficult to handle and reclaim.

Time of Variance:

Chemetco will request that a variance be granted for a period of one year, subject to renewal.

Conclusion:

For the reasons set forth above, Chemetco believes that its request for a variance should be granted if it is determined as a result of its discussions with IEPA and USEPA that the zinc oxide produced by Chemetco will otherwise be considered a hazardous waste subject to regulation under the RCRA regulations.

Exhibits

Exhibit A - Documents concerning Chemetco's sale of zinc oxide to AMAX Lead & Zinc, Inc.

Exhibit B - Documents concerning Chemetco's sale of zinc sulfate solution to Eagle Picher Company

Exhibit C - Contract between Chemetco and Exmet of Kentucky

Exhibit D - Containers for Europe (Concorde Metals)

Exhibit E - Bibliographic references from American Metal Market concerning zinc market

Exhibits

Exhibit A - Documents concerning Chemetco's sale of Zinc Oxide to AMAX Lead & Zinc, Inc.

Exhibit B - Documents concerning Chemetco's sale of Zinc Sulfate solution to Eagle Picher Co.

Exhibit C - Contract between Chemetco and Exmet of Kentucky

Exhibit D - Sales contracts between Chemetco and Concorde Metals Corp.

Exhibit E - Bibliographic references from American Metal Market concerning zinc market

AMAX
LEAD & ZINC, INC.
A Subsidiary of AMAX INC.

7733 Forsyth Boulevard, Suite 600
Clayton, Missouri 63105
Telephone (314) 862-9700

August 29, 1980

Chemetco
P.O. Box 187
Alton, Illinois 62002

Attention: Mr. Jim Roberts

Gentlemen:

As discussed in your office on August 27, 1980, AMAX Zinc Company is interested in purchasing, on a continuing basis, Chemetco's entire production of zinc-bearing dust. The product will be in accordance with the truckload sample recently submitted assaying approximately 40 percent zinc. Chemetco will do its utmost to deliver material averaging 40 percent on a monthly basis.

The price will be 2.5 cents per pound of material (dry basis) F.O.B. delivered to AMAX's plant at Sauget, Illinois.

AMAX's weights, assays and moisture determination will be final. AMAX Zinc Company will account for the material during the month following month of arrival at Sauget.

Delivery of the initial truckload and subsequent monthly rate of shipment, if any, will be arranged in accordance with instructions issued by the AMAX Zinc Company.

In view of the uncertainty regarding the actual assays of the material and the metallurgical effect on AMAX's Sauget refinery, AMAX reserves the right to discontinue the purchase of the zinc-bearing material at any time with no liability.

AMAX Zinc Company will also attempt to purchase, on a mutually agreeable shipment basis, the approximately 3000 tons of zinc-bearing material currently stockpiled at Chemetco.

If the foregoing is in accordance with your understanding, please sign and return one copy of this agreement.

Very truly yours,

AMAX LEAD & ZINC, INC.

R. Valentino

R. Valentino

Accepted by:

Jim Roberts 9/2/80

Chemetco

AMAX ZINC COMPANY, INC.

SAUG ILLINOIS

ERTIFICATE

Smelter Lot No. 16 Sample No.

) Material Zn Sludge Shipper Lot No. Date

MBER	B/L WEIGHT	FREIGHT CHARGES PREPAID	ACTUAL	REF./ADJ.	COND. OF CAR	OUR TRACK SCALES WEIGHT GROSS	TARE	NET	MOIS-TURE %	NET DRY WEIGHT
24		$	$	$		46680	18600	28080	47.4	14770
25						46500	18680	27820	"	14633
26						48600	18900	29700	"	15622
27						44980	18280	26700	"	14044
28						71760	29960	41800	49.3	21193
29						74760	30480	44280	"	22450
30						70680	29500	41180	49.3	20878
31						72620	30260	42360	49.0	21604
32						73600	32500	41100	49.0	20961
33						72320	29480	42840	"	21848
OTALS		$	$	REF. $ ADJ. $		622500	256640	365860		188003

ITIONS

( ) GENERALLY GOOD ( ) ABNORMAL:

ASSAY BY	Zn	Fe	Pb	CaO	MgO	Insol.	Cd	S	Cu	SiO_2	As	Sb	Bi			Oz. Au	Oz. Ag
SHIPPER																	
SMELTER																	
UMPIRE																	
SETTLEMENT																	
TOTAL CONTENTS																	
UMPIRE CHGE. & ACCT.																	

NOTES:

Sandra L Owens

COPY FOR: CUSTOMER - ORIGINAL

FORM 6B REV.

AMAX ZINC COMPANY, INC.

SAUG ILLINOIS

ASSAY AND WEIGHT CERTIFICATE

Smelter Lot No. 24 Sample No.

Shipper Chemetco Material Zn Sludge Shipper Lot No. Date

ENTRY NO.	~~XX~~ Plant ARRIVAL	CAR INITIAL	CAR NUMBER	B/L WEIGHT	FREIGHT CHARGES PREPAID	FREIGHT CHARGES ACTUAL	FREIGHT CHARGES REF./ADJ.	COND. OF CAR	OUR TRACK SCALES WEIGHT GROSS	TARE	NET	MOISTURE %	NET DRY WEIGHT
					$	$	$						
	9/2/82			37420					68220	30800	37420	46.2	20132
	9/2/82			37980					68020	30240	37780	46.2	20326
	9/3/82			42680					73180	34000	39180	47.2	20687
	9/8/82			36220					69580	38240	31340	50.2	15607
	9/8/82			32020					70020	38180	31840	50.2	15856
	9/9/82			33680					71780	39300	32480	49.0	16565
	9/9/82			32800					71860	38480	33380	49.0	17024
	9/10/82			37560					75640	39600	36040	50.6	17804
	9/10/82			21740					61280	32740	28540	50.6	14099
	9/13/82								36160	35320	840	44.0	470
			TOTALS	312100	$	$	REF. $ ADJ. $		665740	356900	308840		158570

NOTES ON WEATHER CONDITIONS
( ) GENERALLY GOOD ( ) ABNORMAL:

ASSAY BY	Zn	Fe	Pb	CaO	MgO	Insol.	Cd	S	Cu	SiO_2	As	Sb	Bi			Oz. Au	Oz. Ag
SHIPPER																	
SMELTER																	
UMPIRE																	
SETTLEMENT																	
TOTAL CONTENTS																	
UMPIRE CHGE. & ACCT.																	

NOTES:

COPY FOR: CUSTOMER - ORIGINAL

FORM 48 REV.

AMAX ZINC COMPANY, INC.

SAUG[illegible]LLINOIS

ASSAY AND WEIGHT CERTIFICATE J. Roberts

Smelter Lot No. 7 Sample No. _____

Shipper Chemetco Material Zn Sludge Shipper Lot No. _____ Date _____

ENTRY NO.	PLANT XXXXXX	CAR INITIAL	CAR NUMBER	B/L WEIGHT	FREIGHT CHARGES PREPAID	FREIGHT CHARGES ACTUAL	FREIGHT CHARGES REF./ADJ.	COND. OF CAR	OUR TRACK SCALES WEIGHT GROSS	TARE	NET	MOISTURE %	NET DRY WEIGHT
	5-3-82			36860	$	$	$		76020	44960	31060	54.7	14070
	"			40000					73920	32680	41240	54.7	18682
	"			39540					72020	32580	39440	54.7	17866
	5-4-82			38840					71480	34440	37040	38.5	22780
	"			40480					74760	34560	40200	38.5	24723
	"			39300					75180	34880	40300	38.5	24785
	5-7-82			36740					71260	36540	34720	44.5	19270
	"			40640					77260	36200	41060	44.5	22788
	"			35840					71860	36760	35100	34.9	22850
	5-10-82			35680					71780	29340	42440	42.5	24403
			TOTALS	383920	$	$	REF. $ ADJ. $		735540	352940	382600		212217

NOTES ON WEATHER CONDITIONS
( ) GENERALLY GOOD ( ) ABNORMAL:

ASSAY BY	Zn	Fe	Pb	CaO	MgO	Insol.	Cd	S	Cu	SiO_2	As	Sb	Bi			Oz. Au	Oz. Ag
SHIPPER																	
SMELTER																	
UMPIRE																	
SETTLEMENT																	
TOTAL CONTENTS																	
UMPIRE CHGE. & ACCT.																	

NOTES:

Sandra L. Owens

COPY FOR: CUSTOMER - ORIGINAL

ORM 66 RF

AMAX ZINC COMPANY, INC.

SAUGET, ILLINOIS

April '82

ASSAY AND WEIGHT CERTIFICATE

Smelter Lot No. 3 Sample No.

Shipper Chemetco Material Zn Sludge Shipper Lot No. Date

TRY NO.	XX. PLANT ARRIVAL	XXX TRUCK INITIAL	XXX TRUCK NUMBER	B/L WEIGHT	FREIGHT CHARGES PREPAID	FREIGHT CHARGES ACTUAL	FREIGHT CHARGES REF./ADJ.	COND. OF CAR	OUR TRACK SCALES WEIGHT GROSS	OUR TRACK SCALES WEIGHT TARE	OUR TRACK SCALES WEIGHT NET	MOIS-TURE %	NET DRY WEIGHT	
					$	$	$							
	4/14/82		20	34420					71720	39140	32580	41.5	19059	
	4/15/82		21	36940					76200	34380	41820	45.0	23001	
	"		22	39780					73960	35820	38140	45.0	20977	
	"		23	36540					72100	35000	37100	45.0	20405	
	4/20/82		24	41640					72300	33000	39300	46.5	21026	
	"		25	47900					77580	30980	46600	46.5	24931	
	4/21/82		26	37240					72280	36440	35840	47.7	18744	
	"		27	40880					75080	35360	39720	47.7	20774	
	4/20/82		28	38240					71020	34420	36600	46.5	19581	
	4/21/82		29	35880					72080	35780	36300	47.7	18985	
			TOTALS	389460	$	$	REF. $ ADJ. $		734320	350320	384000		207483	

NOTES ON WEATHER CONDITIONS
( ) GENERALLY GOOD ( ) ABNORMAL:

ASSAY BY	Zn	Fe	Pb	CaO	MgO	Insol.	Cd	S	Cu	SiO_2	As	Sb	Bi			Oz. Au	Oz. Ag
UPPER																	
ELTER																	
PIRE																	
TLEMENT																	
AL CONTENTS																	
PIRE CHGE. & ACCT.																	

NOTES:

Sandra L. Owens

Sandra L. Owens

COPY FOR: CUSTOMER - ORIGINAL

FORM 68 REV.

AMAX ZINC COMPANY, INC.

SAUGET, ILLINOIS

ASSAY AND WEIGHT CERTIFICATE

J. ROBERTS

Smelter Lot No. 9 Sample No.

Shipper Chemetco Material Zn Sludge Shipper Lot No. Date

ENTRY NO.	RR PLANT ARRIVAL	~~RRX~~ TRUCK INITIAL	~~RRX~~ TRUCK NUMBER	B/L WEIGHT	FREIGHT CHARGES PREPAID	FREIGHT CHARGES ACTUAL	FREIGHT CHARGES REF./ADJ.	COND. OF CAR	OUR TRACK SCALES WEIGHT GROSS	OUR TRACK SCALES WEIGHT TARE	OUR TRACK SCALES WEIGHT NET	MOISTURE %	NET DRY WEIGHT
					$	$	$						
	8/27/81		62						71540	31800	39740	42.0	23049
	8/31/81		63						72640	30600	42040	44.7	23248
	8/28/81		64						76420	30600	45820	41.5	26805
	8/28/81		65						72600	30980	41620	48.0	21642
	8/31/81		66						72340	31720	40620	39.7	24494
	8/31/81		67						70600	31320	39280	38.6	24118
			-32										
			25 TRUCK LOADS										
			20										
			500T										
			TOTALS		$	$	REF. $ ADJ. $		436140	187020	249120		143356

NOTES ON WEATHER CONDITIONS
( ) GENERALLY GOOD ( ) ABNORMAL:

ASSAY BY	Zn	Fe	Pb	CaO	MgO	Insol.	Cd	S	Cu	SiO_2	As	Sb	Bi			Oz. Au	Oz. Ag
SHIPPER																	
SMELTER																	
EMPIRE																	
SETTLEMENT																	
TOTAL CONTENTS																	
EMPIRE CHGE. & ACCT.																	

NOTES:

COPY FOR: CUSTOMER - ORIGINAL

10/21/82

DATE	INVOICE	CONT	CUSTOMER	
9/25/82	5557.01	2700	AMAX LEAD & ZINC, INC.	SA
8/17/82	5565.00	2700	AMAX LEAD & ZINC, INC.	SA
9/25/82	5565.01	2700	AMAX LEAD & ZINC, INC.	SA
8/18/82	5570.00	2700	AMAX LEAD & ZINC. INC.	SA
9/25/82	5570.01	2700	AMAX LEAD & ZINC, INC.	SA
8/18/82	5575.00	2700	AMAX LEAD & ZINC, INC.	SA
9/25/82	5575.01	2700	AMAX LEAD & ZINC. INC.	SA
8/19/82	5577.00	2700	AMAX LEAD & ZINC. INC.	SA
9/25/82	5577.01	2700	AMAX LEAD & ZINC, INC.	SA
8/19/82	5586.00	2700	AMAX LEAD & ZINC. INC.	SA
9/25/82	5586.01	2700	AMAX LEAD & ZINC. INC.	SA
8/20/82	5597.00	2700	AMAX LEAD & ZINC. INC.	SA
9/25/82	5597.01	2700	AMAX LEAD & ZINC. INC.	SA
8/20/82	5600.00	2700	AMAX LEAD & ZINC. INC.	SA
9/25/82	5600.01	2700	AMAX LEAD & ZINC. INC.	SA
8/23/82	5608.00	2700	AMAX LEAD & ZINC. INC.	SA
9/25/82	5608.01	2700	AMAX LEAD & ZINC, INC.	SA
8/24/82	5619.00	2700	AMAX LEAD & ZINC. INC.	SA
9/25/82	5619.01	2700	AMAX LEAD & ZINC. INC.	SA
8/24/82	5623.00	2700	AMAX LEAD & ZINC, INC.	SA
9/25/82	5623.01	2700	AMAX LEAD & ZINC, INC.	SA
8/26/82	5625.00	2700	AMAX LEAD & ZINC, INC.	SA
9/25/82	5625.01	2700	AMAX LEAD & ZINC. INC.	SA
8/26/82	5633.00	2700	AMAX LEAD & ZINC, INC.	SA
9/25/82	5632.01	2700	AMAX LEAD & ZINC, INC.	SA
8/26/82	5633.00	2700	AMAX LEAD & ZINC. INC.	SA
9/25/82	5633.01	2700	AMAX LEAD & ZINC. INC.	SA
8/26/82	5638.00	2700	AMAX LEAD & ZINC. INC.	SA
9/25/82	5638.01	2700	AMAX LEAD & ZINC, INC.	SA
8/30/82	5673.00	2700	AMAX LEAD & ZINC, INC.	SA
9/25/82	5673.01	2700	AMAX LEAD & ZINC. INC.	SA
8/31/82	5695.00	2700	AMAX LEAD & ZINC. INC.	SA
9/25/82	5695.01	2700	AMAX LEAD & ZINC, INC.	SA
9/02/82	5733.00	2700	AMAX LEAD & ZINC. INC.	SA
9/03/82	5743.00	2700	AMAX LEAD & ZINC, INC.	SA
9/09/82	5762.00	2700	AMAX LEAD & ZINC, INC.	SA
9/09/82	5771.00	2700	AMAX LEAD & ZINC. INC.	SA
9/09/82	5773.00	2700	AMAX LEAD & ZINC, INC.	SA
9/09/82	5774.00	2700	AMAX LEAD & ZINC. INC.	SA
9/10/82	5785.00	2700	AMAX LEAD & ZINC, INC.	SA
9/10/82	5791.00	2700	AMAX LEAD & ZINC. INC.	SA
9/10/82	5792.00	2700	AMAX LEAD & ZINC, INC.	SA
9/17/82	5842.00	2700	AMAX LEAD & ZINC. INC.	SA
9/20/82	5851.00		AMAX LEAD & ZINC, INC.	SA
9/20/82	5854.00	2700	AMAX LEAD & ZINC, INC.	SA
9/21/82	5877.00	2700	AMAX LEAD & ZINC. INC.	SA
9/22/82	5885.00	2700	AMAX LEAD & ZINC, INC.	SA

TOTAL PREFILLS NOT INCLUDED IN ABOVE TOTAL-SALES
TOTAL PREFILLS NOT INCLUDED IN ABOVE TOTAL-TOLL

Exhibit B

WORKSTA[illegible]ON 1[illegible] - USER JOE - MCKELL, JOEL 228MC

11:41: [illegible]AM WEDNESDAY APRIL 16, 1986

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****          1         2         3         4         5         6         7         8 ****
**** 12345678901234567890123456789012345678901234567890123456789012345678901234567890 ****
*****************************************************************************************
*  *                                                                                *  *
* 1*                                 CMFIL LISTING                                  * 1*
* 2*   CMNO      CUSTOMER         SUPCOD SHIPDATE TYPE SHIP WGT   CU WGT  INV NO CONT  * 2*
* 3*   75380 EAGLE PICHER COMPAN  828    07/31/85  Z     45940           619900  3221  * 3*
* 4*   75950 EAGLE PICHER COMPAN  828    08/01/85  Z     50340           620600  3221  * 4*
* 5*   76770 EAGLE PICHER COMPAN  828    08/08/85  Z     48240           625100  3221  * 5*
* 6*   76780 EAGLE PICHER COMPAN  828    08/08/85  Z     46420           626000  3221  * 6*
* 7*   77020 EAGLE PICHER COMPAN  828    08/13/85  Z     44860           626900  3221  * 7*
* 8*   77300 EAGLE PICHER COMPAN  828    08/16/85  Z     45100           628500  3221  * 8*
* 9*   77310 EAGLE PICHER COMPAN  828    08/16/85  Z     44600           628600  3221  * 9*
*10*   77320 EAGLE PICHER COMPAN  828    08/16/85  Z      2240           628700  3221  *10*
* 1*   77460 EAGLE PICHER COMPAN  828    08/19/85  Z     45100           629600  3221  * 1*
* 2*   77470 EAGLE PICHER COMPAN  828    08/19/85  Z     45800           629700  3221  * 2*
* 3*   78390 EAGLE PICHER COMPAN  828    08/29/85  Z     44460           636400  3221  * 3*
* 4*   78400 EAGLE PICHER COMPAN  828    08/29/85  Z     44160           636500  3221  * 4*
* 5*   78640 EAGLE PICHER COMPAN  828    08/30/85  Z     45880           637800  3221  * 5*
* 6*   78670 EAGLE PICHER COMPAN  828    08/30/85  Z     44980           638000  3221  * 6*
* 7*   78820 EAGLE PICHER COMPAN  828    09/04/85  Z     45740           638600  3221  * 7*
* 8*   78830 EAGLE PICHER COMPAN  828    09/04/85  Z     46880           638800  3221  * 8*
* 9*   79100 EAGLE PICHER COMPAN  828    09/05/85  Z     44800           640700  3221  * 9*
*20*   79110 EAGLE PICHER COMPAN  828    09/05/85  Z     45200           640900  3221  *20*
* 1*   79230 EAGLE PICHER COMPAN  828    09/09/85  Z     45800           641800  3221  * 1*
* 2*            CUMULATIVE TOTALS                      826540                        * 2*
* 3*                                                                                * 3*
* 4*                 PRESS ENTER TO PAGE, PF 2 FOR FILE COMPARISION                 * 4*
*  *                                                                                *  *
*****************************************************************************************
****          1         2         3         4         5         6         7         8 ****
**** 12345678901234567890123456789012345678901234567890123456789012345678901234567890 ****
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WORKSTATION 14 - USER JOE - MCKELL, JOEL 228MC

11:41: AM WEDNESDAY APRIL 16, 1986

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*****************************************************************************************
****          1         2         3         4         5         6         7         8 ****
**** 12345678901234567890123456789012345678901234567890123456789012345678901234567890 ****
*****************************************************************************************
*  *                                                                                *  *
* 1*                                  CMFIL LISTING                                  * 1*
* 2*   CMNO      CUSTOMER         SUPCOD SHIPDATE TYPE SHIP WGT   CU WGT  INV NO CONT  * 2*
* 3*   79270 EAGLE PICHER COMPAN  828    09/09/85  Z     46220            642000  3221  * 3*
* 4*   79820 EAGLE PICHER COMPAN  828    09/13/85  Z     45980            648200  3221  * 4*
* 5*   79850 EAGLE PICHER COMPAN  828    09/13/85  Z     47320            648300  3221  * 5*
* 6*   80050 EAGLE PICHER COMPAN  828    09/17/85  Z     46120            649300  3221  * 6*
* 7*   80450 EAGLE PICHER COMPAN  828    09/20/85  Z     45040            652000  3221  * 7*
* 8*   80490 EAGLE PICHER COMPAN  828    09/20/85  Z     46920            652200  3221  * 8*
* 9*   81120 EAGLE PICHER COMPAN  828    09/27/85  Z     45820            657100  3221  * 9*
*10*   81130 EAGLE PICHER COMPAN  828    09/27/85  Z     45520            657200  3221  *10*
* 1*   81210 EAGLE PICHER COMPAN  828    09/30/85  Z     46680            657800  3221  * 1*
* 2*   81220 EAGLE PICHER COMPAN  828    09/30/85  Z     45600            657900  3221  * 2*
* 3*   81660 EAGLE PICHER COMPAN  828    10/02/85  Z     45180            660300  3221  * 3*
* 4*   81670 EAGLE PICHER COMPAN  828    10/02/85  Z     46820            660200  3221  * 4*
* 5*   81970 EAGLE PICHER COMPAN  828    10/04/85  Z     45800            662200  3221  * 5*
* 6*   81980 EAGLE PICHER COMPAN  828    10/04/85  Z     45540            662300  3221  * 6*
* 7*   82340 EAGLE PICHER COMPAN  828    10/07/85  Z     45260            662600  3221  * 7*
* 8*   82350 EAGLE PICHER COMPAN  828    10/07/85  Z     45940            662500  3221  * 8*
* 9*   82580 EAGLE PICHER COMPAN  828    10/09/85  Z     47960            663900  3221  * 9*
*20*   82590 EAGLE PICHER COMPAN  828    10/09/85  Z     46320            664000  3221  *20*
* 1*   83060 EAGLE PICHER COMPAN  828    10/14/85  Z     48040            667100  3221  * 1*
* 2*            CUMULATIVE TOTALS                      1704620                        * 2*
* 3*                                                                                * 3*
* 4*                  PRESS ENTER TO PAGE, PF 2 FOR FILE COMPARISION                * 4*
*  *                                                                                *  *
*****************************************************************************************
****          1         2         3         4         5         6         7         8 ****
**** 12345678901234567890123456789012345678901234567890123456789012345678901234567890 ****
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WORKSTATION 14 - USER JOE - MCKELL, JOEL 228MC

11:41 AM WEDNESDAY APRIL 16, 1986

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*****************************************************************************************
****          1         2         3         4         5         6         7         8 ****
**** 12345678901234567890123456789012345678901234567890123456789012345678901234567890 ****
*****************************************************************************************
*  *                                                                                *  *
* 1*                                  CMFIL LISTING                                  * 1*
* 2*   CMNO      CUSTOMER          SUPCOD SHIPDATE TYPE SHIP WGT   CU WGT  INV NO CONT * 2*
* 3*   83230 EAGLE PICHER COMPAN  828    10/16/85  Z     46540            668400  3221 * 3*
* 4*   83240 EAGLE PICHER COMPAN  828    10/16/85  Z     46560            668500  3221 * 4*
* 5*   83430 EAGLE PICHER COMPAN  828    10/18/85  Z     44700            679200  3221 * 5*
* 6*   83440 EAGLE PICHER COMPAN  828    10/18/85  Z     46980            679100  3221 * 6*
* 7*   83560 EAGLE PICHER COMPAN  828    10/21/85  Z     48660            669600  3221 * 7*
* 8*   83610 EAGLE PICHER COMPAN  828    10/21/85  Z     46300            669700  3221 * 8*
* 9*   83730 EAGLE PICHER COMPAN  828    10/23/85  Z     44780            670000  3221 * 9*
*10*   84000 EAGLE PICHER COMPAN  828    10/24/85  Z     46700            672300  3221 *10*
* 1*   84020 EAGLE PICHER COMPAN  828    10/25/85  Z     46260            673200  3221 * 1*
* 2*   84160 EAGLE PICHER COMPAN  828    10/28/85  Z     46860            673500  3221 * 2*
* 3*   84610 EAGLE PICHER COMPAN  828    11/01/85  Z     46260            678500  3221 * 3*
* 4*   84620 EAGLE PICHER COMPAN  828    11/01/85  Z     46660            678400  3221 * 4*
* 5*   84860 EAGLE PICHER COMPAN  828    11/05/85  Z     45820            679700  3221 * 5*
* 6*   84870 EAGLE PICHER COMPAN  828    11/05/85  Z     47640            680300  3221 * 6*
* 7*   85140 EAGLE PICHER COMPAN  828    11/07/85  Z     44800            681100  3221 * 7*
* 8*   85290 EAGLE PICHER COMPAN  828    11/08/85  Z     44180            682600  3221 * 8*
* 9*   85450 EAGLE PICHER COMPAN  828    11/12/85  Z     45700            683600  3221 * 9*
*20*   85460 EAGLE PICHER COMPAN  828    11/12/85  Z     45720            683700  3221 *20*
* 1*   85990 EAGLE PICHER COMPAN  828    11/14/85  Z     46100            685400  3221 * 1*
* 2*            CUMULATIVE TOTALS                      2581840                        * 2*
* 3*                                                                                * 3*
* 4*                  PRESS ENTER TO PAGE, PF 2 FOR FILE COMPARISION                * 4*
*  *                                                                                *  *
*****************************************************************************************
****          1         2         3         4         5         6         7         8 ****
**** 12345678901234567890123456789012345678901234567890123456789012345678901234567890 ****
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WORKS[illegible]ION 7 - USER MEL - LOEWEN, MARGARE[illegible] 217LC

12:44:21 PM THURSDAY SEPTEMBER 12, 1985

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*****************************************************************************************
****          1         2         3         4         5         6         7         8 ****
**** 12345678901234567890123456789012345678901234567890123456789012345678901234567890 ****
*****************************************************************************************
*  *                                                                                  *  *
* 1*                                                          INV. NO. 6380.00        * 1*
* 2*    B/L NO.  CM  7867.0                                                           * 2*
* 3*    SHIPPED TO EAGLE PICHER                               INV DATE  8/30/85       * 3*
* 4*               FAIRBURY, NEBRASKA                         CONT NO. 3221           * 4*
* 5*                                                          SHIPPED FROM            * 5*
* 6*                                                                OUR PLANT         * 6*
* 7*    SOLD TO    EAGLE PICHER COMPANY                       DATE   8/30/85          * 7*
* 8*               P O BOX 550                                F.O.B.     YOUR PLANT   * 8*
* 9*               JOPLIN, MO                64802            PREPAID X               * 9*
*10*                                                          COLLECT                 *10*
* 1*    TERMS  100% NET CASH 30 DAYS                                                  * 1*
* 2*    ROUTE TISCHHAUSER              CAR                                            * 2*
* 3*          DESCRIPTION                              POUNDS   PRICE   AMOUNT         * 3*
* 4*      ZINC OXIDE                    828          0C0044980                        * 4*
* 5*                                                                                  * 5*
* 6*         APPROX. 10% ZINC CONTENT                    4,498 30.00  $1,349.40        * 6*
* 7*                                                                                  * 7*
* 8*                                                                                  * 8*
* 9*                                                                                  * 9*
*20*                                                                                  *20*
* 1*                                                                                  * 1*
* 2*                                                                                  * 2*
* 3*                                                                                  * 3*
* 4*                                                                                  * 4*
*  *                                                                                  *  *
*****************************************************************************************
****          1         2         3         4         5         6         7         8 ****
**** 12345678901234567890123456789012345678901234567890123456789012345678901234567890 ****
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WORKS[illegible]TION 7 - USER MEL - LOEWEN, MARGAR[illegible] 217LC

12:44:35 PM THURSDAY SEPTEMBER 12, 1985

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****          1         2         3         4         5         6         7         8 ****
**** 12345678901234567890123456789012345678901234567890123456789012345678901234567890 ****
*****************************************************************************************
*  *                                                                                  *  *
* 1*                                                                INV. NO. 6388.00   * 1*
* 2*    B/L NO.  CM  7883.0                                                           * 2*
* 3*    SHIPPED TO EAGLE PICHER                                     INV DATE  9/04/85 * 3*
* 4*               FAIRBURY, NEBRASKA                               CONT NO. 3221     * 4*
* 5*                                                                SHIPPED FROM      * 5*
* 6*                                                                      OUR PLANT   * 6*
* 7*    SOLD TO    EAGLE PICHER COMPANY                             DATE   9/04/85    * 7*
* 8*               P O BOX 550                                      F.O.B.     YOUR PLANT * 8*
* 9*               JOPLIN, MO                 64802                 PREPAID X         * 9*
*10*                                                                COLLECT           *10*
* 1*    TERMS  100% NET CASH 30 DAYS                                                    * 1*
* 2*    ROUTE                          CAR                                              * 2*
* 3*          DESCRIPTION                              POUNDS   PRICE    AMOUNT         * 3*
* 4*      ZINC OXIDE                    828          0C0046880                         * 4*
* 5*                                                                                    * 5*
* 6*         APPROX. 10% ZINC CONTENT                    4,688 30.00  $1,406.40         * 6*
* 7*                                                                                    * 7*
* 8*                                                                                    * 8*
* 9*                                                                                    * 9*
*20*                                                                                    *20*
* 1*                                                                                    * 1*
* 2*                                                                                    * 2*
* 3*                                                                                    * 3*
* 4*                                                                                    * 4*
*  *                                                                                    *  *
*****************************************************************************************
****          1         2         3         4         5         6         7         8 ****
**** 12345678901234567890123456789012345678901234567890123456789012345678901234567890 ****
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WORKS[illegible]ION 7 - USER MEL - LOEWEN, MARGARE[illegible] 217LC

12:44:43 PM THURSDAY SEPTEMBER 12, 1985

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****          1         2         3         4         5         6         7         8 ****
**** 12345678901234567890123456789012345678901234567890123456789012345678901234567890 ****
*****************************************************************************************
*  *                                                                                  *  *
* 1*                                                          INV. NO. 6407.00        * 1*
* 2*    B/L NO.  CM  7910.0                                                           * 2*
* 3*    SHIPPED TO EAGLE PICHER                               INV DATE  9/05/85       * 3*
* 4*              FAIRBURY, NEBRASKA                          CONT NO. 3221           * 4*
* 5*                                                          SHIPPED FROM            * 5*
* 6*                                                                 OUR PLANT        * 6*
* 7*    SOLD TO    EAGLE PICHER COMPANY                       DATE   9/05/85          * 7*
* 8*               P O BOX 550                                F.O.B.     YOUR PLANT   * 8*
* 9*               JOPLIN, MO              64802              PREPAID X               * 9*
*10*                                                          COLLECT                 *10*
* 1*    TERMS  100% NET CASH 30 DAYS                                                  * 1*
* 2*    ROUTE                        CAR                                              * 2*
* 3*          DESCRIPTION                          POUNDS   PRICE    AMOUNT            * 3*
* 4*      ZINC OXIDE                  828         000044800                           * 4*
* 5*         APPROX. 10% ZINC CONTENT                 4,480  30.00 $1,344.00           * 5*
* 6*                                                                                  * 6*
* 7*                                                                                  * 7*
* 8*         FREIGHT PER ATTACHED                                     411.93           * 8*
* 9*                                                                 ---------        * 9*
*20*                                                                $1,755.93         *20*
* 1*                                                                                  * 1*
* 2*                                                                                  * 2*
* 3*                                                                                  * 3*
* 4*                                                                                  * 4*
*  *                                                                                  *  *
*****************************************************************************************
****          1         2         3         4         5         6         7         8 ****
**** 12345678901234567890123456789012345678901234567890123456789012345678901234567890 ****
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WORKS[illegible]ION 7 - USER MEL - LOEWEN, MARGARE[illegible] 217LO

12:44:51 PM THURSDAY SEPTEMBER 12, 1985

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*****************************************************************************************
****          1         2         3         4         5         6         7         8 ****
**** 12345678901234567890123456789012345678901234567890123456789012345678901234567890 ****
*****************************************************************************************
*  *                                                                                  *  *
* 1*                                                          INV. NO. 6409.00         * 1*
* 2*    B/L NO.  CM  7911.0                                                           * 2*
* 3*    SHIPPED TO EAGLE PICHER                               INV DATE  9/05/85       * 3*
* 4*               FAIRBURY, NEBRASKA                         CONT NO. 3221           * 4*
* 5*                                                          SHIPPED FROM            * 5*
* 6*                                                                 OUR PLANT        * 6*
* 7*    SOLD TO    EAGLE PICHER COMPANY                       DATE   9/05/85          * 7*
* 8*               P O BOX 550                                F.O.B.     YOUR PLANT   * 8*
* 9*               JOPLIN, MO              64802              PREPAID X               * 9*
*10*                                                          COLLECT                 *10*
* 1*    TERMS  100% NET CASH 30 DAYS                                                  * 1*
* 2*    ROUTE                         CAR                                             * 2*
* 3*            DESCRIPTION                          POUNDS   PRICE    AMOUNT          * 3*
* 4*      ZINC OXIDE                  828          000045200                          * 4*
* 5*                                                                                  * 5*
* 6*        APPROX. 10% ZINC CONTENT                   4,520 30.00  $1,356.00          * 6*
* 7*                                                                                  * 7*
* 8*                                                                                  * 8*
* 9*                                                                                  * 9*
*20*                                                                                  *20*
* 1*                                                                                  * 1*
* 2*                                                                                  * 2*
* 3*                                                                                  * 3*
* 4*                                                                                  * 4*
*  *                                                                                  *  *
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WORKS[illegible]TION 7 - USER MEL - LOEWEN, MARGAR[illegible] 217LO

12:44:57 PM THURSDAY SEPTEMBER 12, 1985

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*  *                                                                                  *  *
* 1*                                                                INV. NO. 6418.00   * 1*
* 2*    B/L NO.  CM  7923.0                                                           * 2*
* 3*    SHIPPED TO EAGLE PICHER                                     INV DATE  9/09/85 * 3*
* 4*                FAIRBURY, NEBRASKA                              CONT NO. 3221     * 4*
* 5*                                                                SHIPPED FROM      * 5*
* 6*                                                                        OUR PLANT * 6*
* 7*    SOLD TO     EAGLE PICHER COMPANY                            DATE   9/09/85    * 7*
* 8*                P O BOX 550                                     F.O.B.     YOUR PLANT * 8*
* 9*                JOPLIN, MO                 64802                PREPAID X         * 9*
*10*                                                                COLLECT           *10*
* 1*    TERMS  100% NET CASH 30 DAYS                                                  * 1*
* 2*    ROUTE                          CAR                                            * 2*
* 3*            DESCRIPTION                          POUNDS   PRICE    AMOUNT          * 3*
* 4*      ZINC OXIDE                    828         0C0045800                        * 4*
* 5*                                                                                  * 5*
* 6*         APPROX. 10% ZINC CONTENT                  4,580 30.00  $1,374.00          * 6*
* 7*                                                                                  * 7*
* 8*                                                                                  * 8*
* 9*                                                                                  * 9*
*20*                                                                                  *20*
* 1*                                                                                  * 1*
* 2*                                                                                  * 2*
* 3*                                                                                  * 3*
* 4*                                                                                  * 4*
*  *                                                                                  *  *
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12:45:04 THURSDAY SEPTEMBER 12, 1985

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*  *                                                                             *  *
* 1*                                                      INV. NO. 6420.00       * 1*
* 2*    B/L NO.  CM  7927.0                                                      * 2*
* 3*    SHIPPED TO EAGLE PICHER                           INV DATE  9/09/85      * 3*
* 4*               FAIRBURY, NEBRASKA                     CONT NO. 3221          * 4*
* 5*                                                      SHIPPED FROM           * 5*
* 6*                                                             OUR PLANT       * 6*
* 7*    SOLD TO    EAGLE PICHER COMPANY                   DATE   9/09/85         * 7*
* 8*               P O BOX 550                            F.O.B.     YOUR PLANT  * 8*
* 9*               JOPLIN, MO                64802        PREPAID X              * 9*
*10*                                                      COLLECT                *10*
* 1*    TERMS  100% NET CASH 30 DAYS                                             * 1*
* 2*    ROUTE                        CAR                                         * 2*
* 3*          DESCRIPTION                          POUNDS   PRICE   AMOUNT        * 3*
* 4*      ZINC OXIDE                   828        000046220                      * 4*
* 5*                                                                             * 5*
* 6*          APPROX. 10% ZINC CONTENT                  4,622 30.00  $1,386.60    * 6*
* 7*                                                                             * 7*
* 8*                                                                             * 8*
* 9*                                                                             * 9*
*20*                                                                             *20*
* 1*                                                                             * 1*
* 2*                                                                             * 2*
* 3*                                                                             * 3*
* 4*                                                                             * 4*
*  *                                                                             *  *
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****          1         2         3         4         5         6         7         8 ****
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Exhibit C

WORKSTATION 42 - USER JIM - ROBERTS, JIM 245RC

2:47:05 PM FRIDAY OCTOBER 3, 1986

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****          1         2         3         4         5         6         7         8 ****
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*****************************************************************************************
*  *                                                                                  *  *
* 1*                                                   SALES CONTRACT NO. 3659        * 1*
* 2*       EXMET OF KENTUCKY                           DATE:  5/30/86                 * 2*
* 3*       1400 SOUTH HANCOCK STREET                   YOUR REFERENCE:                * 3*
* 4*       LOUISVILLE, KENTUCKY     40217              BUYER: SHIRLEY FERON     1     * 4*
* 5*       ATTN: DENNIS LISACK                                                        * 5*
* 6*                                                                                  * 6*
* 7*       ATTN:                                                                      * 7*
* 8*                                                                                  * 8*
* 9*       CHEMETCO AGREES TO SELL AND EXMET AGREES TO PURCHASE THE FOLLOWING         * 9*
*10*       MATERIAL:                                                                  *10*
* 1*                                                                                  * 1*
* 2*       ALL CURRENT PRODUCTION OF ZINC OXIDE FILTER CAKE FOR A PRICE EQUIVALENT    * 2*
* 3*       TO TRANSPORTATION CHARGES TO LOUISVILLE AND THAT CHEMETCO IN TURN          * 3*
* 4*       WOULD RE-PURCHASE THE LEAD CAKE RESIUDE FROM EXMET AFTER ZINC EXTRAC-      * 4*
* 5*       TION FOR A PRICE EQUIVALENT TO TRANSPORTATION CHARGES BACK TO CHEMETCO.    * 5*
* 6*                                                                                  * 6*
* 7*       REFERENCE:    THIS IS CHEMETCO PURCH. CONTR. NO 1740 FROM COOPER'S.        * 7*
* 8*                                                                                  * 8*
* 9*                                                                                  * 9*
*20*                                                                                  *20*
* 1*       COPPER PRICE:  COMEX CASH CLOSING PRICE FOR THE PREVIOUS DAYS SHIPMENT     * 1*
* 2*            SMELTING CHARGE FIRST 2000 TONS $72.50, REMAINDER $57.23              * 2*
* 3*                                                                                  * 3*
* 4*  ENTER - NEXT CONTRACT,PF 1 TO 5 FOR PAGE, PF 6 FOR STATISTICS, PF 16 - CANCEL   * 4*
*  *                                                                                  *  *
*****************************************************************************************
****          1         2         3         4         5         6         7         8 ****
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CHEMETCO
P.O. BOX 187 • ALTON, ILLINOIS 62002
(618) 254-4381 • TELEX: WU44-2481

Memorandum

March 6, 1986

At a meeting held on March 6, 1986 at the offices of Chemetco between John Suarez and Jim Roberts, representing Chemetco, and Dennis Lisack, representing Exmet of Kentucky, it was agreed that Exmet would buy from Chemetco all current production of zinc oxide filter cake for a price equivalent to transportation charges to Louisville and that Chemetco in turn would re-purchase the lead cake residue from Exmet after zinc extraction for a price equivalent to transportation charges back to East St. Louis.

It was agreed to commence delivery as soon as it was feasible for Exmet to store the material and that no charges will be billed to Exmet until the material is actually processed. Exmet commits to actual production start-up no later than August, 1986.

It was also agreed that Exmet will have available for processing material stockpiled on similar terms - details of movement and recovery from the present location will be worked out mutually between the parties.

Both parties also agreed to work together, using Chemetco's accumulated experience, on satisfying all EPA and other enviromental questions pertaining to the transporting, storing, and disposition of the material.

Jim Roberts
Jim Roberts

Dennis Lisack
Dennis Lisack

WORKSTATION 42 - USER JIM - ROBERTS, JIM 245RC

2:06:11 PM FRIDAY OCTOBER 3, 1986

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****          1         2         3         4         5         6         7         8 ****
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*  *                                                                                  *  *
* 1*                                                  SALES CONTRACT NO. 3999          * 1*
* 2*       CONCORDE METALS CORPORATION                DATE:  9/12/86                   * 2*
* 3*       2701 MANCKIN STREET                        YOUR REFERENCE:                  * 3*
* 4*       BALTIMORE, MD            21230             BUYER: SHARON BROWN      5       * 4*
* 5*                                                                                  * 5*
* 6*                                                                                  * 6*
* 7*       ATTN: PAT FERON                                                            * 7*
* 8*                                                                                  * 8*
* 9*       CHEMETCO AGREES TO SELL AND CONCORDE METALS CORP. AGREES TO BUY            * 9*
*10*       THE FOLLOWING:                                                             *10*
* 1*       MATERIAL:      ZINC BEARING RESIDUES (ZINC OXIDE).                         * 1*
* 2*       QUANTITY:      APPROXIMATELY 80,000 LBS.                                   * 2*
* 3*       PRICE:         95% OF ZN CONTENT AT 50% OF PRODUCER PRICE; T.C. OF         * 3*
* 4*       (ZN PROD.      11.50 BELGIAN FRANCS PER KILO OF ZN PAYABLE.  COPPER        * 4*
* 5*       PRICE IS       LESS 2.50 UNITS AT 50% OF LOWEST LME PRICE; T.C. OF         * 5*
* 6*       BASIS G.O.B    23.00 BELGIAN FRANS PER KILO OF CU PAYABLE.  PENALTY        * 6*
* 7*       PRODUCER IN    FOR NICKEL AND/OR CADMIUM:  45.00 BELGIAN FRANCS PER        * 7*
* 8*       METAL BULLE-   KILO OF BOTH COMBINED.  ADDITIONAL TREATMENT CHARGE OF      * 8*
* 9*       TIN US$$)      .25 CENT/LB MAT (COMM. TO CONCORDE).                        * 9*
*20*       TERMS:         90% THIRTY DAYS AFTER ARRIVAL; BAL UPON ANALYSIS.           *20*
* 1*       DELIVERY:      C&F METALLO CHIMIQUE.                                       * 1*
* 2*       FORCE MAJEURE USUAL                                                        * 2*
* 3*                                                                                  * 3*
* 4*  ENTER - NEXT CONTRACT,PF 1 TO 5 FOR PAGE, PF 6 FOR STATISTICS, PF 16 - CANCEL   * 4*
*  *                                                                                  *  *
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WORKSTATION 42 - USER JIM - ROBERTS, JIM 245PC

2:06:26 PM FRIDAY OCTOBER 3, 1986

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*  *                                                                        *  *
* 1*                                                SALES CONTRACT NO. 4000  * 1*
* 2*        CONCORDE METALS CORPORATION             DATE:  9/12/86           * 2*
* 3*        2701 MANOKIN STREET                     YOUR REFERENCE:          * 3*
* 4*        BALTIMORE, MD            21230          BUYER: SHARON BROWN   5  * 4*
* 5*                                                                         * 5*
* 6*                                                                         * 6*
* 7*        ATTN: PAT FERON                                                  * 7*
* 8*                                                                         * 8*
* 9*        CHEMETCO AGREES TO SELL AND CONCORDE METALS CORP. AGREES TO BUY  * 9*
*10*        THE FOLLOWING:                                                   *10*
* 1*        MATERIAL:      ZINC BEARING RESIDUES (ZINC OXIDE).               * 1*
* 2*        QUANTITY:      APPROX. 200,000 POUNDS.                           * 2*
* 3*        PRICE:         95% OF ZN CONTENT AT 50% OF PRODUCER PRICE; T.C. OF * 3*
* 4*        (ZN PROD.      11.50 BELGIAN FRANCS PER KILO OF ZN PAYABLE.  COPPER * 4*
* 5*        PRICE IS       LESS 2.50 UNITS AT 50% OF LOWEST LME PRICE; T.C. OF * 5*
* 6*        BASIS G.O.B    23.00 BELGIAN FRANS PER KILO OF CU PAYABLE.  PENALTY * 6*
* 7*        PRODUCER IN    FOR NICKEL AND/OR CADMIUM:  45.00 BELGIAN FRANCS PER * 7*
* 8*        METAL BULLE-   KILO OF BOTH COMBINED.  ADDITIONAL TREATMENT CHARGE OF * 8*
* 9*        TIN US$$)      .25 CENT/LB MAT (COMM. TO CONCORDE).              * 9*
*20*        TERMS:         90% THIRTY DAYS AFTER ARRIVAL; BAL UPON ANALYSIS. *20*
* 1*        DELIVERY:      C&F METALLO CHIMIQUE.                             * 1*
* 2*        FORCE MAJEURE USUAL                                              * 2*
* 3*                                                                         * 3*
* 4*  ENTER - NEXT CONTRACT,PF 1 TO 5 FOR PAGE, PF 6 FOR STATISTICS, PF 16 - CANCEL  * 4*
*  *                                                                         *  *
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WORKSTATION 42 - USER JIM - ROBERTS, JIM 245RC

2:06:52 PM FRIDAY OCTOBER 3, 1986

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*  *                                                                                  *  *
* 1*                                                  SALES CONTRACT NO. 4008          * 1*
* 2*       CONCORDE METALS CORPORATION                DATE:  9/19/86                   * 2*
* 3*       2701 MANCKIN STREET                        YOUR REFERENCE:                  * 3*
* 4*       BALTIMORE, MD            21230             BUYER: SHARON BROWN     5        * 4*
* 5*                                                                                  * 5*
* 6*                                                                                  * 6*
* 7*       ATTN: PAT PERON                                                            * 7*
* 8*                                                                                  * 8*
* 9*       CHEMETCO AGREES TO SELL AND CONCORDE METALS CORP. AGREES TO BUY            * 9*
*10*       THE FOLLOWING:                                                             *10*
* 1*       MATERIAL:      ZINC BEARING RESIDUES (ZINC OXIDE).                         * 1*
* 2*       QUANTITY:      APPROX. 200,000 POUNDS.                                     * 2*
* 3*       PRICE:         95% OF ZN CONTENT AT 50% OF PRODUCER PRICE; T.C. OF         * 3*
* 4*       (ZN PROD.      11.50 BELGIAN FRANCS PER KILO OF ZN PAYABLE.  COPPER        * 4*
* 5*       PRICE IS       LESS 2.50 UNITS AT 50% OF LOWEST LME PRICE; T.C. OF         * 5*
* 6*       BASIS G.O.B    23.00 BELGIAN FRANS PER KILO OF CU PAYABLE.  PENALTY        * 6*
* 7*       PRODUCER IN    FOR NICKEL AND/OR CADMIUM:  45.00 BELGIAN FRANCS PER        * 7*
* 8*       METAL BULLE-   KILO OF BOTH COMBINED.  ADDITIONAL TREATMENT CHARGE OF      * 8*
* 9*       TIN US$$)      .25 CENT/LB MAT (COMM. TO CONCORDE).                        * 9*
*20*       TERMS:         90% THIRTY DAYS AFTER ARRIVAL; BAL UPON ANALYSIS.           *20*
* 1*       DELIVERY:      C&F METALLO CHIMIQUE.                                       * 1*
* 2*       FORCE MAJEURE USUAL                                                        * 2*
* 3*                                                                                  * 3*
* 4*  ENTER - NEXT CONTRACT,PF 1 TO 5 FOR PAGE, PF 6 FOR STATISTICS, PF 16 - CANCEL   * 4*
*  *                                                                                  *  *
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RKSTATION  42  -  USER JIM  -  ROBERTS, JIM        245RC

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*  *                                                                                  *  *
* 1*                                                  SALES CONTRACT NO. 4015          * 1*
* 2*       CONCORDE METALS CORPORATION                DATE:  9/29/86                   * 2*
* 3*       2701 MANOKIN STREET                        YOUR REFERENCE:                  * 3*
* 4*       BALTIMORE, MD            21230             BUYER: SHARON BROWN      5       * 4*
* 5*                                                                                  * 5*
* 6*                                                                                  * 6*
* 7*       ATTN: PAT PERON                                                            * 7*
* 8*                                                                                  * 8*
* 9*       CHEMETCO AGREES TO SELL AND CONCORDE METALS CORP. AGREES TO BUY            * 9*
*10*       THE FOLLOWING:                                                             *10*
* 1*       MATERIAL:      ZINC BEARING RESIDUES (ZINC OXIDE).                         * 1*
* 2*       QUANTITY:      APPROX. 200,000 POUNDS.                                     * 2*
* 3*       PRICE:         95% OF ZN CONTENT AT 50% OF PRODUCER PRICE; T.C. OF         * 3*
* 4*       (ZN PROD.      11.50 BELGIAN FRANCS PER KILO OF ZN PAYABLE.  COPPER        * 4*
* 5*       PRICE IS       LESS 2.50 UNITS AT 50% OF LOWEST LME PRICE; T.C. OF         * 5*
* 6*       BASIS G.O.B    23.00 BELGIAN FRANS PER KILO OF CU PAYABLE.  PENALTY        * 6*
* 7*       PRODUCER IN    FOR NICKEL AND/OR CADMIUM:  45.00 BELGIAN FRANCS PER        * 7*
* 8*       METAL BULLE-   KILO OF BOTH COMBINED.  ADDITIONAL TREATMENT CHARGE OF      * 8*
* 9*       TIN US$$)      .25 CENT/LB MAT (COMM. TO CONCORDE).                        * 9*
*20*       TERMS:         90% THIRTY DAYS AFTER ARRIVAL; BAL UPON ANALYSIS.           *20*
* 1*       DELIVERY:      C&F METALLO CHIMIQUE.                                       * 1*
* 2*       FORCE MAJEURE USUAL                                                        * 2*
* 3*                                                                                  * 3*
* 4*  ENTER - NEXT CONTRACT,PF 1 TO 5 FOR PAGE, PF 6 FOR STATISTICS, PF 16 - CANCEL   * 4*
*  *                                                                                  *  *
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****          1         2         3         4         5         6         7         8 ****
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Exhibit D E

4/2/3
1320069
NEWS BRIEFS: PERU'S STATE-OWNED.
American Metal Market March 6, 1986 p. 2

*3PER *Peru *1001000 *Metal Ores *53 *labor use; *Minera Centro Peru

4/2/4
1314672
Company News: A zinc mine suspension.
Financial Post February 22, 1986 p. 30

*2CAN *Canada *1033000 *Zinc Mines *14 *parents-jt venture; *Teck; Duns No: *20-574-8163; CUSIP: *878742
2CAN Canada 1033000 Zinc Mines 14 parents-jt venture; AMAX
2CAN Canada 1033000 Zinc Mines 44 facilities; AMAX
2CAN Canada 1033000 Zinc Mines 44 facilities; Teck

4/2/5
1314551
NONFERROUS: Amax, Union Continuing Talks On New Pact at Zinc Refinery.
American Metal Market February 19, 1986 p. 4

*1617 *Illinois *3333000 *Zinc *53 *labor use; *AMAX

4/2/6
1309164
Metal Market: [redacted]
American Metal Market [redacted] p. 19

*1447 *Tennessee *3333000 *Zinc *44 *facilities; *Asarco; Duns No: *00-132-5281; Ticker: *AR; CUSIP: *043413

4/2/7
1280815
NEWS BRIEFS: THE GREENEX ZINC.
American Metal Market November 13, 1985 p. 2

*5ICE *Iceland *1030000 *Lead & Zinc Mines *44 *facilities

4/2/8
1278556
Hudson Bay Sets New Policy For Zinc Pricing in N America.
American Metal Market November 1, 1985 p. 1,20

*2CAN *Canada *3333000 *Zinc *74 *prices; *Hudson Bay Mining & Smelting; Duns No: *20-009-1155; Ticker: *HD; CUSIP: *443654

4/2/9
1274015
[redacted].
American Metal Market [redacted] p. 2

*2CAN *Canada *1033000 *Zinc Mines *44 *facilities; *Falconbridge Copper

4/2/10
1271115
MITI Sets 3% Loans To 19 Copper, Zinc Cos.
American Metal Market October 30, 1985 p. 1,12

*9JPN *Japan *3331000 *Copper *82 *loan & other funds

4/2/11
1269095
NEWS BRIEFS: Japan's Ministry.

American Metal Market October 24, 1985 p. 2

*9JPN *Japan *3310000 *Primary Iron & Steel *82 *loan & other funds

4/2/12
1269092
Tara, Bula Deal Falls Through.
American Metal Market October 24, 1985 p. 1

*4IRE *Ireland *1030000 *Lead & Zinc Mines *16 *assets sought; *Bula
4IRE Ireland 1030000 Lead & Zinc Mines 15 seeks assets; Tara Mines

4/2/13
1267872
and Blamed in Navan Impasse.
Mining Journal (incl Mining Mag & Annual Review) October 25, 1985 p. 328

*4IRE *Ireland *1000000 *Mining & Extractive Industries *16 *sought in merger; *Bula
4IRE Ireland 1030000 [redacted]; Tara Mines

4/2/14
1267871
Zinc Price Affects Cominco.
Mining Journal (incl Mining Mag & Annual Review) October 25, 1985 p. 328

*5GRL *Greenland *1033100 *Zinc Ores *44 *facilities; *Cominco; Duns No: *20-215-1551; Ticker: *CLT; CUSIP: *200435

4/2/15
1266569
[redacted].
Mining Journal (incl Mining Mag & Annual Review) October 18, 1985 p. 312

*2CAN *Canada *1033200 *Zinc Concentrates *44 *facilities; *Cominco; Duns No: *20-215-1551; Ticker: *CLT; CUSIP: *200435

4/2/16
1245494
NONFERROUS: Z[redacted].
American Metal Market August 29, 1985 p. 4

*1548 *Texas *3333000 *Zinc *44 *facilities; *Asarco; Duns No: *00-132-5281; Ticker: *AR; CUSIP: *043413

4/2/17
1237402
ORES & CONCENTRATES: Disputes on zinc mating factors.
American Metal Market August 14, 1985 p. 10

*2CAN *Canada *1033200 *Zinc Concentrates *61 *contracts received
4 W West Europe 3333000 Zinc 61 contracts received

4/2/18
1229048
[redacted].
American Metal Market June 28, 1985 p. 2

*2CAN *Canada *1033200 *Zinc Concentrates *62 *production data; *Pine Point Mines; CUSIP: *722732

4/2/19
1223270

4/2/19
1223270
Substantial lead, zinc price hoosts expected to be limited this year.
American Metal Market July 11, 1985 p. 4

*4UK *United Kingdom *3332000 *Lead *60 *market data

4/2/20
1222369
Pr[redacted]
American Metal Market May 31, 1985 p. 2

*4UK *United Kingdom *3333400 *Refined Zinc *74 *prices

4/2/21
1218902
Nonferrous metal firms recover from slump.
Japan Chemical Week June 20, 1985 p. 4

*9JPN *Japan *1000000 *Mining & Extractive Industries *83 *company sales

4/2/22
1215419
Business Briefs.
Wall Street Journal 3 Star, Eastern (Princeton, NJ) Edition June 20, 1985 p. 44

*2CAN *Canada *1030000 *Lead & Zinc Mines *83 *company sales; *Tara Exploration & Development; CUSIP: *876086

4/2/23
1179316
[redacted].
Chemical Marketing Reporter April 22, 1985 p. 30

*1548 *Texas *3333400 *Refined Zinc *44 *facilities; *Asarco; Duns No: *00-132-5281; Ticker: *AR; CUSIP: *043413

4/2/24
1174431
[redacted]e.
American Metal Market March 26, 1985 p. 9,11

*1USA *United States *3333000 *Zinc *60 *market data
O W World 3333000 Zinc 62 production data

4/2/25
1169703
Outlook for Zinc In Global Market Seen Optimistic.
American Metal Market March 29, 1985 p. 1,16

*O W *World *3333000 *Zinc *74 *prices

? DS
Set Items Description
1 7251 ZINC
2 75079 PRIC?
3 641 1 AND 2
[redacted] 82 ZINC(N)PRIC?
[redacted]4/2/26-52
4/2/26
1149843
Observers Term A[redacted]e.
American Metal Market February 1, 1985 p. 1,16

*1548 *Texas *3333000 *Zinc *44 *facilities; *Asarco; Duns No: *00-132-5281; Ticker: *AR; CUSIP: *043413

4/2/27
1132948
SCRAP: 95 Percent Copper Penny Seen as Benefit to Industry.
American Metal Market January 14, 1985 p. 22

*1USA *United States *3469996 *Metal Mints ex Precious Metal *94 *regulation

4/2/28
1109915
[redacted].
American Metal Market November 9, 1984 p. 2

*2CAN *Canada *1033000 *Zinc Mines *44 *facilities; *Cominco; Duns No: *20-215-1551; Ticker: *CLT; CUSIP: *200435
5GRL Greenland 1030200 Lead & Zinc Concentrates 44 facilities; Greenex
2CAN Canada 1030000 Lead & Zinc Mines 14 subsidiary,100%; Vestgron Mines; CUSIP: 925487
2CAN Canada 1030000 Lead & Zinc Mines 14 subsidiary,50-79%; Cominco; Duns No: 20-215-1551; Ticker: CLT; CUSIP: 200435

4/2/29
1077451
Metal Market: St Joe Finalizes Deal to Acquire Nat'l Zinc Assets.
American Metal Market August 27, 1984 p. 17,21

*1USA *United States *3333000 *Zinc *16 *sought in merger; *National Zinc
1USA United States 3330000 Nonferrous Metals 15 seeks to acquire; St Joe Minerals; Duns No: 00-134-4134

4/2/30
1059429
[redacted]
American Metal Market July 20, 1984 p. 1,16

*1USA *United States *3333000 *Zinc *60 *market data

4/2/31
1059140
Metallgesellschaft Move, [redacted], [redacted].
American Metal Market July 11, 1984 p. 1,6

*4WGE *West Germany *3333000 *Zinc *74 *prices
4 W West Europe 3333000 Zinc 74 prices
2CAN Canada 3333000 Zinc 74 prices
4UK United Kingdom 6231200 Commodity Exchanges 74 prices

4/2/32
1049776
NONFERROUS: Zinc Pact Is Issue On LME.
American Metal Market June 19, 1984 p. 9,15

*4UK *United Kingdom *3333000 *Zinc *85 *financial analysis

4/2/33
1047617
Inland Notifies of Zinc Extra.
American Metal Market June 26, 1984 p. 11

*1USA *United States *3312431 *Galvanized Sheet *74 *prices; *Inland Steel; Duns No: *00-132-5422; Ticker: *IAD; CUSIP: *457470

4/2/34
1039699
Industry IN ACTION: DEVELOPMENT: Thai Zinc Refinery.
Mining Journal (incl Mining Mag & Annual Review) March 30, 1984 p. 211

Industry IN ACTION: DEVELOPMENT: Thai Zinc Refinery.
Mining Journal (incl Mining Mag & Annual Review) March 30, 1984 p. 211

*9THA *Thailand *3333400 *Refined Zinc *44 *facilities

4/2/35
[illegible]4527
[illegible]NONFERROUS: Union Miniere, Acquisition No Zinc Aggression Sign.
American Metal Market May 17, 1984 p. 4

*1USA *United States *3333000 *Zinc *16 *acquired; *Jersey Miniere Zinc
1USA United States 3333000 Zinc 15 completes acquistn; Union Zinc
1USA United States 3333000 Zinc 16 sells subsidiary; Gulf & Western Industries; Duns No: 01-204-9334; Ticker: GW; CUSIP: 402064
1USA United States 3333000 Zinc 14 subsidiary,100%; Union Zinc

4/2/36
1019439
Rapid Zinc Price Hikes Lead to Rift Between Producers, Smelters.
American Metal Market April 5, 1984 p. 1,16

*0123 *Western World *3333000 *Zinc *74 *prices

4/2/37
1003379
MINING NEWS: Better year for EZ Industries.
Financial Times (London Edition) August 24, 1983 p. 16

*9AUS *Australia *1000000 *Mining & Extractive Industries *83 *company sales; *EZ Industries

4/2/38
9[illegible]264
[illegible]S Steel Restoring Zinc Fees.
American Metal Market February 17, 1984 p. 2,8

*1USA *United States *3333000 *Zinc *74 *prices; *US Steel

4/2/39
977461
EZ Industries will expand capacity to 210,000 m tpy from 1982's 184,178 m tpy at its Risdon refinery in Tasmania, in response to the recent rise in world zinc prices.
Mining Journal (incl Mining Mag & Annual Review) November 18, 1983 p. 367

*9AUS *Australia *3333400 *Refined Zinc *44 *facilities; *EZ Industries

4/2/40
953115
Prieska Copper Mines is expected to follow through on its decision to close all mining operations in 1985, despite higher profits in 1982.
American Metal Market September 16, 1983 p. 7

*7SOA *South Africa *1001000 *Metal Ores *44 *plant closed; *Prieska Copper Mines

4/2/41
94[illegible]379
[illegible]ile the recent shotgun rises in zinc prices may slow in ensuing months, [illegible] industry observers appear confident that market fundamentals will sustain the current strength at least through end-1983.
American Metal Market September 1, 1983 p. 1,16

*1USA *United States *3333000 *Zinc *74 *whsle price

4/2/42

Market prices appeared to be firming at the new zinc producer price base of $0.43/lb for benchmark High Grade material, amid growing reports of tightening zinc supplies and increased consumer buying.
American Metal Market July 27, 1983 p. 1,16

*1USA *United States *3333000 *Zinc *74 *whsle price

4/2/43
932475
Pine Point Mines will resume concentrate production in mid-1983 at its lead-zinc mine in Pine Point, NWT, the mine having been closed since 1/2/83 due to low lead and zinc prices.
American Metal Market June 29, 1983 p. 4

*2CAN *Canada *1030200 *Lead & Zinc Concentrates *62 *production; *Pine Point Mines; CUSIP: *722732

4/2/44
924745
US hot dip galvanizers are developing methods of reducing zinc dross generation and studying the possibility of recycling more of the metallics from top skimming, according to M Hettleman, pres of Southern Galvaniziang Co (Baltimore, Md), speaking at a Natl Assn of Recyling Industries' lead and zinc roundtable.
American Metal Market June 2, 1983 p. 8

*1USA *United States *3479031 *Galvanizing & Hot Dip Coating *32 *process R&D

4/2/45
914631
Sherritt Gordon Mines in 1983 expects to produce 44.5mil lb at its only nickel refinery in Ft Saskatchewan, Alta, up 15% from 1982.
American Metal Market April 20, 1983 p. 1,16

*2CAN *Canada *3339752 *Refined Nickel *44 *new capacity; *Sherritt Gordon Mines; Duns No: *20-175-2680; Ticker: *SHR; CUSIP: *824280

4/2/46
911090
Heath Steele Mines in mid-1983 will close down its underground zinc-lead-copper-silver mine near Newcastle, NB, for [illegible] in [illegible] probably.
Financial Post April 9, 1983 p. 17

*2CAN *Canada *1001100 *Nonferrous Ores & Concentrates *44 *plant closed; *Heath Steele Mines

4/2/47
903900
Cyprus Anvil Mining has received a $25mil loan from the govt to reopen its Faro lead/zinc mine in the Yukon, which has been closed since 6/82.
Corpus Chemical Report (incorporating CPI Management & Polyfacts) May 2, 1983 p. 4

*2CAN *Canada *1030000 *Lead & Zinc Mines *44 *capacity; *Cyprus Anvil Mining

4/2/48
8[illegible]791
World: Consumption of nonferrous metals fell sharply in 1979-82.
Frankfurter Allgmeine November 30, 1982 p. 13
Language: German

*4WGE *West Germany *3330000 *Nonferrous Metals *60 *market data
4WGE West Germany 3331000 Copper 60 market data
4WGE West Germany 3332000 Lead 60 market data
4WGE West Germany [illegible]

*4WGE *West Germany *3330000 *Nonferrous Metals *60 *market data
4WGE West Germany 3331000 Copper 60 market data
4WGE West Germany 3332000 Lead 60 market data
4WGE West Germany 3334100 Primary Aluminum 60 market data
4WGE West Germany 3339750 Nickel 60 market data

[redacted]/49
[redacted]981
Asa[redacted]
de[redacted]
Energy & Minerals Resources May 21, 1982 p. 210

*1548 *Texas *3333400 *Refined Zinc *44 *plant closed; *Asarco; Duns No: *00-132-5281; Ticker: *AR; CUSIP: *043413

4/2/50
764295
Anaconda Copper will close its Berkeley open-pit copper mine in Butte, Mont, one of the world's largest open-pit copper mines.
Chemical Week May 5, 1982 p. 37

*1830 *Montana *1021000 *Copper Mines *44 *plant closed; *Anaconda Copper

4/2/51
763253
W Europe: Zinc producer prices were united again yesterday, 3/5/82, at $900/m ton, when W German smelters lifted their quotations from $875/m ton to $900/m ton[redacted]950/m ton to $900/m ton.
Financial Times (London Edition) March 5, 1982 p. 31

*4 W *West Europe *3333000 *Zinc *74 *whsle price

4[redacted]52
753801

World Aluminum & Other Nonferrous Metals to 1995-Industry Study 253
November 1981 p. 1-157

*0 W *World *3330000 *Nonferrous Metals *03 *statistics
0 W World 3331000 Copper 03 statistics
0 W World 3334000 Aluminum 03 statistics

? T 4/2/53-75
4/2/53
691743
Jersey Miniere Zinc will expand its Tennessee zinc-mine operations to ultimately double zinc concentrate output due to zinc price improvements and a shortage of zinc concentrates.
Wall Street Journal 3 Star, Eastern SP edition September 1, 1981 p. 12

*1USA *United States *1033200 *Zinc Concentrates *44 *new capacity; *Jersey Miniere Zinc

4/2/54
684867
N[redacted]
p[redacted]
Ne[redacted] York Times October 17, 1981 p. 29,30
[redacted]

*1USA *United States *3333000 *Zinc *12 *organiztn history; *New Jersey Zinc

4/2/55
672607
Gulf & Western Natural Resources Group will expand Jersey Miniere Zinc's operations, doubling concentrate output fr[redacted]

*1USA *United States *1033200 *Zinc Concentrates *44 *new capacity; *Jersey Miniere Zinc
1USA United States 1030000 Lead & Zinc Mines 44 plant closed; Bunker Hill

4/2/56
647474
Societe de Prayon (Belgium) has begun bankruptcy proceedings, having asked the Liege tribunal of commerce for a concordat to prevent creditors from calling in loans for 2 mos while the company continues trading on a cash-only basis and devises a survival formula.
European Chemical News May 25, 1981 p. 4

*4BEL *Belgium *2800000 *Chemicals *12 *bankruptcy; *Prayon

4/2/57
647333
Prayon (Belgium) is in receivership.
Europa Chemie Issue 15, 1981 p. 257
Language: German

*4BEL *Belgium *2800000 *Chemicals *12 *bankruptcy; *Prayon

4/2/58
644564
US zinc prices by end-1981 may be $0.10-0.15/lb higher and merchants should play a more vital role in 'swapping' tightening supplies, according to MF Schwarz, VP/metals at Assoc Metals & Minerals Export Corp (New York, NY).
American Metal Market May 14, 1981 p. 8

*1USA *United States *3333000 *Zinc *74 *whsle price

4/2/59
640077
Non-ferrous metal stocks are high and prices are beginning to retreat as the European business turndown takes its toll.
Purchasing World April 1981 p. 80

*4UK *United Kingdom *3330000 *Nonferrous Metals *74 *whsle price

4/2/60
605314
Metallgesellschaft AG's investments in the year to 9/81 will total DM360 mil ($184 mil), up 55.8% from 1979-80, including DM90 mil in investments in affiliates and joint venture firms, up 2X+.
American Metal Market December 18, 1980 p. 8

*4WGE *West Germany *3330000 *Nonferrous Metals *43 *capital expend; *Metallgesellschaft

4/2/61
594033
US zinc oxide demand is declining, especially in the rubber, photocopying and paint industries.
#Chemical Purchasing October 1980 p. 55-59

*1USA *United States *2819869 *Zinc Compounds NEC *60 *market data

4/2/62
583538
New Jersey Zinc Co (Nashville, Tenn) will close indefinitely the slab zinc operation at its smelting facility in Palmerton, Pa.
American Metal Market August 6, 1980 p. 1,11

*1USA *United States *3333000 *Zinc *44 *plant closed; *New Jersey Zinc

4/2/63

*1USA *United States *3333000 *Zinc *44 *plant closed; *New Jersey Zinc

4/2/63
553707
Up to 50% of polymer growth could be based on substitution for metal and wood if manufacturers stress the progressive qualities of polymers, their s[illegible]ial properties and characteristics, rather than concentrating on cost [illegible]antages.
#British Plastics & Rubber April 1980 p. 23,25+

*4UK *United Kingdom *2820000 *Polymers: Plastic, Rubber, Fiber *17 *industry structure

4/2/64
530563
Toho Zinc (Japan) is profiled from its foundation in 1937.
#Metal Bulletin Monthly November 1979 p. 29-31

*9JPN *Japan *3333000 *Zinc *12 *organiztn history; *Toho Zinc

4/2/65
527622
[redacted] but zi[redacted] may help it regain some of the market it lost in the mid 1970s, according to the Economist Intelligence Unit.
Metal Bulletin December 11, 1979 p. 25

*0 W *World *3333000 *Zinc *60 *market data
&EAG East Germany 1033000 Zinc Mines 64 exports to
&EAG East Germany 3333000 Zinc 64 exports to

4/2/66
48[illegible]0
[illegible]ilippine zinc metal production in 1978 totaled 9,466 m tons, down 24% from 1977's 12,455 m tons, due to de[redacted] and production difficulties, according to US BuMines.
American Metal Market May 30, 1979 p. 14

*9PHI *Philippines *3333000 *Zinc *62 *production

4/2/67
473638
US zinc production totaled 342,000 s tons in 1978, down 24% from 1977.
Minerals & Materials/a Monthly Survey January 1979 p. 9

*1USA *United States *1033100 *Zinc Ores *62 *production
USA United States 3333100 Primary Zinc 44 capacity

[illegible]/2/68
55006
France's 1978 refined zinc demand is estimated at 275,000 tons, vs 57,700 tons in 1977.
etal Bulletin December 1, 1978 p. 23

4FRA *France *3333400 *Refined Zinc *65 *total demand
FRA France 1033100 Zinc Ores 62 production
FRA France 3356970 Zinc Mill Products 64 exports

[illegible]/2/69
45[illegible]
[illegible]rld zinc prices must rise 60% to justify new investment in the [illegible]d-1980s, according to LM Perlman of Commodities Research Unit.
[illegible]tal Bulletin October 24, 1978 p. 22

[illegible] W *World *3333000 *Zinc *60 *market data

[illegible]2/70

421993
Plastics should hold their automotive and appliance markets despite falling zinc prices, which dropped 1.5 cents to 29 cents/lb recently; zinc prices have fallen 22% since July 1977.
Plastics World April 1978 p. 17

*1USA *United States *3075210 *Plastic Motor Vehicle Parts *69 *materials by use
1USA United States 3075400 Plastic Appliance Parts 69 materials by use

4/2/71
407858
Cominco Inc will close is lead-zinc HB Mine in British Columbia on Sept 1, 1978, due to lack of ore.
American Metal Market February 28, 1978 p. 6

*2CAN *Canada *1030000 *Lead & Zinc Mines *44 *plant closed; *Cominco; Duns No: *20-215-1551; Ticker: *CLT; CUSIP: *200435

4/2/72
405865
A reduction in European zinc prices will lead to heavy losses to the zinc producers.
Metal Bulletin February 7, 1978 p. 21,22

*4 E *Europe *3333000 *Zinc *74 *prices

4/2/73
401950
European zinc flooding into the US is taking jobs from US workers and weakening the country's production ability, said WE Flaherty, exec VP of Gulf & Western Natural Resources Group.
American Paint & Coatings Journal December 26, 1977 p. 33

*1USA *United States *3333000 *Zinc *60 *market data

4/2/74
397707
Zinc prices dropped 13% in 1977, an advantage for the rubber industry, but US producers may inflate prices to spark popular and govt awareness of their problems, which they blame on discounting by foreign producers.
Rubber & Plastics News December 26, 1977 p. 1,24

*1USA *United States *3333000 *Zinc *74 *prices
1USA United States 2816220 Zinc Oxide 69 materials by use
USA United States 2869331 Accelerators, Activators, Vulcanizers 46 materials use
USA United States 2869331 Accelerators, Activators, Vulcanizers 46 materials use

/2/75
60711
Brunswick Mining & Smelting Corp will delay completion of its Bathhurst, 3, No 12 zinc mine for over 1 yr, until 1980.
ew York Times September 13, 1977 p. 53

CAN *Canada *1033000 *Zinc Mines *44 *facilities NEC; *Brunswick Mining & Smelting; CUSIP: *117259

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$29.87 0.262 Hrs File16 4 Descriptors
$2.62 Telenet
$36.00 75 Types
$68.49 Estimated Total Cost

CHEMETCO INC.
HARTFORD, IL.

ZINC OXIDE PITS

CLOSURE DOCUMENTATION REPORT

October 23, 1986

1. DESCRIPTION OF THE FACILITY

Chemetco is a secondary copper smelter located at the intersection of Illinois Route 3 and Oldenberg Road in Madison County, Illinois. The smelter processes copper and tin bearing materials from all over the United States and is classified with the SIC designation of 3341. In its smelting and other processes, Chemetco produces the following products: anode copper, crude lead-tin solder, crude zinc oxide, and an iron silicate slag that can be used in highway construction and other applications.

The raw materials are processed initially in special Top Blown Rotary Converters. Molten copper is drawn off through an Outokumpu Casting System that uses a rotating 22 mold casting wheel to cast cooper plates, or anodes. Prior to November of 1984, Chemetco used some of these copper anodes to produce copper cathodes through an electrolytic refining process.

Exhaust gas from the Converters is captured by a tandem, double quencher/venturi scrubber system (the "AAF" scrubber) that produces crude zinc oxide. The zinc oxide is washed from the exhaust gas by a water spray. The water-borne

zinc oxide is collected as a slurry and channeled to a settling system from which the zinc oxide can be removed by pumping or by other means.

Slag, which is mostly comprised of FeO, SiO_2, CaO, and Al_2O_3, rises to the top of the molten metal bath in the Converter and is poured off into a Kress Slag Hauler. The molten slag is further processed in several different ways, depending on its intended end use.

2. DESCRIPTION OF THE UNITS TO BE CLOSED

The Zinc Oxide Pits were 2 parallel dirt-lined excavations approximately 25 feet wide, 180 feet long, and 15 feed deep located east of the Foundry and "AAF" scrubber areas (See Appendix A for diagrams of site). The slurry from the "AAF" scrubber system was pumped to the zinc oxide pits. The zinc oxide pits were used as settling units to provide time for the zinc oxide solids to settle out of the scrubber slurry. After this separation, the decanted liquid was returned, via pump and pipeline, to the scrubber circuit to collect more solid material. The zinc oxide solids were removed from the pit by "clamshell bucket" and were either sold in that form, or taken to a concrete bunker for additional dewatering. Dimensions of the pits are shown in Appendix B.

The process code for the zinc oxide pits was SO4 in the original Part A application filed on November 20, 1980. The zinc oxide pits were not listed in the revised Part A application filed on November 8, 1985, because they had been

taken out of service. A copy of the original Part A application is included in Appendix C. The zinc oxide pits accounted for 70% of the volume listed on line 1 of the Part A. Thus, the total capacity of the two parallel pits was approximately 890,000 gallons. They were placed in service in the latter part of 1978 and were operated until 1984.

In the area of the zinc oxide pits, the first fifteen feet of the soil depth consists of soils which range from dark gray silty clay loam, to brown sand. The next fifteen feet of soil is comprised of brown silty clay, grey-brown silty clay, and finally, a clay seam.

3. CONTAINMENT CAPABILITY OF UNIT

The perimeter around the pits was constructed of large aggregate built up to approximately 8 inches above the top level of the pit surface. Because of the batch type operation of the pits they had no special drainage features. The topography of the area caused the rainfall to run away from the pits. A topographical map of the site is included in Appendix D. The pits were not lined. The naturally occurring clay seam underlying the pits provided the principal containment. There were no other special containment features.

As stated above, the slurry was pumped from the "AAF" concrete pits to the dirt pits, and the decanted liquid from the dirt pits was also pumped back to the "AAF" area. There were minimum problems with spills during the routine handling of the zinc oxide slurry.

As each section of the pit was excavated, soil samples were collected and analyzed in accordance with the grid system described in Section 8 below. (See Appendix G.) If the EP Toxicity level for lead or cadmium was exceeded, further excavation was conducted. After satisfactory soil sample results were obtained for all portions of the pit, the pits were filled.

The project was completed on February 8, 1985.

6. DECONTAMINATION DESCRIPTION

The interconnecting piping and pumps which had been used to transfer the zinc oxide slurry to the pits and to return process water to the scrubber unit were cleaned with high pressure water in a concreted area of the "AAF" unit. The wash water was collected in a sump and pumped back to the "AAF" scrubber to recover any metals and zinc oxide material.

The pump was moved to a different area of the plant and placed in service.

The piping was cut to short lengths, filled with concrete and used to construct protective "bumpers" around several ground water monitoring well locations. There were minimum problems with spills during the routine handling of the zinc oxide slurry. Any spills and/or leaks from the pump or piping was confined to the north end of the pits and was cleaned up and placed in the dump trucks and transported to the storage bunker at the time of closure.

The details of the sampling protocols are presented in Appendix H. A summary of the analyses is presented in Appendix J, and copies of the laboratory reports are presented in Appendix K. The laboratory analysis protocol is presented in Appendix L

9. DESCRIPTION OF ZINC OXIDE REMOVAL

The zinc oxide material was removed from the storage pits in the sequence described in Section 5 and shown in Appendix M. The material removed from the pits was placed in the zinc oxide inventory storage area shown on Chemetco drawing no. H-4500-2-662. (See Appendix N.) Section 5 (CLOSURE CHRONOLOGY) above describes in detail the zinc oxide removal. The pavement surface at the storage area is 8-inch reinforced concrete. Around this storage slab is a reinforced concrete wall. The outer perimeter of the containment wall is protected from leaks by a curbed secondary collection system.

10. DESCRIPTION OF EQUIPMENT CLEANING

At the end of each day during the pit closing operation, the dump trucks used to haul the zinc oxide material to the new storage area were scraped and washed. The cleaning included both the truck beds and the tires. Water came from a high pressure water system. The cleaning was performed in a concreted area of the "AAF" unit which contained a sump and pump. Wash water was pumped into the "AAF" unit to reclaim zinc oxide material.

11. STATEMENT OF FACILITY STATUS AFTER CLOSURE

No treatment, storage or disposal will occur at this facility. More than 100 kg/month, but less than 1,000 kg/month will be generated, and storage will be for less than 90 days.

12. POST CLOSURE CARE PLAN

The results of the laboratory analyses indicate that the pits were closed clean. Consequently, no post closure plan is necessary. An overall site groundwater monitoring plan has been submitted to IEPA for approval.

13. CLOSURE COST

The cost to close both pits was $49,476.85, not counting Chemetco supervision and analytical laboratory charges, and has been paid in full. See Appendix O.

APPENDICES

A - Site Map

B - Pit Dimension Sketch

C - RCRA Part A Application

D - Topographic Map of Area

E - Chemical Analysis of Zinc Oxide

F - Excavation Equipment Descriptions

G - Sampling Grid

H - Sampling Protocol

I - EP Toxicity Test Procedure

J - Summary of Analytical Results

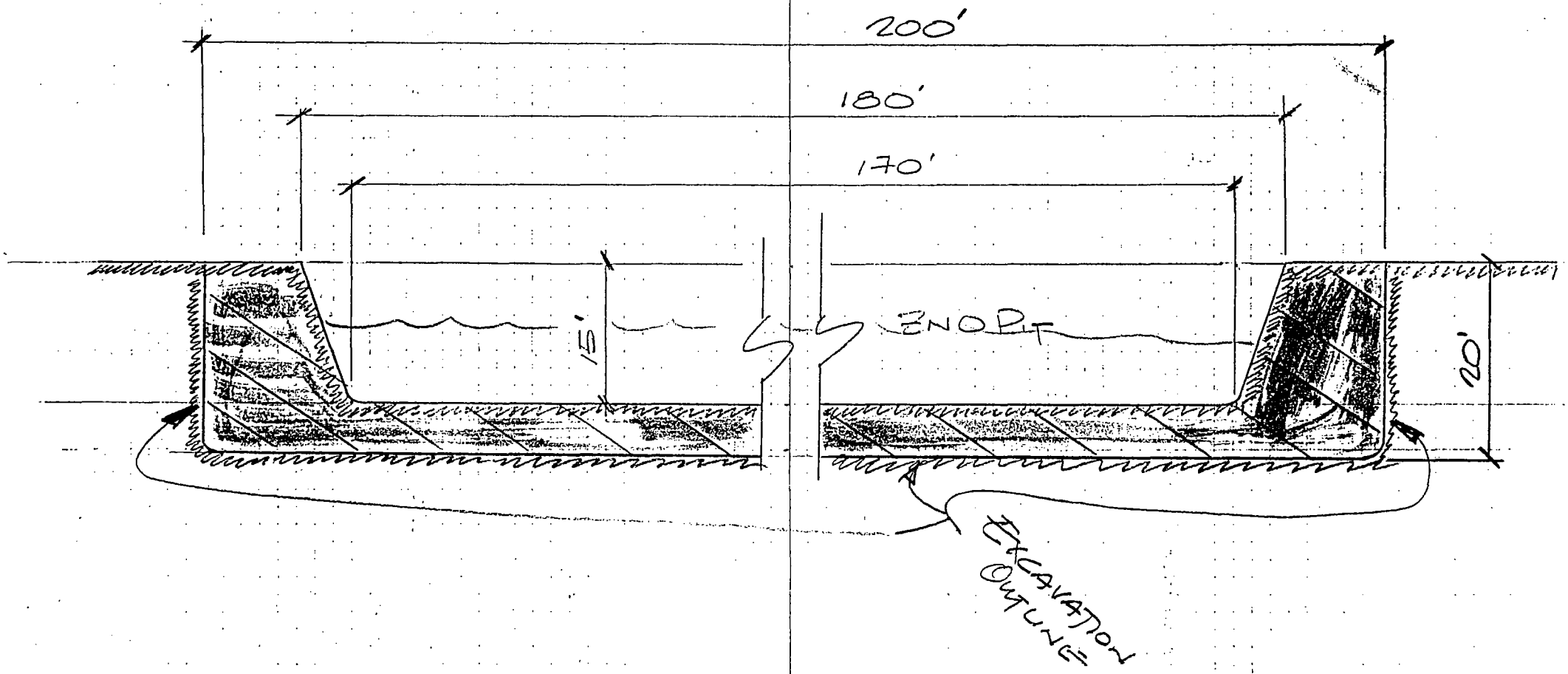
K - Detailed Laboratory Reports

L - Analytical Laboratory Protocol

M - Material Removal Sequence

N - Drawing of Zinc Oxide Inventory Storage Bunker (H4500-2662)

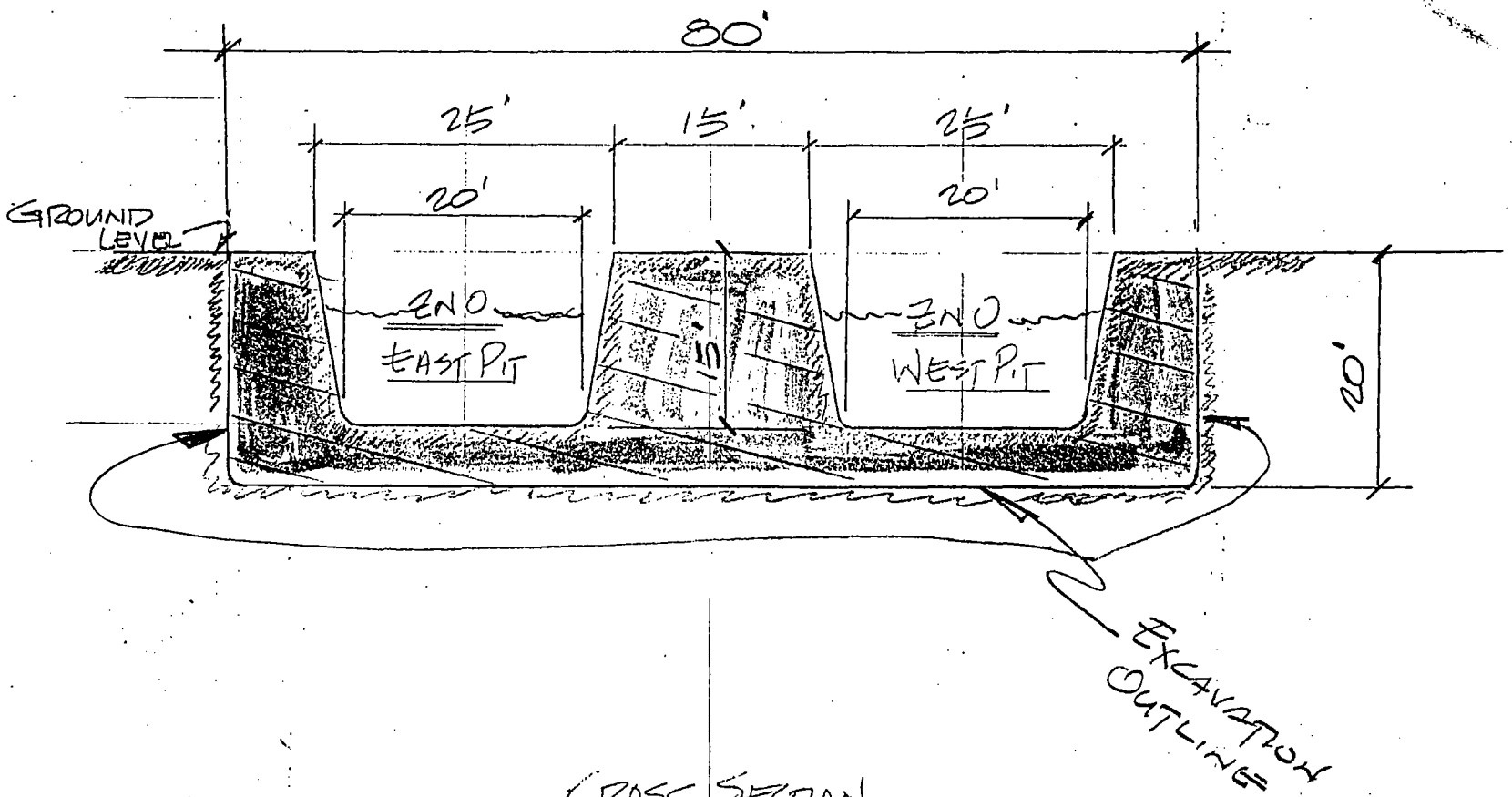
O - Confirmation of Payment for Closure Charges



LONGITUDINAL SECTION
THRU PITS
(TYPICAL OF EAST AND WEST)

APPENDIX B

ZNO SOLIDS
APPROX 1/2 TOTAL VOLUME



CROSS SECTION
THRU PITS
SHOWING MATERIAL
REMOVED

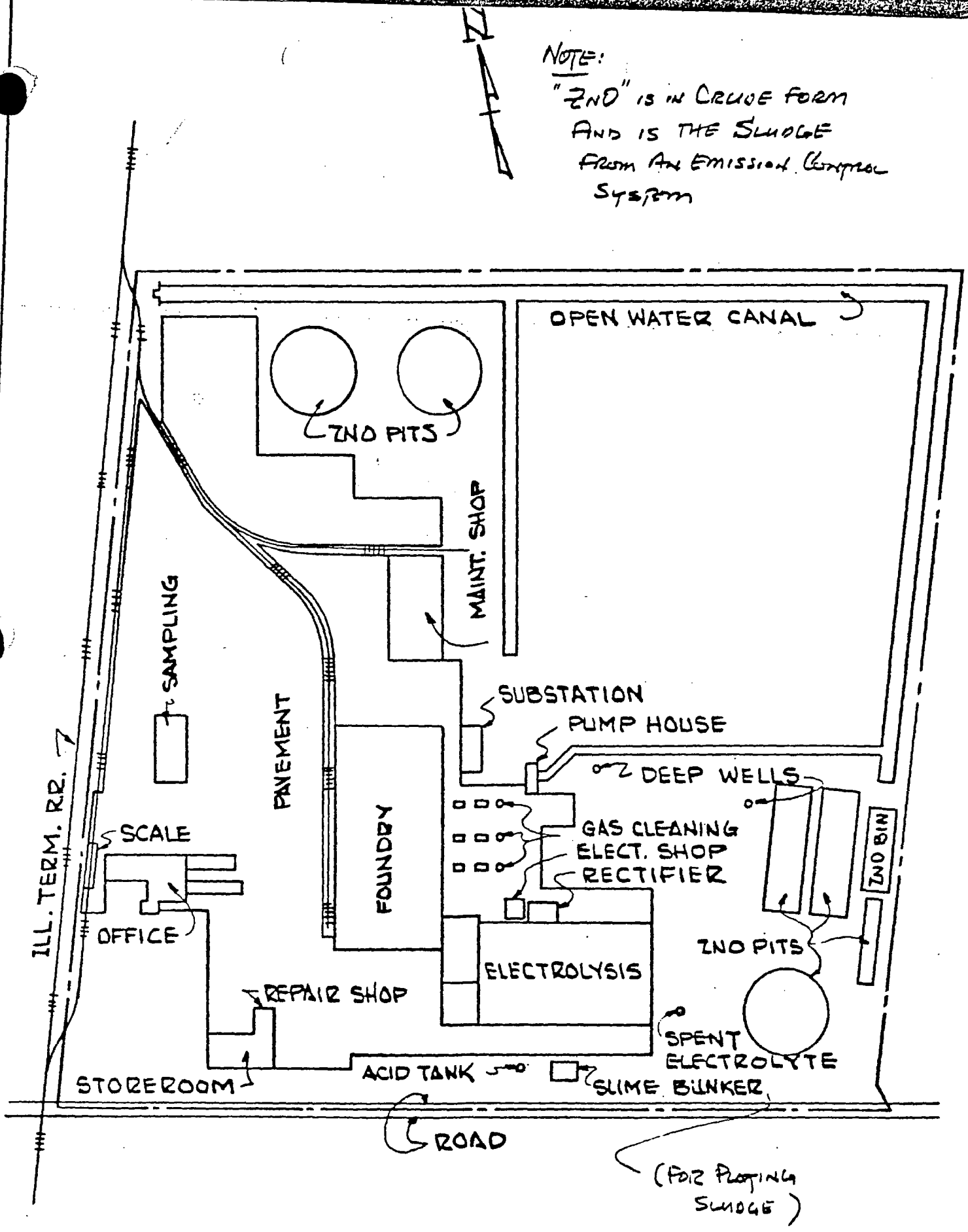
ZnO SOLIDS
APPROX 1/2 TOTAL VOLUME

APPENDIX B

Continued from page 4.

V. FACILITY DRAWING (see page 4)

Form Approved OMB No. 158-S80004



PRESENT SITE PLAN

SCALE ~ 1" = 200'

APPENDIX C

Please print or type in the unshaded areas only
(fill-in areas are spaced for elite type, i.e., 12 characters/inch).

Form Approved OMB No. 158-R0175

FORM 1 GENERAL INFORMATION

U.S. ENVIRONMENTAL PROTECTION AGENCY

EPA — U.S. ENVIRONMENTAL PROTECTION AGENCY
NOTIFICATION OF HAZARDOUS WASTE ACTIVITY

I. EPA I.D. NUMBER: F ILD048843809 D

GENERAL INSTRUCTIONS

If a preprinted label has been provided, affix it in the designated space. Review the information carefully; if any of it is incorrect, cross through it and enter the correct data in the appropriate fill-in area below. Also, if any of the preprinted data is absent *(the area to the left of the label space lists the information that should appear)*, please provide it in the proper fill-in area(s) below. If the label is complete and correct, you need not complete Items I, III, V, and VI *(except VI-B which must be completed regardless)*. Complete all items if no label has been provided. Refer to the instructions for detailed item descriptions and for the legal authorizations under which this data is collected.

INSTALLATION'S EPA I.D. NO.	ILD048843809
I. NAME OF INSTALLATION	CHEMETCO INC
II. INSTALLATION MAILING ADDRESS	HWY 3 & OLDENBURG RD HARTFORD, IL 62048
III. LOCATION OF INSTALLATION	HWY 3 & OLDENBURG RD HARTFORD, IL 62048

II. POLLUTANT CHARACTERISTICS

INSTRUCTIONS: Complete A through J to determine whether you need to submit any permit application forms to the EPA. If you answer "yes" to any questions, you must submit this form and the supplemental form listed in the parenthesis following the question. Mark "X" in the box in the third column if the supplemental form is attached. If you answer "no" to each question, you need not submit any of these forms. You may answer "no" if your activity is excluded from permit requirements; see Section C of the instructions. See also, Section D of the instructions for definitions of bold-faced terms.

SPECIFIC QUESTIONS	MARK 'X' YES	NO	FORM ATTACHED
A. Is this facility a **publicly owned treatment works** which results in a **discharge to waters of the U.S.**? (FORM 2A)		X	
B. Does or will this facility *(either existing or proposed)* include a **concentrated animal feeding operation** or **aquatic animal production facility** which results in a **discharge to waters of the U.S.**? (FORM 2B)		X	
C. Is this a facility which currently results in discharges to waters of the U.S. other than those described in A or B above? (FORM 2C)	X		
D. Is this a proposed facility *(other than those described in A or B above)* which will result in a **discharge** to waters of the U.S.? (FORM 2D)		X	
E. Does or will this facility treat, store, or dispose of **hazardous wastes**? (FORM 3)	X		
F. Do you or will you inject at this facility industrial or municipal effluent below the lowermost stratum containing, within one quarter mile of the well bore, underground sources of drinking water? (FORM 4)		X	
G. Do you or will you inject at this facility any produced water or other fluids which are brought to the surface in connection with conventional oil or natural gas production, inject fluids used for enhanced recovery of oil or natural gas, or inject fluids for storage of liquid hydrocarbons? (FORM 4)		X	
H. Do you or will you inject at this facility fluids for special processes such as mining of sulfur by the Frasch process, solution mining of minerals, in situ combustion of fossil fuel, or recovery of geothermal energy? (FORM 4)		X	
I. Is this facility a proposed **stationary source** which is one of the 28 industrial categories listed in the instructions and which will potentially emit 100 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)		X	
J. Is this facility a proposed **stationary source** which is NOT one of the 28 industrial categories listed in the instructions and which will potentially emit 250 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)		X	

III. NAME OF FACILITY

1 SKIP CHEMETCO INC

IV. FACILITY CONTACT

A. NAME & TITLE *(last, first, & title)*	B. PHONE *(area code & no.)*
2 SUAREZ JOHN VP&GEN MGR	618 254 4391

V. FACILITY MAILING ADDRESS

A. STREET OR P.O. BOX

3 P.O. BOX 187

B. CITY OR TOWN	C. STATE	D. ZIP CODE
4 ALTON	IL	62002

VI. FACILITY LOCATION

A. STREET, ROUTE NO. OR OTHER SPECIFIC IDENTIFIER

5 ROUTE 3 & OLDENBERG ROAD

B. COUNTY NAME

MADISON

C. CITY OR TOWN	D. STATE	E. ZIP CODE	F. COUNTY CODE *(if known)*
6 HARTFORD	IL	62048	UNK

CONTINUE ON REVERSE

APPENDIX C

CONTINUED FROM THE FRONT

II. SIC CODES (4-digit, in order of priority)

A. FIRST	B. SECOND
3341 (specify) COPPER	7313 (specify) COPPER
C. THIRD	**D. FOURTH**
331 (specify) COPPER	7339 (specify) COPPER

III. OPERATOR INFORMATION

A. NAME: SUAREZ JOHN

B. Is the name listed in Item VIII-A also the owner? ☐ YES ☑ NO

C. STATUS OF OPERATOR (Enter the appropriate letter into the answer box; if "Other", specify.)
F = FEDERAL
S = STATE
P = PRIVATE
M = PUBLIC (other than federal or state)
O = OTHER (specify)

P (specify) N/A

D. PHONE (area code & no.): A 618 254 4381

E. STREET OR P.O. BOX: PO BOX 187

F. CITY OR TOWN	G. STATE	H. ZIP CODE
ALTON	IL	62002

IX. INDIAN LAND

Is the facility located on Indian lands? ☐ YES ☑ NO

V. EXISTING ENVIRONMENTAL PERMITS

A. NPDES (Discharges to Surface Water): IL0025747

D. PSD (Air Emissions from Proposed Sources): 9P NA

B. UIC (Underground Injection of Fluids): NA

E. OTHER (specify): 9 119801AAC (specify) ILL EPA PLANT OPERATING PERMIT

C. RCRA (Hazardous Wastes):

E. OTHER (specify): 9 119801AAC (specify) ILL EPA FURNACE OPERATING PERMIT

VI. MAP

Attach to this application a topographic map of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing and proposed intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all springs, rivers and other surface water bodies in the map area. See instructions for precise requirements.

VII. NATURE OF BUSINESS (provide a brief description)

Secondary copper smelter with an electrolytic refinery for producing copper cathode

XIII. CERTIFICATION (see instructions)

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME & OFFICIAL TITLE (type or print)	B. SIGNATURE	C. DATE SIGNED
John M. Suarez, V. P.		

COMMENTS FOR OFFICIAL USE ONLY

Please print or type in the unshaded areas only
(fill-in areas are spaced for elite type, i.e., 12 characters/inch).

Form Approved OMB No. 158-S80004

FORM 3 3 RCRA

U.S. ENVIRONMENTAL PROTECTION AGENCY

HAZARDOUS WASTE PERMIT APPLICATION

Consolidated Permits Program

(This information is required under Section 3005 of RCRA.)

I. EPA I.D. NUMBER

S											T/A	C
F	I	L	D	0	4	8	8	4	3	8	0	9		1

FOR OFFICIAL USE ONLY

APPLICATION APPROVED	DATE RECEIVED (yr., mo., & day)	COMMENTS

II. FIRST OR REVISED APPLICATION

Place an "X" in the appropriate box in A or B below *(mark one box only)* to indicate whether this is the first application you are submitting for your facility or a revised application. If this is your first application and you already know your facility's EPA I.D. Number, or if this is a revised application, enter your facility's EPA I.D. Number in Item I above.

A. FIRST APPLICATION *(place an "X" below and provide the appropriate date)*

[X] 1. EXISTING FACILITY *(See instructions for definition of "existing" facility. Complete item below.)*

FOR EXISTING FACILITIES, PROVIDE THE DATE *(yr., mo., & day)* OPERATION BEGAN OR THE DATE CONSTRUCTION COMMENCED *(use the boxes to the left)*

YR.	MO.	DAY
69	06	01

[ ] 2. NEW FACILITY *(Complete item below.)*

FOR NEW FACILITIES, PROVIDE THE DATE *(yr., mo., & day)* OPERATION BEGAN OR IS EXPECTED TO BEGIN

YR.	MO.	DAY

B. REVISED APPLICATION *(place an "X" below and complete Item I above)*

[X] 1. FACILITY HAS INTERIM STATUS

[ ] 2. FACILITY HAS A RCRA PERMIT

III. PROCESSES — CODES AND DESIGN CAPACITIES

A. PROCESS CODE — Enter the code from the list of process codes below that best describes each process to be used at the facility. Ten lines are provided for entering codes. If more lines are needed, enter the code(s) in the space provided. If a process will be used that is not included in the list of codes below, then describe the process *(including its design capacity)* in the space provided on the form *(Item III-C)*.

B. PROCESS DESIGN CAPACITY — For each code entered in column A enter the capacity of the process.
1. AMOUNT — Enter the amount.
2. UNIT OF MEASURE — For each amount entered in column B(1), enter the code from the list of unit measure codes below that describes the unit of measure used. Only the units of measure that are listed below should be used.

PROCESS	PROCESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
Storage:		
CONTAINER *(barrel, drum, etc.)*	S01	GALLONS OR LITERS
TANK	S02	GALLONS OR LITERS
WASTE PILE	S03	CUBIC YARDS OR CUBIC METERS
SURFACE IMPOUNDMENT	S04	GALLONS OR LITERS
Disposal:		
INJECTION WELL	D79	GALLONS OR LITERS
LANDFILL	D80	ACRE-FEET *(the volume that would cover one acre to a depth of one foot)* OR HECTARE-METER
LAND APPLICATION	D81	ACRES OR HECTARES
OCEAN DISPOSAL	D82	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	D83	GALLONS OR LITERS

PROCESS	PROCESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
Treatment:		
TANK	T01	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	T02	GALLONS PER DAY OR LITERS PER DAY
INCINERATOR	T03	TONS PER HOUR OR METRIC TONS PER HOUR; GALLONS PER HOUR OR LITERS PER HOUR
OTHER *(Use for physical, chemical, thermal or biological treatment processes not occurring in tanks, surface impoundments or incinerators. Describe the processes in the space provided; Item III-C.)*	T04	GALLONS PER DAY OR LITERS PER DAY

UNIT OF MEASURE	UNIT OF MEASURE CODE	UNIT OF MEASURE	UNIT OF MEASURE CODE	UNIT OF MEASURE	UNIT OF MEASURE CODE
GALLONS	G	LITERS PER DAY	V	ACRE-FEET	A
LITERS	L	TONS PER HOUR	D	HECTARE-METER	F
CUBIC YARDS	Y	METRIC TONS PER HOUR	W	ACRES	B
CUBIC METERS	C	GALLONS PER HOUR	E	HECTARES	Q
GALLONS PER DAY	U	LITERS PER HOUR	H		

EXAMPLE FOR COMPLETING ITEM III *(shown in line numbers X-1 and X-2 below)*: A facility has two storage tanks, one tank can hold 200 gallons and the other can hold 400 gallons. The facility also has an incinerator that can burn up to 20 gallons per hour.

S											T/A	C
C	D	U	P									1

LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT (specify)	B. PROCESS DESIGN CAPACITY 2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY	LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT	B. PROCESS DESIGN CAPACITY 2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY
X-1	S02	600	G		5				
X-2	T03	20	E		6				
1	S04	1271792	G		7				
2	D03	6296	Y		8				
3	S02	20000	G		9				
4	S01	110	G		10				

CONTINUE ON REVERSE

APPENDIX C

tinued from the front.

PROCESSES *(continued)*

"ACE FOR ADDITIONAL PROCESS CODES OR FOR DESCRIBING OTHER PROCESSES *(code "T04")*. FOR EACH PROCESS ENTERED HERE NCLUDE DESIGN CAPACITY.

NA

DESCRIPTION OF HAZARDOUS WASTES

EPA HAZARDOUS WASTE NUMBER – Enter the four–digit number from 40 CFR, Subpart D for each listed hazardous waste you will handle. If you andle hazardous wastes which are not listed in 40 CFR, Subpart D, enter the four–digit number*(s)* from 40 CFR, Subpart C that describes the characteristics and/or the toxic contaminants of those hazardous wastes.

ESTIMATED ANNUAL QUANTITY – For each listed waste entered in column A estimate the quantity of that waste that will be handled on an annual asis. For each characteristic or toxic contaminant entered in column A estimate the total annual quantity of all the non–listed waste*(s)* that will be handled hich possess that characteristic or contaminant.

UNIT OF MEASURE – For each quantity entered in column B enter the unit of measure code. Units of measure which must be used and the appropriate odes are:

ENGLISH UNIT OF MEASURE	CODE	METRIC UNIT OF MEASURE	CODE
POUNDS	P	KILOGRAMS	K
TONS	T	METRIC TONS	M

f facility records use any other unit of measure for quantity, the units of measure must be converted into one of the required units of measure taking into ccount the appropriate density or specific gravity of the waste.

PROCESSES

1. PROCESS CODES:
   For listed hazardous waste: For each listed hazardous waste entered in column A select the code*(s)* from the list of process codes contained in Item III to indicate how the waste will be stored, treated, and/or disposed of at the facility.
   For non–listed hazardous wastes: For each characteristic or toxic contaminant entered in column A, select the code*(s)* from the list of process codes contained in Item III to indicate all the processes that will be used to store, treat, and/or dispose of all the non–listed hazardous wastes that possess that characteristic or toxic contaminant.
   Note: Four spaces are provided for entering process codes. If more are needed: (1) Enter the first three as described above; (2) Enter "000" in the extreme right box of Item IV-D(1); and (3) Enter in the space provided on page 4, the line number and the additional code*(s)*.

2. PROCESS DESCRIPTION: If a code is not listed for a process that will be used, describe the process in the space provided on the form.

OTE: HAZARDOUS WASTES DESCRIBED BY MORE THAN ONE EPA HAZARDOUS WASTE NUMBER – Hazardous wastes that can be described by ore than one EPA Hazardous Waste Number shall be described on the form as follows:

1. Select one of the EPA Hazardous Waste Numbers and enter it in column A. On the same line complete columns B,C, and D by estimating the total annual quantity of the waste and describing all the processes to be used to treat, store, and/or dispose of the waste.
2. In column A of the next line enter the other EPA Hazardous Waste Number that can be used to describe the waste. In column D(2) on that line enter "included with above" and make no other entries on that line.
3. Repeat step 2 for each other EPA Hazardous Waste Number that can be used to describe the hazardous waste.

XAMPLE FOR COMPLETING ITEM IV *(shown in line numbers X-1, X-2, X-3, and X-4 below)* – A facility will treat and dispose of an estimated 900 pounds r year of chrome shavings from leather tanning and finishing operation. In addition, the facility will treat and dispose of three non–listed wastes. Two wastes e corrosive only and there will be an estimated 200 pounds per year of each waste. The other waste is corrosive and ignitable and there will be an estimated 0 pounds per year of that waste. Treatment will be in an incinerator and disposal will be in a landfill.

O Z	A. EPA HAZARD. WASTE NO (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)	D. PROCESSES 2. PROCESS DESCRIPTION (if a code is not entered in D(1))
-1	K 0 5 4	900	P	T 0 3 D 8 0	
	0 0 2	400	P	T 0 3 D 8 0	
-3	D 0 0 1	100	P	T 0 3 D 8 0	
-4	D 0 0 2				included with above

A Form 3510-3 (6-80)

CONTINUE ON PAGE 3

Continued from page 2.
NOTE: Photocopy this page before completing if you have more than 26 wastes to list.

Form Approved OMB No. 158-S80004

EPA I.D. NUMBER (enter from page 1)	FOR OFFICIAL USE ONLY
W I L D 0 4 8 8 4 3 8 0 9 T/A C 1	W DUP T/A C 2 DUP

DESCRIPTION OF HAZARDOUS WASTES (continued)

LINE NO.	A. EPA HAZARD. WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)	D. PROCESSES 2. PROCESS DESCRIPTION (if a code is not entered in D(1))
1	F002	50	G	S01	
2	F007	7300000	L	S02	
3	F008	56100	G	S01	
4	U043	50	G	S01	
5	U219	50	G	S01	
6	U226	50	G	S01	
7	K069	822	T	S04	
8	K069	822	T	S03	
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					

EPA Form 3510-3 (6-80)

CONTINUE ON REVERSE

APPENDIX C

ntinued from the front.

. DESCRIPTION OF HAZARDOUS WASTES ntinued)

. USE THIS SPACE TO LIST ADDITIONAL PROCESS CODES FROM ITEM D(1) ON PAGE 3

N/A

EPA I.D. NO. (enter from page 1)	
ILD048843809	T/A C 16

VI. FACILITY DRAWING

A. existing facilities must include in the space provided on page 5 a scale drawing of the facility *(see instructions for more detail).*

VII. PHOTOGRAPHS

existing facilities must include photographs *(aerial or ground—level)* that clearly delineate all existing structures; existing storage, treatment and disposal areas; and sites of future storage, treatment or disposal areas *(see instructions for more detail).*

V ACILITY GEOGRAPHIC LOCATION

LATITUDE (degrees, minutes, & seconds)	LONGITUDE (degrees, minutes, & seconds)
38 47 030	090 05 000

VIII. FACILITY OWNER

A. If the facility owner is also the facility operator as listed in Section VIII on Form 1, "General Information", place an "X" in the box to the left and skip to Section IX below.

B. If the facility owner is not the facility operator as listed in Section VIII on Form 1, complete the following items:

1. NAME OF FACILITY'S LEGAL OWNER	2. PHONE NO. (area code & no.)
CHEMETCO	618-254-4381

3. STREET OR P.O. BOX	4. CITY OR TOWN	5. ST.	6. ZIP CODE
P. O. Box 187	ALTON	IL	62002

IX. OWNER CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME (print or type)	B. SIGNATURE	C. DATE SIGNED
John M. Suarez		

X. OPERATOR CERTIFICATION

certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached uments, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the mitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, cluding the possibility of fine and imprisonment.

A. NAME (print or type)	B. SIGNATURE	C. DATE SIGNED
John M. Suarez		

CONTINUE ON PAGE 5

znoanal

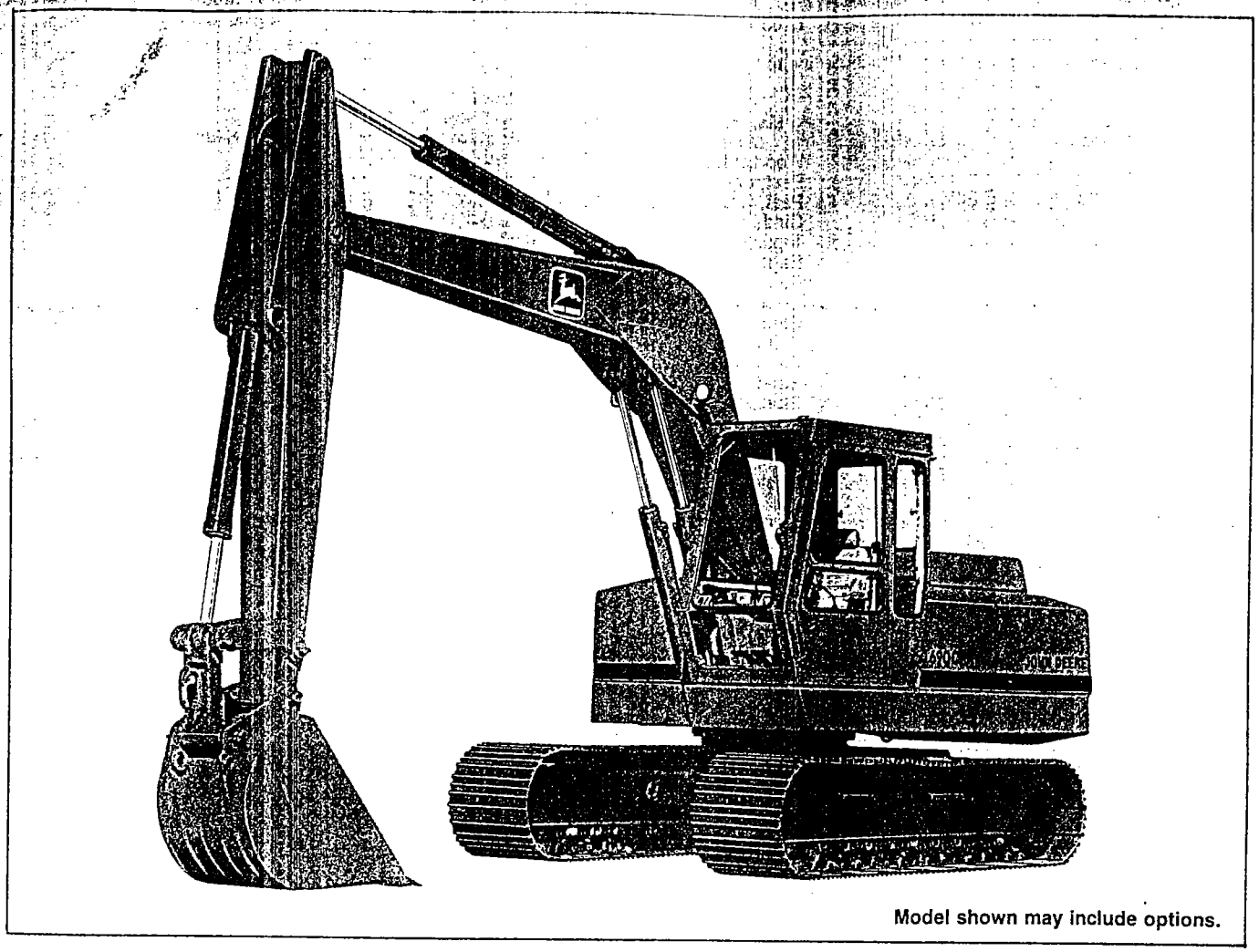
CHEMETCO INC
HARTFORD , IL
ZNO
CHEMICAL ANALYSIS

PERCENT--DRY WEIGHT BASIS

PARAMETER	SAMPLE1	SAMPLE2	SAMPLE3	SAMPLE4	SAMPLE5	SAMPLE6	SAMPLE7	SAMPLE8
ZINC	18.8	25.4	33.6	27.7	31.6	35.65	28.84	40.61
ARSENIC	0.02	0.09	0.03	0.03	0.09			
ANTIMONY	0.1	0.07	0.05	0.04	0.07	0.087	0.132	0.07
TELLURIUM	0.06	0.07	0.03	0.05	0.06			
SELENIUM	0	0	0	0	0			
TIN	0.68	0.43	0.25	0.42	0.81	1.53	1.39	1.27
IRON	2	1.5	1.58	2	1.68	2.53	2.7	2.12
LEAD	12.4	16.3	6.31	8.68	10.6	14.37	12.82	18.89
SILVER	0.022	0.016	0.022	0.01	0.17			
COPPER	14.5	9.05	7.05	7.81	10.6	9.69	12.39	8.1
NICKEL	0.15	0.22	0.36	0.25	0.16	0.53	0.59	0.38
ALUMINUM	1.3	0.31	0.67	0.79	0.53			

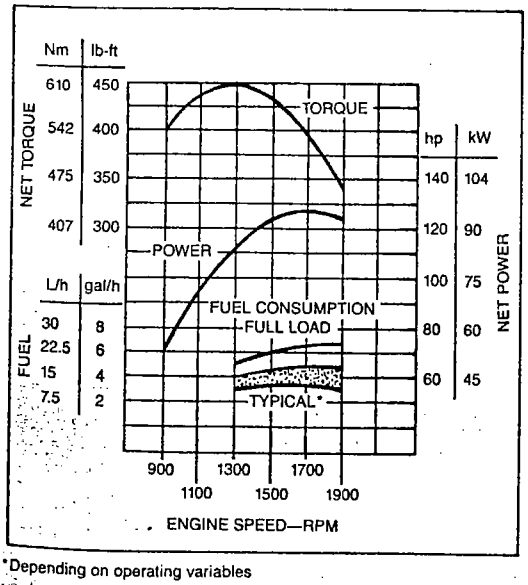
APPENDIX E

690C EXCAVATOR



Model shown may include options.

ENGINE PERFORMANCE



*Depending on operating variables

FEATURES

125-SAE-net-hp (93 kW) turbocharged John Deere diesel engine

21-ft. (6.40 m) digging depth

30-ft. (9.14 m) reach at ground level

Two-lever, all-hydraulic pilot control of boom, arm, bucket, and 360-degree continuous swing

Simultaneous operation of digging functions and propel

Track-type undercarriage with hydraulic track adjustment, sealed track chain and metal-faced seals for rollers and idlers

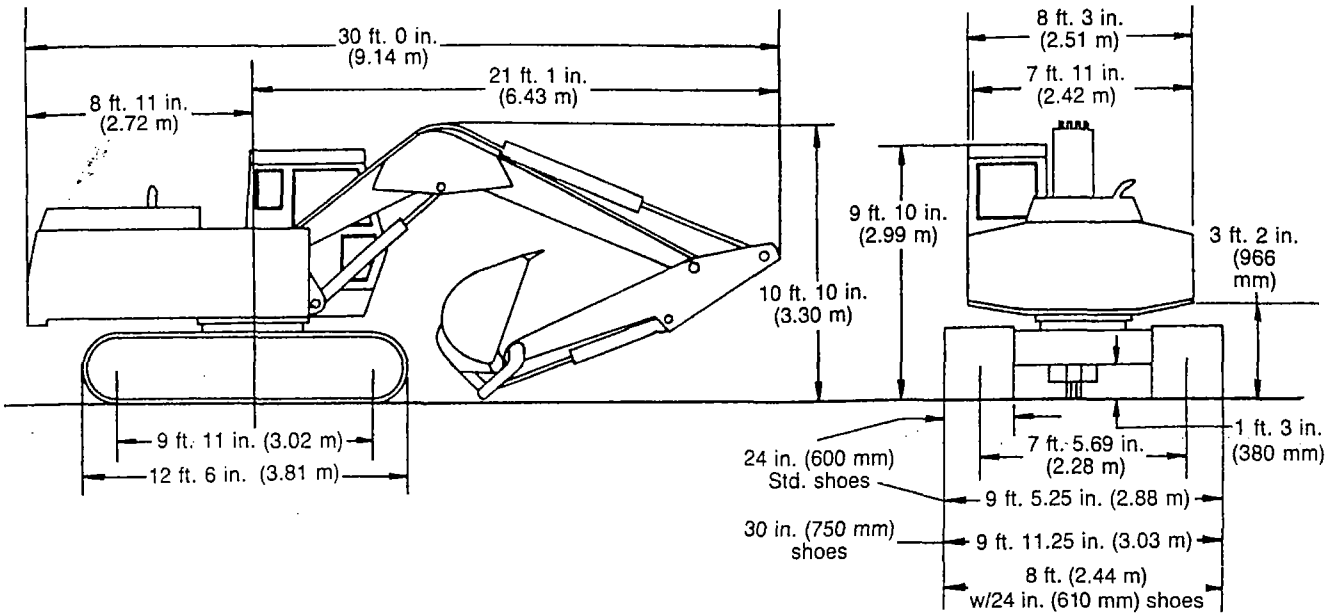
Two-speed propel with planetary gear reduction and automatically engaged multiple-wet-disk brakes

Large cab for improved operator comfort and visibility

Vandal protection—lockable cab and service doors

APPENDIX F

1/2



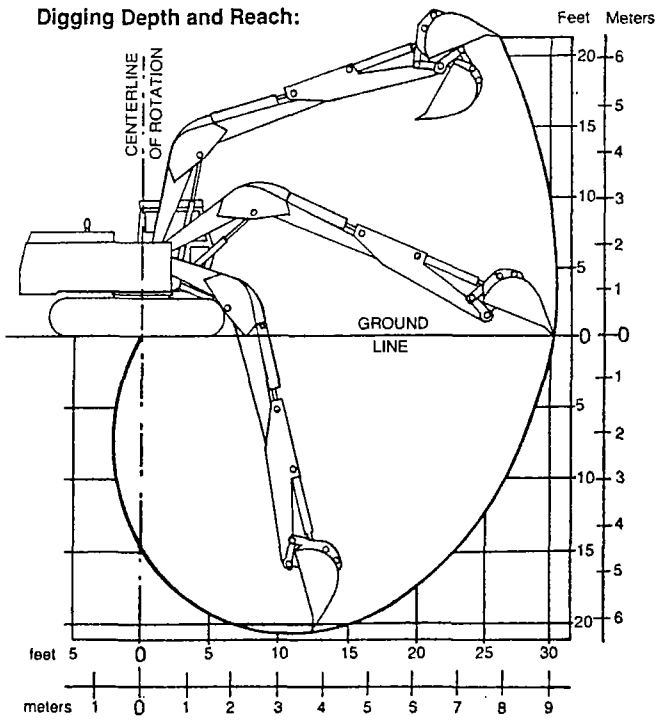
Operating Information:

Max. digging depth	21 ft. (6.40 m)
Max. reach at ground level	30 ft. (9.14 m)
Max. dumping height	15 ft. (4.57 m)
Gradability	70% (35°)
Swing speed	0-7.8 rpm
Travel speeds: Low range	0 to 0.9 mph (1.5 km/h)
High range	0 to 1.8 mph (2.8 km/h)

Weights:	lb.	kg
Operating weight (w/full fuel tank, operator, and bucket) with:		
24-in. (600 mm) triple grouser shoes	39,935	18 115
30-in. (750 mm) triple grouser shoes	40,895	18 550
Upperstructure (less front attachment and undercarriage)	15,530	7045
Undercarriage:		
24-in. (600 mm) triple-grouser shoes	17,020	7720
30-in. (750 mm) triple-grouser shoes	17,980	8155
One-piece boom (with arm cylinder)	3,350	1520
Arm, 108.14 in. (2.75 m) w/bucket cylinder and linkage	2,165	980
Boom lift cylinders, total weight (2)	515	234
Main counterweight	4,280	1940
Optional auxiliary counterweights (per set) (Two sets available)	1,100	500

Capacities:	U.S.	Liters
Fuel tank	70 gal.	265
Cooling system	42 qt.	40
Engine lubrication, including filter	25 qt.	24
Hydraulic system	80 gal.	303
Planetary propel drive (each)	10 qt.	9.5
Swing drive	8 qt.	7.6
Swing planetary drive	0.4 qt.	0.4

Digging Depth and Reach:



APPENDIX F

1150B LOADER

105 NET FLYWHEEL HORSEPOWER
Six cylinder, 451 c.i.d. Case diesel engine

FULL POWERSHIFT TRANSMISSION
Modulated power shift with torque converter for smooth directional changes and positive control

SINGLE LEVER BUCKET CONTROL
Low lever effort and ease of operation

COUNTER-ROTATING TRACKS
Turn in the length of the tractor

CONTROLLED TRANSMISSION STEERING OR BRAKE STEERING
Choice of power turns or brake turns for operator convenience and unmatched performance

IN-LINE LOADER LINKAGE
Excellent visibility of work area and bucket

Unit shown is equipped with non-standard items.
Manufactured by J I Case Company, Racine Wisconsin USA

J I Case
A Tenneco Company

1150B SPECIFICATIONS

ENGINE

Case Model A451BD, 4-cycle, naturally-aspirated diesel. Open chamber design. Uses No. 2 diesel fuel. Seven main bearings. Positive pressure oil lubrication with full flow filtering and internal cooling. Multiple cylinder heads. Aluminum alloy pistons with full skirt, three ring design. 24-volt direct-electric starting. Dry type, two-stage air cleaner with service indicator. Two-stage full flow spin-on fuel filters.

Maximum rated horsepower	
(1) Gross	125 @ 2100 rpm
(2) SAE net	105 @ 2100 rpm
Displacement	451 cu. in. (7392 cm³)
Number of cylinders	6
Bore and stroke	4⅜" × 5" (111 mm × 127 mm)
Compression ratio	16.5:1
Torque, maximum, lbs.-ft. (Nm)	
Sea level, 60°F	359 @ 1300 rpm (487 @ 1300 tr/mn)
500' altitude, 85°F	345 @ 1300 rpm (468 @ 1300 tr/mn)

(1) Manufacturer's rating of maximum engine horsepower at flywheel when equipped with oil and water pumps. Fuel set at maximum quantity for this application. Corrected to sea level - 29.92" (760 mm) Hg. and 60°F (15°C) dry air

(2) SAE net flywheel horsepower of engine as applied to this vehicle when equipped with operating accessories including oil and water pumps, alternator, air cleaner, fan and muffler. Corrected to 500' (152 m) altitude with .36" (9.5 mm) Hg. vapor pressure. 29.38" (746 mm) Hg. observed barometer and 85°F(29°C) air (per SAE J816 b).

TORQUE CONVERTER

Single stage, hydrokinetic type, 13" (330 mm) diameter with 2.92 : 1 ratio.

TRANSMISSION

Constant mesh, four speed full power shift with modulation permitting directional changes under full throttle. Four speeds forward and four speeds reverse.

TRAVEL SPEEDS

	1st		2nd		3rd		4th	
	mph	km/h	mph	km/h	mph	km/h	mph	km/h
Forward	2.1	3.4	3.0	4.8	4.3	6.9	6.0	9.7
Reverse	2.5	4.0	3.6	5.8	5.1	8.2	7.2	11.5

STEERING

Steering controlled by independent hydraulic clutches in transmission or by multiple disc power brakes. Four types of turns: power turns, gradual turns, counter-rotation, and brake turns.

FINAL DRIVES

Spur and bull gear type, single reduction. One-piece line-bored case with final drive seal guards.

BRAKES

Two multiple disc power brakes, oil cooled, independently controlled by power brake pedals for steering. Center pedal controlled braking. Separate pedal provides braking without disengaging transmission. Hand operated over-center parking brake.

UNDERCARRIAGE

Sealed track, hydraulic track adjusters. Track rollers, carrier rollers and drum type idlers are permanently lubricated. Solid disc hunting tooth sprockets and three bar semi-grousers. Reinforced box section track roller frame.

Track frame	Rigid
Track rollers (each side)	6
Carrier rollers (each side)	1
Track gauge	62" (1574 mm)
Length of track on ground	86.7" (2202 mm)
Shoes per track	40
Track shoe widths available	15" (381 mm) 16" (406 mm)
Area, track on ground	(15" shoe) 2601 sq. in. (1,68m²) (16" shoe) 2770 sq. in. (1,79m²)

BUCKET CONTROLS

Single lever control for bucket lift and dump with positive-hold regenerative "float" position in lift circuit. Positive-hold "rollback" position in dump circuit. Return-to-dig and automatic height control.

LOADER HYDRAULIC SYSTEM

Pump: Gear type, torque converter mounted, driven from engine. 52 gpm @ 2100 rpm (197 lit/min @ 2100 tr/mn).

Control Valve: Open center, parallel with pressure compensation.

System relief pressure: 2200 psi (155 kg/cm²).

Hydraulic lines: Steel tubing with flared fittings and wire-braid high-pressure hose with crimped full flow fittings.

Cylinders: Double acting with hardened, chrome plated rods.

Lift (2)	5.0" dia. × 31.45" stroke, × 2.25" rod (127 mm dia. × 799 mm stroke × 57 mm rod)
Bucket (2)	4.5" dia. × 32.0" stroke, × 2.25" rod (114 mm dia. × 813 mm stroke × 57 mm rod)

Hydraulic cycle time:

Rated load in bucket	Seconds
Raise	5.9
Dump	1.9
Lower (float down)	4.0

SERVICE REFILL CAPACITIES

	U.S. Gals.	Liters
Fuel tank	52	196.8
Engine crankcase (with filter)	3.75	14.2
Hydraulic system	15	56.8
Transmission and torque converter	15	56.8
Final drives (each side)	2	7.6
Cooling system	13	49.3

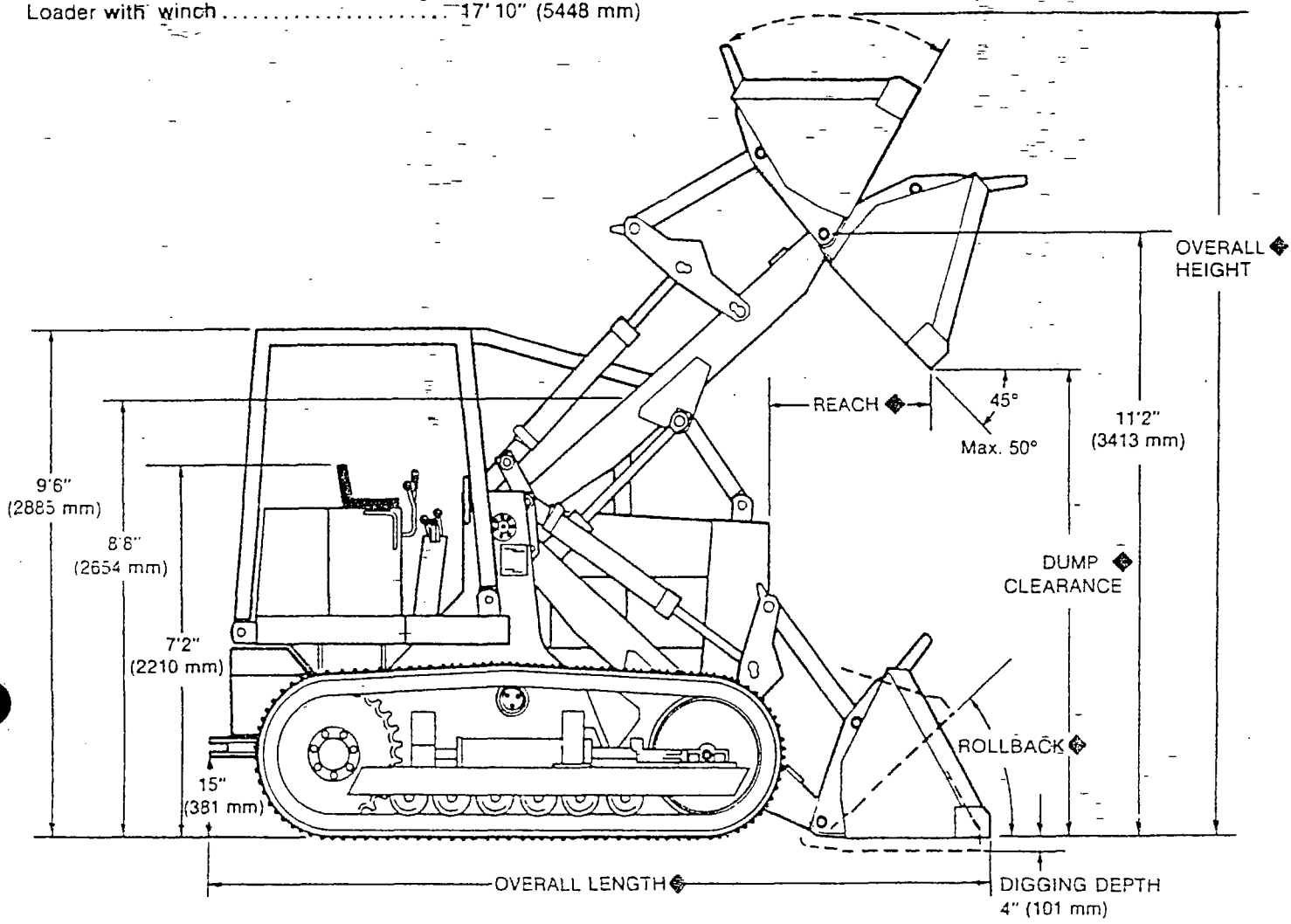
GENERAL DIMENSIONS

Overall width (at track, 15" shoes)	77" (1956 mm)
Ground clearance	13" (330 mm)
Turning clearance circle (counter-rotate turn)	22'4" (6807 mm)
Grading angle	103°

OPERATING DIMENSIONS

◆ Varies with bucket size. Refer to Performance Specifications

Overall lengths:
Loader with ripper raised ..... 18' 10" (5735 mm)
Loader with winch ..... 17' 10" (5448 mm)



PERFORMANCE SPECIFICATIONS

BUCKET TYPE - Capacity, SAE rated nominally heaped	GENERAL PURPOSE 1-3/4 cu. yd. (1,33m³)	LIGHT MATERIAL 2.0 cu. yd. (1.52m³)	4-IN-1 1-3/4 cu. yd. (1,33m³)
Struck capacity	1.52 cu. yd. (1,16m³)	1.65 cu. yd. (1,26m³)	1.47 cu. yd. (1.12m³)
Bucket weight (less teeth)	1620 lbs. (735 kg)	1800 lbs. (817 kg)	2,480 lbs. (1125 kg)
Bucket width	81.2" (2062 mm)	87" (2210 mm)	84.4" (2144 mm)
Breakout force	18,400 lbs. (8346 kg)	17,100 lbs. (7756 kg)	17,400 lbs. (7892 kg)
Maximum lift capacity	9,200 lbs. (4173 kg)	9,000 lbs. (4082 kg)	8,100 lbs. (3674 kg)
Bucket rollback at ground line	40°	40.5°	43°
at 18" (457 mm) carry	43°	43°	45°
Dump clearance @ full lift-45° discharge	8'8" (2641 mm)	8'5" (2575 mm)	8'2" (2495 mm)
Reach @ 45° discharge angle, 7' clearance	4'6" (1366 mm)	4'5" (1364 mm)	4'1" (1252 mm)
Reach @ full lift, 45° discharge	3' 4¾" (1036 mm)	3'6" (1066 mm)	3'3" (998 mm)
Overall length	15'9" (4800 mm)	16'0" (4890 mm)	16'4" (4978 mm)
Overall height	15'4" (4673 mm)	15'2" (4635 mm)	15'3" (4648 mm)
Static tipping load**	16,700 lbs. (7575 kg)	16,600 lbs. (7530 kg)	15,100 lbs. (6849 kg)
Operating weight (approx.)**	24,800 lbs. (11249 kg)	25,000 lbs. (11340 kg)	25,700 lbs. (11658 kg)
With ROPS**	25,515 lbs. (11574 kg)	25,715 lbs. (11664 kg)	26,415 lbs. (11982 kg)

**Machine stability and operating weight can be increased through the addition of optional equipment.

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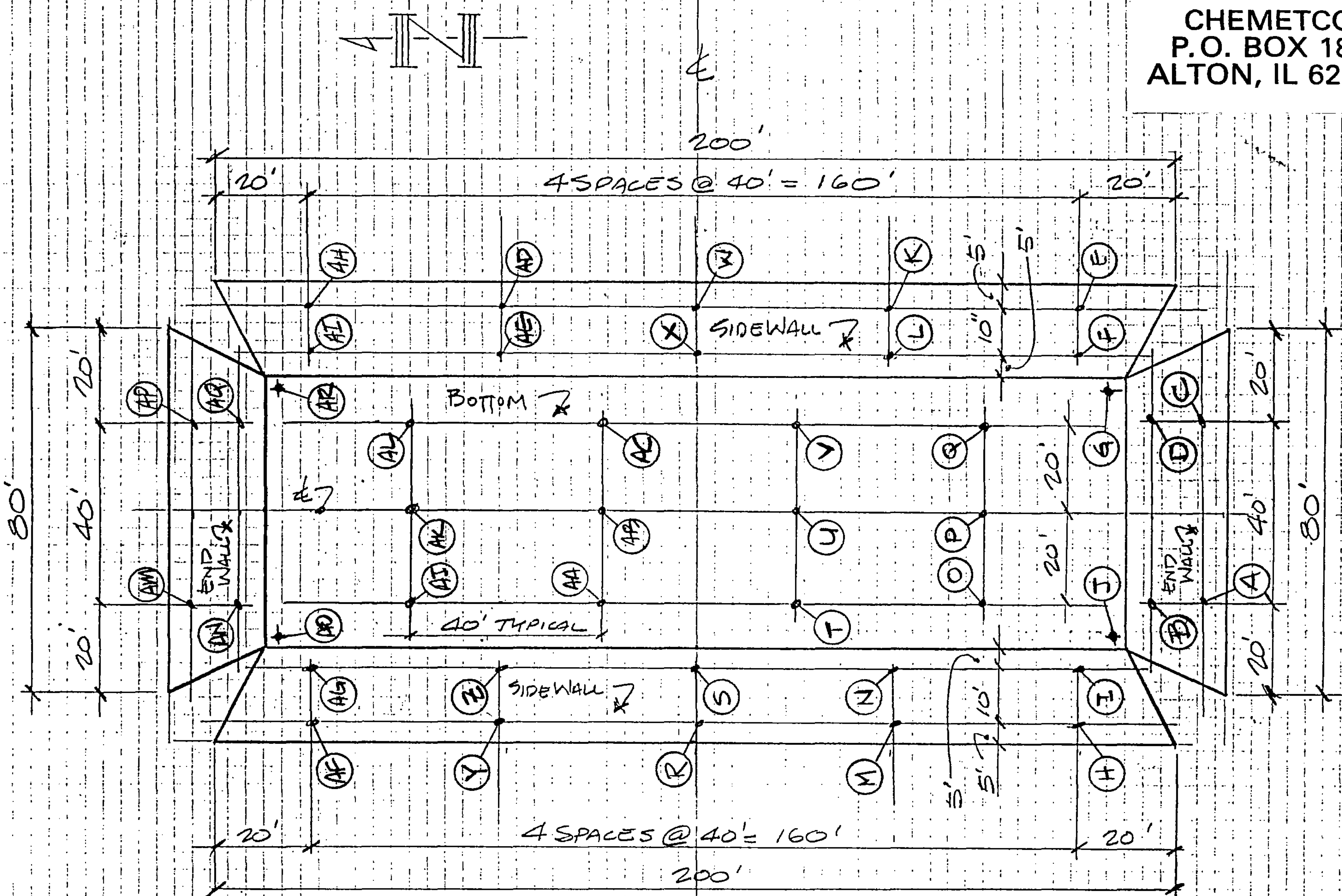
ALTON, IL 62002

Appendix G



ZnO PIT
PLAN VIEW
SAMPLING AND ANALYSIS
SAMPLE GRID

OPENING AT GROUNDLEVEL
APPROXIMATELY 80' X 200'
BOTTOM
APPROXIMATELY 60' X 180'

CHEMETCO INC.
HARTFORD, IL.

ZINC OXIDE PIT-CLOSURE
SOIL SAMPLING PROCEDURE

1. The surface dimensions of the zinc oxide pits were determined by measuring. The pit depth was estimated.

2. The pit area was inspected for evidence of spills, anomolies, and any irregularities requiring special consideration, or additional sampling.

3. The history of pit usage was reviewed.

4. A sampling grid was prepared. (See Appendix G.)

5. Based on pit usage, and the known chemical constituents of Chemetco's of zinc oxide were selected as the appropriate analytical parameters for analyzing the soil at both the sides and bottom of the pit.

6. 12" x 15" "ziploc" plastic bags were selected for sample containers. Using a broad-tipped indelible marker, each bag was numbered to correspond to the respective sample grid site location.

7. A new long handled round point shovel was chosen for taking the soil sample.

8. A box of new "wiping cloths" was obtained from the plant storeroom.

9. A five-gallon container of distilled water was obtained from the plant laboratory.

10. Individuals involved in closure and sampling were required to wear hard hats, safety glasses, safety shoes, and leather-palmed work gloves.

11. At each sample site, samples were collected after the zinc oxide material and sufficient underlying soil had been removed to expose apparently clean soil.

12. The shovel was inspected for contamination with foreign material.

13. The shovel point was rinsed with distilled water and wiped dry with the cloths obtained from the storeroom.

14. The blade of the shovel was positioned perpendicular to the soil surface and forced into it to a depth of approximately 12 inches.

15. The soil was transferred to the "ziploc" container, the container was closed and sealed.

16. The outside of the container was wiped clean and labeled.

17. The sample site designation was checked to compare the site number with the corresponding number on the sample container.

18. The sampler (shovel) was cleaned as in Item 13 above.

19. The sample was delivered to the laboratory for immediate analysis for EP Toxicity for lead and cadmium.

20. The above steps were repeated at each sample site.

October 26, 1986

§ 261.33 Discarded commercial chemical products, off-specification species, container residues and spill residues thereof.

The following materials or items are hazardous wastes if and when they are discarded or intended to be discarded unless they are excluded under §§ 260.20 and 260.22 and listed in Appendix IX.

* * * * *

(f) * * *

Hazardous waste No.	Substance
* * * * *	
U242	Pentachlorophenol.
* * * * *	
U242	Phenol, pentachloro-.
U212	Phenol, 2,3,4,6-tetrachloro-.
U212	Phenol, 2,4,5-trichloro-.
U230	Phenol, 2,4,6-trichloro-.
* * * * *	
U231	Propionic acid, 2-(2,4,5-trichlorophenoxy)-.
* * * * *	
U233	Silvex.
* * * * *	
U232	2,4,5-T.
* * * * *	
U212	2,3,4,6-Tetrachlorophenol.
* * * * *	
U230	2,4,5-Trichlorophenol.
U231	2,4,6-Trichlorophenol.
U230	2,4,5-Trichlorophenoxyacetic acid.
* * * * *	

Appendix I—Representative Sampling Methods

The methods and equipment used for sampling waste materials will vary with the form and consistency of the waste materials to be sampled. Samples collected using the sampling protocols listed below, for sampling waste with properties similar to the indicated materials, will be considered by the Agency to be representative of the waste.

Extremely viscous liquid—ASTM Standard D140-70 Crushed or powdered material—ASTM Standard D346-75 Soil or rock-like material—ASTM Standard D420-69 Soil-like material—ASTM Standard D1452-65

Fly Ash-like material—ASTM Standard D2234-76 [ASTM Standards are available from ASTM, 1916 Race St., Philadelphia, PA 19103]

Containerized liquid wastes—"COLIWASA" described in "Test Methods for the Evaluation of Solid Waste, Physical/Chemical Methods," [a] U.S. Environmental Protection Agency, Office of Solid Waste, Washington, D.C. 20460. [Copies may be obtained from Solid Waste Information, U.S. Environmental Protection Agency, 26 W. St. Clair St., Cincinnati, Ohio 45268]

Liquid waste in pits, ponds, lagoons, and similar reservoirs.—"Pond Sampler" described in "Test Methods for the Evaluation of Solid Waste, Physical/Chemical Methods." [a]

This manual also contains additional information on application of these protocols.

Appendix II—EP Toxicity Test Procedures

A. Extraction Procedure (EP)

1. A representative sample of the waste to be tested (minimum size 100 grams) shall be obtained using the methods specified in Appendix I or any other method capable of yielding a representative sample within the meaning of Part 260. [For detailed guidance on conducting the various aspects of the EP see "Test Methods for the Evaluation of Solid Waste, Physical/Chemical Methods" (incorporated by reference, see § 260.11).]

2. The sample shall be separated into its component liquid and solid phases using the method described in "Separation Procedure" below. If the solid residue [b] obtained using this method totals less than 0.5% of the original weight of the waste, the residue can be discarded and the operator shall treat the liquid phase as the extract and proceed immediately to Step 8.

3. The solid material obtained from the Separation Procedure shall be evaluated for its particle size. If the solid material has a surface area per gram of material equal to, or greater than, 3.1 cm^2 or passes through a 9.5 mm (0.375 inch) standard sieve, the operator shall proceed to Step 4. If the surface area is smaller or the particle size larger than specified above, the solid material shall be prepared for extraction by crushing, cutting or grinding the material so that

[a] These methods are also described in "Samplers and Sampling Procedures for Hazardous Waste Streams," EPA 600/2-80-018, January 1980.

[b] The percent solids is determined by drying the filter pad at 80°C until it reaches constant weight and then calculating the percent solids using the following equation:

Percent solids =

$$\frac{(\text{weight of pad + solid}) - (\text{tare weight of pad})}{\text{initial weight of sample}} \times 100$$

it passes through a 9.5 mm (0.375 inch) sieve or, if the material is in a single piece, by subjecting the material to the "Structural Integrity Procedure" described below.

4. The solid material obtained in Step 3 shall be weighed and placed in an extractor with 16 times its weight of deionized water. Do not allow the material to dry prior to weighing. For purposes of this test, an acceptable extractor is one which will impart sufficient agitation to the mixture to not only prevent stratification of the sample and extraction fluid but also insure that all sample surfaces are continuously brought into contact with well mixed extraction fluid.

5. After the solid material and deionized water are placed in the extractor, the operator shall begin agitation and measure the pH of the solution in the extractor. If the pH is greater than 5.0, the pH of the solution shall be decreased to 5.0 ± 0.2 by adding 0.5 N acetic acid. If the pH is equal to or less than 5.0, no acetic acid should be added. The pH of the solution shall be monitored, as described below, during the course of the extraction and if the pH rises above 5.2, 0.5N acetic acid shall be added to bring the pH down to 5.0 ± 0.2. However, in no event shall the aggregrate amount of acid added to the solution exceed 4 ml of acid per gram of solid. The mixture shall be agitated for 24 hours and maintained at 20°-40°C (68°-104°F) during this time. It is recommended that the operator monitor and adjust the pH during the course of the extraction with a device such as the Type 45-A pH Controller manufactured by Chemtrix, Inc., Hillsboro, Oregon 97123 or its equivalent, in conjunction with a metering pump and reservoir of 0.5N acetic acid. If such a system is not available, the following manual procedure shall be employed:

(a) A pH meter shall be calibrated in accordance with the manufacturer's specifications.

(b) The pH of the solution shall be checked and, if necessary, 0.5N acetic acid shall be manually added to the extractor until the pH reaches 5.0 ± 0.2. The pH of the solution shall be adjusted at 15, 30 and 60 minute intervals, moving to the next longer interval if the pH does not have to be adjusted more than 0.5N pH units.

(c) The adjustment procedure shall be continued for at least 6 hours.

(d) If at the end of the 24-hour extraction period, the pH of the solution is not below 5.2 and the maximum amount of acid (4 ml per gram of solids) has not been added, the pH shall be adjusted to 5.0 ± 0.2 and the extraction continued for an additional four hours, during which the pH shall be adjusted at one hour intervals.

6. At the end of the 24 hour extraction period, deionized water shall be added to the extractor in an amount determined by the following equation:

$V=(20)(W)-16(W)-A$

V = ml deionized water to be added

W = weight in grams of solid charged to extractor

A = ml of 0.5N acetic acid added during extraction

7. The material in the extractor shall be separated into its component liquid and solid phases as described under "Separation Procedure."

8. The liquids resulting from Steps 2 and 7 shall be combined. This combined liquid (or the waste itself if it has less than ½ percent solids, as noted in step 2) is the extract and shall be analyzed for the presence of any of the contaminants specified in Table I of § 261.24 using the Analytical Procedures designated below.

Separation Procedure

Equipment: A filter holder, designed for filtration media having a nominal pore size of 0.45 micrometers and capable of applying a 5.3 kg/cm² (75 psi) hydrostatic pressure to the solution being filtered, shall be used. For mixtures containing nonabsorptive solids, where separation can be effected without imposing a 5.3 kg/cm² pressure differential, vacuum filters employing a 0.45 micrometers filter media can be used. (For further guidance on filtration equipment or procedures see "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods" incorporated by reference, see § 260.11). Procedure:[2]

(i) Following manufacturer's directions, the filter unit shall be assembled with a filter bed consisting of a 0.45 micrometer filter membrane. For difficult or slow to filter mixtures a prefilter bed consisting of the following prefilters in increasing pore size (0.65 micrometer membrane, fine glass

[2]This procedure is intended to result in separation of the "free" liquid portion of the waste from any solid matter having a particle size >0.45 μm. If the sample will not filter, various other separation techniques can be used to aid in the filtration. As described above, pressure filtration is employed to speed up the filtration process. This does not alter the nature of the separation. If liquid does not separate during filtration, the waste can be centrifuged. If separation occurs during centrifugation, the liquid portion (centrifugate) is filtered through the 0.45 μm filter prior to becoming mixed with the liquid portion of the waste obtained from the initial filtration. Any material that will not pass through the filter after centrifugation is considered a solid and is extracted.

fiber prefilter, and coarse glass fiber prefilter) can be used.

(ii) The waste shall be poured into the filtration unit.

(iii) The reservoir shall be slowly pressurized until liquid begins to flow from the filtrate outlet at which point the pressure in the filter shall be immediately lowered to 10-15 psig. Filtration shall be continued until liquid flow ceases.

(iv) The pressure shall be increased stepwise in 10 psi increments to 75 psig and filtration continued until flow ceases or the pressurizing gas begins to exit from the filtrate outlet.

(v) The filter unit shall be depressurized, the solid material removed and weighed and then transferred to the extraction apparatus, or, in the case of final filtration prior to analysis, discarded. Do not allow the material retained on the filter pad to dry prior to weighing.

(vi) The liquid phase shall be stored at 4°C for subsequent use in Step 8.

B. Structural Integrity Procedure

Equipment: A Structural Integrity Tester having a 3.18 cm (1.25 in.) diameter hammer weighing 0.33 kg (0.73 lbs.) and having a free fall of 15.24 cm (6 in.) shall be used. This device is available from Associated Design and Manufacturing Company, Alexandria, VA 22314, as Part No. 125, or it may be fabricated to meet the specifications shown in Figure 1.

Procedure

1. The sample holder shall be filled with the material to be tested. If the sample of waste is a large monolithic block, a portion shall be cut from the block having the dimensions of a 3.3 cm (1.3 in.) diameter x 7.1 cm (2.8 in.) cylinder. For a fixated waste samples may be cast in the form of a 3.3 cm (1.3 in.) diameter x 7.1 cm (2.8 in.) cylinder for purposes of conducting this test. In such cases, the waste may be allowed to cure for 30 days prior to further testing.

2. The sample holder shall be placed into the Structural Integrity Tester, then the hammer shall be raised to its maximum height and dropped. This shall be repeated fifteen times.

3. The material shall be removed from the sample holder, weighed, and transferred to the extraction apparatus for extraction.

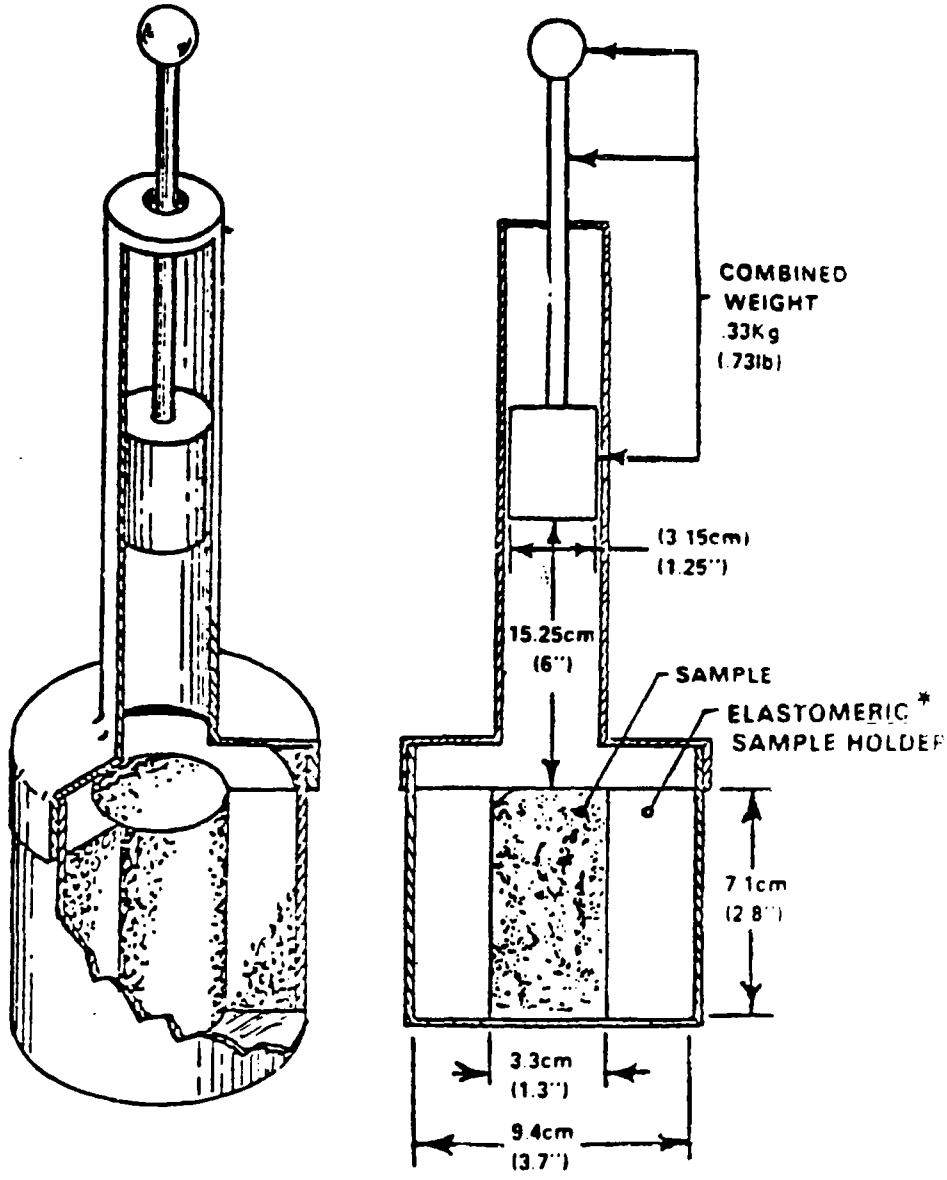
Analytical Procedures for Analyzing Extract Contaminants

The test methods for analyzing the extract are as follows:

1. For arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver, endrin, lindane, methoxychlor, toxaphene, 2,4-D[2,4-dichlorophenoxyacetic acid] or 2,4,5-TP [2,4,5-trichlorophenoxypropionic acid]: "Test Methods for the Evaluation of Solid Waste, Physical/Chemical Methods" (incorporated by reference, see § 260.11).

2. [Reserved]

For all analyses, the methods of standard addition shall be used for quantification of species concentration.



*ELASTOMERIC SAMPLE HOLDER FABRICATED OF MATERIAL FIRM ENOUGH TO SUPPORT THE SAMPLE

Figure 1
COMPACTION TESTER

[45 FR 33119, May 19, 1980, as amended at 46 FR 35247, July 7, 1981]

znopit

CHEMETCO, HARTFORD IL
ZNO PIT CLOSURE
SAMPLING RESULTS (EP TOXICITY)

SAMPLE NO.	LEAD (UG/G)	CADMIUM (UG/G)	LAB
1	0.016	0.005	EA
2	0.1	0.01	EA
3	0.017	0.005	EA
4	0.1	0.01	EA
5	0.014	0.005	EA
6	0.1	0.01	EA
7	0.016	0.005	EA
8	0.023	0.005	EA
9	0.1	0.01	EA
10	0.018	0.005	EA
11	0.021	0.01	EA
12	0.017	0.01	EA
13	1.08	0.005	EA
14	0.21	0.005	EA
15	0.006	0.005	EA
16	0.009	0.005	EA
17	0.012	0.01	EA
18	0.011	0.01	EA
19	0.009	0.005	EA
20	0.027	0.01	EA
21	0.1	0.01	LC
22	0.1	0.01	EA
23	0.1	0.1	EA
24	0.011	0.01	EA
25	0.085	0.01	EA
26	0.1	0.01	EA
27	0.009	0.01	EA
28	0.013	0.01	EA
29	0.1	0.01	EA
30	0.009	0.01	EA
31	0.1	0.01	EA
32	0.031	0.01	EA
33	0.013	0.005	EA
34	0.012	0.01	EA
35	0.008	0.01	EA
36	0.024	0.01	EA
37	0.023	0.01	EA
38	0.101	0.005	EA
39	0.01	0.005	EA
40	0.1	0.01	EA
41	0.011	0.01	EA
42	0.005	0.01	EA
43	0.008	0.005	EA
44	0.127	0.01	LC
AVERAGE	0.070590	0.010111	

APPENDIX J

Environmental Analysis, Inc.
3278 N. Lindbergh Blvd. · Florissant, MO 63033 · 314-921-4488

PAGE NO : 1
REPORT NO : 8600845
DATE : 06/27/86
P.O. No. : VERBAL

MR. JOEL MCKELL
CHEMETCO
POST OFFICE BOX 187
ALTON IL 62002

REPORT OF ANALYSIS

SUBJECT : Analysis of waste samples in accordance with SW-846: Test Methods for Evaluating Solid Waste - Physical/Chemical Methods, 1982; where applicable.

LOG NUMBER	SAMPLE DESCRIPTION
706624	SOIL SAMPLE #2
706625	SOIL SAMPLE #4
706626	SOIL SAMPLE #6
706627	SOIL SAMPLE #9
706628	SOIL SAMPLE #22
706629	SOIL SAMPLE #23
706630	SOIL SAMPLE #26
706631	SOIL SAMPLE #29
706632	SOIL SAMPLE #31
706633	SOIL SAMPLE #40

RESULTS OF ANALYSIS APPEAR ON FOLLOWING PAGES

RESPECTFULLY SUBMITTED

R. M. FERRIS

APPENDIX K

Environmental Analysis, Inc.
3278 N. Lindbergh Blvd. · Florissant, MO 63033 · 314-921-4488

CHEMETCO

REPORT NO : 8600845
DATE : 06/27/86

RESULTS OF ANALYSIS

LOG NUMBER	SAMPLE DESCRIPTION	TEST NAME	RESULTS OF ANALYSIS	UNITS OF EXPRESSION
706624	SOIL SAMPLE #2	EP TOXICITY	261.24	Meth.No
		EP Cadmium	<0.010	mg Cd/l
		EP Lead	<0.10	mg Pb/l
706625	SOIL SAMPLE #4	EP TOXICITY	261.24	Meth.No
		EP Cadmium	<0.010	mg Cd/l
		EP Lead	<0.10	mg Pb/l
706626	SOIL SAMPLE #6	EP TOXICITY	261.24	Meth.No
		EP Cadmium	<0.010	mg Cd/l
		EP Lead	<0.10	mg Pb/l
706627	SOIL SAMPLE #9	EP TOXICITY	261.24	Meth.No
		EP Cadmium	<0.010	mg Cd/l
		EP Lead	<0.10	mg Pb/l
706628	SOIL SAMPLE #22	EP TOXICITY	261.24	Meth.No
		EP Cadmium	<0.010	mg Cd/l
		EP Lead	<0.10	mg Pb/l
706629	SOIL SAMPLE #23	EP TOXICITY	261.24	Meth.No
		EP Cadmium	<0.010	mg Cd/l
		EP Lead	<0.10	mg Pb/l
706630	SOIL SAMPLE #26	EP TOXICITY	261.24	Meth.No
		EP Cadmium	<0.010	mg Cd/l
		EP Lead	<0.10	mg Pb/l
706631	SOIL SAMPLE #29	EP TOXICITY	261.24	Meth.No
		EP Cadmium	<0.010	mg Cd/l
		EP Lead	<0.10	mg Pb/l
706632	SOIL SAMPLE #31	EP TOXICITY	261.24	Meth.No
		EP Cadmium	<0.010	mg Cd/l

Appendix K

Environmental Analysis, Inc.
3278 N. Lindbergh Blvd. · Florissant, MO 63033 · 314-921-4488

PAGE NO : 3
REPORT NO : 8600845
DATE : 06/27/86

CHEMETCO

RESULTS OF ANALYSIS

LOG NUMBER	SAMPLE DESCRIPTION	TEST NAME	RESULTS OF ANALYSIS	UNITS OF EXPRESSION
706632	SOIL SAMPLE #31	EP Lead	<0.10	mg Pb/l
706633	SOIL SAMPLE #40	EP TOXICITY	261.24	Meth.No
		EP Cadmium	<0.010	mg Cd/l
		EP Lead	<0.10	mg Pb/l

Environmental Analysis, Inc.
3278 N. Lindbergh Blvd. · Florissant, MO 63033 · 314-921-4488

Joel

PAGE NO : 1
REPORT NO : 22925
DATE : 10/14/86
P.O. No. :

JANE DRUMHILLER
LC METALS
BOX 192
GRANITE CITY IL 62040

REPORT OF ANALYSIS

SUBJECT : Analysis of waste samples in accordance with SW-846: Test Methods for Evaluating Solid Waste - Physical/Chemical Methods, 1982; where applicable.

LOG NUMBER	SAMPLE DESCRIPTION
715520	SAMPLE #3 9/25
715521	SAMPLE #5 9/25
715522	SAMPLE #13 9/25
715523	SAMPLE #14 9/25
715524	SAMPLE #15 9/25
715525	SAMPLE #16 9/25
715526	SAMPLE #19 9/25
715527	SAMPLE #33 9/25
715528	SAMPLE #38 9/25
715529	SAMPLE #39 9/25
715530	SAMPLE #43 9/25

RESULTS OF ANALYSIS APPEAR ON FOLLOWING PAGES

RESPECTFULLY SUBMITTED

R. M. FERRIS

K

Environmental Analysis, Inc.
3278 N. Lindbergh Blvd. • Florissant, MO 63033 • 314-921-4488

LC METALS

REPORT NO : 22925
DATE : 10/14/86

RESULTS OF ANALYSIS

LOG NUMBER	SAMPLE DESCRIPTION	TEST NAME	RESULTS OF ANALYSIS	UNITS OF EXPRESSION
715520	SAMPLE #3 9/25	EP TOXICITY	261.24	Meth.No
		EP Cadmium	<0.005	mg Cd/l
		EP Lead	0.017	mg Pb/l
715521	SAMPLE #5 9/25	EP TOXICITY	261.24	Meth.No
		EP Cadmium	<0.005	mg Cd/l
		EP Lead	0.014	mg Pb/l
715522	SAMPLE #13 9/25	EP TOXICITY	261.24	Meth.No
		EP Cadmium	<0.005	mg Cd/l
		EP Lead	1.08	mg Pb/l
715523	SAMPLE #14 9/25	EP TOXICITY	261.24	Meth.No
		EP Cadmium	<0.005	mg Cd/l
		EP Lead	0.21	mg Pb/l
715524	SAMPLE #15 9/25	EP TOXICITY	261.24	Meth.No
		EP Cadmium	<0.005	mg Cd/l
		EP Lead	0.006	mg Pb/l
715525	SAMPLE #16 9/25	EP TOXICITY	261.24	Meth.No
		EP Cadmium	<0.005	mg Cd/l
		EP Lead	0.009	mg Pb/l
715526	SAMPLE #19 9/25	EP TOXICITY	261.24	Meth.No
		EP Cadmium	<0.005	mg Cd/l
		EP Lead	0.009	mg Pb/l
715527	SAMPLE #33 9/25	EP TOXICITY	261.24	Meth.No
		EP Cadmium	<0.005	mg Cd/l
		EP Lead	0.013	mg Pb/l
715528	SAMPLE #38 9/25	EP TOXICITY	261.24	Meth.No
		EP Cadmium	<0.005	mg Cd/l

K

Environmental Analysis, Inc.
3278 N. Lindbergh Blvd. · Florissant, MO 63033 · 314-921-4488

LC METALS

REPORT NO : 22925
DATE : 10/14/86

RESULTS OF ANALYSIS

LOG NUMBER	SAMPLE DESCRIPTION	TEST NAME	RESULTS OF ANALYSIS	UNITS OF EXPRESSION
715528	SAMPLE #38 9/25	EP Lead	0.101	mg Pb/l
715529	SAMPLE #39 9/25	EP TOXICITY	261.24	Meth.No
		EP Cadmium	<0.005	mg Cd/l
		EP Lead	0.010	mg Pb/l
715530	SAMPLE #43 9/25	EP TOXICITY	261.24	Meth.No
		EP Cadmium	<0.005	mg Cd/l
		EP Lead	0.008	mg Pb/l

K

Environmental Analysis, Inc.
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PAGE NO : 1
REPORT NO : 23038
DATE : 10/23/86
P.O. No. :

JANE DRUMHILLER
LC METALS
BOX 192
GRANITE CITY IL 62040

REPORT OF ANALYSIS

SUBJECT : Analysis of waste samples in accordance with SW-846: Test Methods for Evaluating Solid Waste - Physical/Chemical Methods, 1982; where applicable.

LOG NUMBER	SAMPLE DESCRIPTION
715531	SAMPLE #1 9/25
715532	SAMPLE #7 9/25
715533	SAMPLE #8 9/25
715534	SAMPLE #10 9/25
715601	SAMPLE #11 9/25
715602	SAMPLE #12 9/25
715603	SAMPLE #17 9/25
715604	SAMPLE #18 9/25
715605	SAMPLE #20 9/25
715606	SAMPLE #24 9/25
715607	SAMPLE #25 9/25
715608	SAMPLE #27 9/25
715609	SAMPLE #28 9/25
715610	SAMPLE #30 9/25
715611	SAMPLE #32 9/25
715612	SAMPLE #34 9/25
715613	SAMPLE #35 9/25
715614	SAMPLE #36 9/25
715615	SAMPLE #37 9/25
715616	SAMPLE #41 9/25
715617	SAMPLE #42 9/25

RESULTS OF ANALYSIS APPEAR ON FOLLOWING PAGES

RESPECTFULLY SUBMITTED

R. M. Ferris

R. M. FERRIS

Environmental Analysis, Inc.
3278 N. Lindbergh Blvd. · Florissant, MO 63033 · 314-921-4488

REPORT NO : 23038
DATE : 10/23/86

LC METALS

RESULTS OF ANALYSIS

LOG NUMBER	SAMPLE DESCRIPTION	TEST NAME	RESULTS OF ANALYSIS	UNITS OF EXPRESSION
715531	SAMPLE #1 9/25	EP TOXICITY	261.24	Meth.N
		EP Cadmium	<0.005	mg Cd/
		EP Lead	0.016	mg Pb/
715532	SAMPLE #7 9/25	EP TOXICITY	261.24	Meth.N
		EP Cadmium	<0.005	mg Cd/
		EP Lead	0.016	mg Pb/
715533	SAMPLE #8 9/25	EP TOXICITY	261.24	Meth.N
		EP Cadmium	<0.005	mg Cd/
		EP Lead	0.023	mg Pb/
715534	SAMPLE #10 9/25	EP TOXICITY	261.24	Meth.N
		EP Cadmium	<0.005	mg Cd/
		EP Lead	0.018	mg Pb/
715601	SAMPLE #11 9/25	EP TOXICITY	261.24	Meth.N
		EP Cadmium	<0.010	mg Cd/
		EP Lead	0.021	mg Pb/
715602	SAMPLE #12 9/25	EP TOXICITY	261.24	Meth.N
		EP Cadmium	<0.010	mg Cd/
		EP Lead	0.017	mg Pb/
715603	SAMPLE #17 9/25	EP TOXICITY	261.24	Meth.N
		EP Cadmium	<0.010	mg Cd/
		EP Lead	0.012	mg Pb/
715604	SAMPLE #18 9/25	EP TOXICITY	261.24	Meth.N
		EP Cadmium	<0.010	mg Cd/
		EP Lead	0.011	mg Pb/
715605	SAMPLE #20 9/25	EP TOXICITY	261.24	Meth.N
		EP Cadmium	<0.010	mg Cd/

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RESULTS OF ANALYSIS

LOG NUMBER	SAMPLE DESCRIPTION	TEST NAME	RESULTS OF ANALYSIS	UNITS OF EXPRESSION
715605	SAMPLE #20 9/25	EP Lead	0.027	mg Pb/
715606	SAMPLE #24 9/25	EP TOXICITY	261.24	Meth.N
		EP Cadmium	<0.010	mg Cd/
		EP Lead	0.011	mg Pb/
715607	SAMPLE #25 9/25	EP TOXICITY	261.24	Meth.N
		EP Cadmium	<0.010	mg Cd/
		EP Lead	0.085	mg Pb/
715608	SAMPLE #27 9/25	EP TOXICITY	261.24	Meth.N
		EP Cadmium	<0.010	mg Cd/
		EP Lead	0.009	mg Pb/
715609	SAMPLE #28 9/25	EP TOXICITY	261.24	Meth.N
		EP Cadmium	<0.010	mg Cd/
		EP Lead	0.013	mg Pb/
715610	SAMPLE #30 9/25	EP TOXICITY	261.24	Meth.N
		EP Cadmium	<0.010	mg Cd/
		EP Lead	0.009	mg Pb/
715611	SAMPLE #32 9/25	EP TOXICITY	261.24	Meth.N
		EP Cadmium	<0.010	mg Cd/
		EP Lead	0.031	mg Pb/
715612	SAMPLE #34 9/25	EP TOXICITY	261.24	Meth.N
		EP Cadmium	<0.010	mg Cd/
		EP Lead	0.012	mg Pb/
715613	SAMPLE #35 9/25	EP TOXICITY	261.24	Meth.N
		EP Cadmium	<0.010	mg Cd/
		EP Lead	0.008	mg Pb/
715614	SAMPLE #36 9/25	EP TOXICITY	261.24	Meth.N

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LC METALS

REPORT NO : 23038
DATE : 10/23/86

RESULTS OF ANALYSIS

LOG NUMBER	SAMPLE DESCRIPTION	TEST NAME	RESULTS OF ANALYSIS	UNITS OF EXPRESSION
715614	SAMPLE #36 9/25	EP Cadmium	<0.010	mg Cd/
		EP Lead	0.024	mg Pb/
715615	SAMPLE #37 9/25	EP TOXICITY	261.24	Meth.N
		EP Cadmium	<0.010	mg Cd/
		EP Lead	0.023	mg Pb/
715616	SAMPLE #41 9/25	EP TOXICITY	261.24	Meth.N
		EP Cadmium	<0.010	mg Cd/
		EP Lead	0.011	mg Pb/
715617	SAMPLE #42 9/25	EP TOXICITY	261.24	Meth.N
		EP Cadmium	<0.010	mg Cd/
		EP Lead	0.005	mg Pb/

Environmental Analysis, Inc.

3278 N. Lindbergh Blvd. • Florissant, MO 63033 • 314-921-4488

INVOICE NO : 23038
DATE : 10/23/86
CUSTOMER P.O. :

BILL TO:
LC METALS
BOX 192
GRANITE CITY IL 62040
JANE DRUMHILLER

REPORT TO:
LC METALS
BOX 192
GRANITE CITY IL 62040
JANE DRUMHILLER

Date Sent 10/23/86 Sent VIA U. S. MAIL Terms : NET 30 DAYS

Quantity	Description	Unit Price	Amount
21	EP TOXICITY	68.40	1436.40
21	EP Cadmium	13.68	287.28
21	EP Lead	13.68	287.28

Thank You TOTAL==>> 2010.96

K. Part B Certification

I, John Suarez, am the Vice-President and General Manager of Chemetco, Inc. (EPA# ILD048843809) located at Route 3 and Oldenberg Road, Hartford, Illinois. I certify that the surface impoundment, waste pile, container storage area, belt and filter presses, settling tanks, and storage and processing tanks at this facility are in compliance with all applicable ground-water monitoring and financial responsibility requirements in 40 CFR Part 265 Subparts F and H.

I, John Suarez, as Vice-President and General Manager of Chemetco, Inc., located at Route 3 and Oldenberg Road, Hartford, Illinois, knowingly and willfully make this true and accurate certification to the United States Environmental Protection Agency pursuant to section 3005(e) of the Hazardous and Solid Waste Disposal Act, as amended.

Nov 7 1985
(Date)

John Suarez
Vice-President and General Manager
Chemetco, Inc.

GOOD LABORATORY PRACTICES

1986 MANUAL

Environmental Analysis, Inc.

Analytical Chemistry • Research • Field Studies

APPENDIX L

Environmental Analysis, Inc. follows a preventative maintenance schedule on all major instruments in use in the laboratory. Maintenance records are kept on file in the front office.

Most major instruments, such as atomic absorption spectrophotometers, gas chromatographs, high pressure liquid chromatographs, balances, and UV-Vis Spectrophotometers are serviced by the manufacturers' service representatives.

Performance of instruments is checked periodically against specifications set by the manufacturer. Details of test procedures and minimum specifications are given in the manufacturers' manuals kept with the instruments. Results are recorded in the quality control notebooks and are filed with the quality assurance data.

Instrument performance is assessed during the calibration step of method development and sample analysis. When an instrument fails to meet performance specifications, corrective action is taken.

All laboratory equipment and instrumentation requires calibration in order to ensure generation of reliable, high quality data.

The records of routine calibrations performed by laboratory technicians are kept in the Quality Control Records and Charts notebook in the Quality Control Supervisor's office. A brief description of calibration procedures for the major pieces of equipment and instrumentation are described as follows:

Analytical balances are checked with class S weights each day they are used. The calibration data, model identification, and serial number of the balance are recorded on a Calibration Sheet for Laboratory Balances which is dated and signed by the technician performing the calibration. The balances are serviced and calibrated by a certified service technician on a yearly contract basis, or more frequently if found to be out of specification. Calibration certificates, which list the traceability to NBS weight standards, are posted at the balance table area.

Atomic absorption spectrophotometers are calibrated for each element analyzed. The calibration data is recorded on a Calibration and Data Sheet for A.A.S. which is dated and signed by the technician who performed the determination. Each working calibration is checked by comparing a reference standard obtained from an independent source, such as the Environmental Protection Agency or Environmental Resource Associates. If the reference standard does not fall within published tolerances, corrective action is taken which may include professional service.

The **dissolved oxygen meters** are set up and calibrated according to the manufacturers instructions. Each day they are used, calibration is performed and the data is recorded on a Calibration Sheet for Dissolved Oxygen Meter Control. This data includes the equipment identification, model number, serial number, date, temperature, barometric pressure, oxygen solubility and the signature of the technician performing the calibration.

All **laboratory pH meters** are calibrated each day they are used and calibration is checked during the determination of measurements required by regulation (such as NPDES samples). Calibration is performed by setting the instrument at two buffer values, and reading a third known buffer value. The % slope is read and if not within the manufacturers specifications, corrective action is taken before analysis proceeds. All data, including the equipment identification, model number, serial number, buffer values, % slope, and adjustments made, are recorded and signed on a Calibration Sheet for pH Meter Control.

The laboratory contains several **drying ovens, incubators, and refrigerators.** Each of these pieces of equipment are checked for proper calibration daily, or when in use. The data is recorded on a Calibration Sheet for Temperature Control and signed by the technician performing the calibration. If any readings are out of specification, adjustments are noted on the calibration sheet. Each piece of equipment is assigned a calibration sheet listing the make, model number, and serial number.

The **total organic carbon analyzer** is calibrated each day it is in operation. Calibration data is recorded on laboratory worksheet booklets which list the date, null setting, standard setting, standard reading, % variation, and the technician's signature.

UV-Visible spectrophotometers are microprocessor controlled and are calibrated for each parameter before samples are measured. Calibration is performed by setting the values for a minimum of two standards within the working range of the determination. A reagent blank is determined with each set of analysis performed. Standard reference solutions, both in house and independently manufactured, are analyzed in order to verify the standardization. A K-factor (ratio of Concentration/Absorbance) is calculated for each set of determinations performed on a routine basis each time the test parameter is run. The K-factor is used as a control check for standardization.

The **oxygen bomb calorimeter** is calibrated monthly with NBS benzoic acid, when in use, as recommended by the manufacturer.

Gas chromatographs and **high pressure liquid chromatographs** are calibrated for sensitivity and accuracy for the required compounds being determined. Maintenance is performed if the required sensitivity cannot be achieved and professional service is obtained when necessary.

The **flash point** testing equipment is set up according to the manufactures instructions. Each day when they are in use, reference materials of known flash point are run to assure proper operation. All data, including the equipment identification, model number, serial number, and adjustments made, are recorded and signed on a Calibration Sheet for Flash Point Control

All **specific ion electrodes** are calibrated each day they are used and calibration is checked during the determination of measurements required by regulation (such as NPDES samples). Calibration is performed by setting the specific ion meter and electrode combination with a series of values, and a standard curve is prepared. The % slope is read and if not within the manufacturers or method specifications, corrective action is taken before analysis proceeds. All data, including the equipment identification, model number, serial number, standard solution values, % slope, and adjustments made, are recorded and signed on a Calibration Sheet for Specific Ion Meter Control.

Other pieces of laboratory equipment which are not frequently used are calibrated in accordance with accepted manufacturers instructions.

The use of fresh, reliable, well characterized standards and reagents is of the utmost importance in the laboratory. The quality of the reagents and standards will have a direct affect on the analytical results produced in the laboratory.

When reagent chemicals are purchased, the highest quality is selected for its specific usage. Each reagent chemical is stamped with the date when it is received in the laboratory and an expiration date is marked on the container. Expiration dates are determined by the manufacturer, literature, or experience. The expiration date, if not known, is marked as unknown or indefinite. All reagents received into the laboratory prior to 1/1/83 are marked Prior to 1983.

When standard solutions are manufactured in the laboratory, all data involved in the process is recorded in a hard bound record book titled Standards and Solutions. These records contain the date of manufacture, reagents used, weights and measures, and are signed by the analyst performing the operations. Each container is marked with the date of manufacture, expiration date, identification and concentration of the standard. Special storage conditions are noted when necessary. The quality of the working standards are monitored by the individual analyst.

Only those reagents which have not expired will be used in the laboratory unless they have been tested and proved to be of acceptable quality and known concentration.

Standard stock solutions and reagent chemicals are stored in the Reagent Chemicals storage room. Working standards are stored in closed cabinets in the areas in which they are used. Some standard solutions are stored in a lockable refrigerator.

Environmental Analysis, Incorporated must select analytical methods that meet the requirements of our clientele. In many cases, the specific standardized methods are required by the clients' contract with our laboratory. In all cases, the use of uniform methods is important in order to remove the methodology as a variable in comparison or use of data between laboratories. A lack of standardization of methods may affect the validity of the results reported.

Specific requirements for the selection of analytical methods may be dependent on the final use of the data generated by the procedure.

When the use of specific analytical methods is required by regulatory agencies, they are most often found in the following references:

* Standard Methods for the Examination of Water and Wastewater, 16th Edition, 1985.
* Standard Methods for the Examination of Water and Wastewater, 15th Edition, 1980.
* Standard Methods for the Examination of Water and Wastewater, 14th Edition, 1975.
* "Methods for Analysis of Water and Wastes", USEPA Publication No. EPA-600/4-79-020.
* "Test Methods for Evaluating Solid Wastes", Physical/Chemical Methods, Publication No. EPA-SW-846, 1983 Edition.
* "Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater", Publication No. EPA-600/482-057.
* Annual Book of ASTM Standards, Part 31, Water, 1982.

The following references may be used in addition to the references listed above, when the use of specific analytical methods is not required or recommended by regulatory agencies, such as industrial plant operating parameters and product quality control:

* Chemical Analysis of Industrial Water, James McCoy, Chemical Publishing Company, New York, N.Y., 1969.

* Official Methods of Analysis of the Association of Official Analytical Chemists, 13th Edition, 1980.

* Scott's Standard Methods of Chemical Analysis, Volume One - The Elements and Volume Two - Special Subjects, D. Van-Nostrand Company, Inc.

* Annual Book of ASTM Standards, various volumes for specific methods of analysis on petroleum products, fuels, paints, ores, metals, limestone, and cement.

Analytical methods used to set up specific operation conditions on atomic absorption spectrophotometers, gas chromatographs, and high pressure liquid chromotographs are found in the references below:

* "Analytical Methods for Atomic Absorption Spectrophotometry", Perkin-Elmer Corp., September 1976 with supplement January 1982.

* "Analytical Methods for Furnace Atomic Absorption Spectrophotometry", Perkin-Elmer Corp., February 1980.

* "Analytical Methods for Gas Chromatography", Perkin-Elmer Corp.

* "Analytical Methods for High Pressure Liquid Chromatography", Perkin-Elmer Corp.

All routinely used methods are reviewed and approved at least annually by the laboratory director and quality control supervisor. A listing of the approved methods being used for NPDES monitoring is submitted to the clients for which this testing is being performed. A copy of the current list is found in the appendix.

ENVIRONMENTAL ANALYSIS, INCORPORATED
GLP Manual - Quality Control Program

This section of the GLP manual describes the control of analytical performance in the laboratory. Precision and accuracy are the key factors in the quality control program. Our goal is to assure that both precision and accuracy are appropriate for the requirements of each job.

The analytical methods used in the laboratory are checked for accuracy and precision by the analysis of reference standards, duplicates, and spiked samples. The control samples are prepared and submitted by someone other than the person performing the analysis. The frequency of control samples is determined by a number of factors. Samples required to demonstrate compliance with environmental regulations are controlled with:

* 5% sample spikes.
* 10% duplicates.
* 10% reference standards.

This quality control sample frequency is followed on a general basis, but may be increased or decreased by specific customer requests.

Environmental Analysis, Inc. also participates in several analytical round robin programs each year. These programs are administered by the Environmental Protection Agency under the NPDES Performance Evaluation Study and Water Pollution Performance Evaluation Study. Also, samples are submitted by some clients for evaluation of contract and in house laboratories.

The data obtained from the analysis of all quality control samples is recorded in a Quality Control record book that is maintained by the Quality Control Supervisor. The approved data is then entered into a computer system, stored on floppy disk, and printed. The printed data sheets are compiled and distributed, as requested, to all major clients on a quarterly basis. The laboratory keeps all of the data sheets on file in the Quality Control Supervisor's office.

When the analyst or the Quality Control Supervisor finds a value that is out of specification for either accuracy or precision, analysis is stopped until the problem is identified and resolved. Corrective action is initiated which consists of a series of steps to correct the deficiency. The Quality Control Supervisor and the analyst will perform these steps:

* Calculations are checked for errors.

* Reagents are checked for expiration date and quality.

* Instruments are checked for defects or calibration errors.

* Procedures are checked and interferences are reviewed.

If the error is corrected by any of the steps above, the test is repeated to obtain the results within the specification. If the error is not corrected, the steps are pursued in greater detail with the Laboratory Director. Alternate procedures may be used in some cases, with the approval of the laboratory director and the client. Environmental Analysis, Inc. will reanalyze any batch of samples that are found to be out of control by our quality control procedures at no extra charge to the client. Any problems regarding the reanalysis of samples will be discussed with the client.

The Handbook for Analytical Quality Control in Water and Wastewater Laboratories and Standard Methods for the Examination of Water and Wastewater are used for references on all quality control procedures. These publications are kept in the library located in the Laboratory Director's office.

ENVIRONMENTAL ANALYSIS, INC.

ANALYTICAL CHEMISTRY · RESEARCH · FIELD STUDIES

3278 N. LINDBERGH BLVD. *FLORISSANT, MO. 63033* *PHONE 1-314-921-4488*

CORRECTIVE ACTION REPORT

ON THE STANDARD WAS USED TO RUN THE TEST
THE VALUE OF . MG/L WAS OBTAINED BY
THIS RESULT WAS ABOVE THE UPPER LIMIT OF BY

PLEASE LIST THE REASONS FOR THE
OUT OF RANGE RESULT AND MEASURES
TAKEN TO PREVENT THIS IN THE FUTURE

****

****

SIGNATURE OF

DATE

CALIBRATION SHEET FOR DISSOLVED OXYGEN METER CONTROL

Equipment Identification: _____ Model No. _____

Serial No. _____

DATE	Temperature, C	Barometric Press	O_2 Solubility	Technician

CALIBRATION SHEET FOR LABORATORY BALANCES

Balance Identification: Model _____ Serial No. _____

Date	1 gram	10 gram	Variation	Adjustment Performed	Technician

CALIBRATION SHEET FOR pH METER CONTROL

Equipment Identification: _____ Model No. _____

Serial No. _____

DATE	4.00 Buffer	7.00 Buffer	10.00 Buffer	Adjustment	Technician

CALIBRATION SHEET FOR TEMPERATURE CONTROL

Equipment Identification: Make _____ Model _____

Serial No. _____

Date	Temp. °C	Adjustment	Technician	Date	Temp. °C	Adjustment	Technician

CALIBRATION AND DATA SHEET FOR FLAME A. A. S.

Date: _____ Time: _____ Technician: _____

Element: _____ W.L. _____ Slit: _____ B.G.C. _____

Sample #	Sample Identification	Dilut.	Uncorr. Result	Corrected Result	Average

CALIBRATION AND DATA SHEET FOR FLAME A. A. S.

Date: _____ Time: _____ Technician: _____

Element: _____ W.L. _____ Slit: _____ B.G.C. _____

Sample #	Sample Identification	Dilut.	Uncorr. Result	Corrected Result	Average

CALIBRATION AND DATA SHEET FOR FURNACE A. A. S.

ELEMENT_____ W.L._____ SLIT_____ PLATFORM_____ STD. RANGE_____

M.M._____ EXP._____ DATE_____ TIME_____ ANALYST_____

STEP	TEMP	RAMP TIME	HOLD TIME	KEYBOARD ENTRIES
1	------	------	------	------
2	------	------	------	------
3	------	------	------	------
4	------	------	------	------
5	------	------	------	------

AS#	REC#	SAMPLE IDENTIFICATION	DILUT.	UNC. RESULT	CORR. RESULT	AVERAGE
1	01-02					
2	03-04					
3	05-06					
4	07-08					
5	09-10					
6	11-12					
7	13-14					
8	15-16					
9	17-18					
10	19-20					
11	21-22					
12	23-24					
13	25-26					
14	27-28					
15	29-30					
16	31-32					
17	33-34					
18	35-36					
19	37-38					
20	39-40					
21	41-42					
22	43-44					
23	45-46					
24	47-48					
25	49-50					
26	51-52					
27	53-54					
28	55-56					
29	57-58					

DATA SHEETS FOR INORGANIC CHLORIDES

STANDARD METHODS, 15th EDITION, METHOD 407 A & B, page 271

DATE STARTED_____ TIME STARTED_____ ANALYST_____

TITRANT USED: _____N Hg(NO3)2 / _____N SILVER NITRATE

LAB NO	SAMPLE ID	SAMPLE SIZE	MLS TITRATED	CORRECTED TITRATION	mg Cl/L

DATA SHEET FOR PH DETERMINATION

STANDARD METHODS, 16 th EDITION, METHOD 423, page 429

DATE STARTED_____ TIME STARTED_____ ANALYST_____

ELECTRODE USED_____

LAB NO.	SAMPLE ID	PH	PH 10% SOLUTION

DATA SHEET FOR RESIDUE DETERMINATION

Standard Methods, 15th Edition, Methods 209 - A,B,C,D, & E; pages 92-95

Date Started _____ Time Started _____ Analyst _____

Oven Used _____ Balance Used _____ Test Code: Total Solids TS

Dissolved Solids DS

Oven Used _____ Muffle Furnace Used _____ Total Suspended Solids TSS

Total Volatile Solids TVS

Volatile Susp. Solids VSS

ab No.	Sample Identification	Test Code	Drying Temp., C	Sample Size, ml.	Tare Weight, g	Tare Wt. +Residue,g.	Weight of Residue,g.	Final Result, mg/l

A final **Report of Analysis** is issued to the client for each sample or set of samples submitted to the laboratory. This report is issued when all of the requested analytical procedures have been completed and the data recorded on the laboratory worksheets has been reviewed by the Laboratory Supervisor or Laboratory Director.

The **report of analysis** contains information pertinent to each sample and may include a **chain of custody sheet** as an attachment. The information contained in each report is as follows:

* Data of issue.
* Unique sequential report number.
* Log in number (Lab No.) of each sample.
* Purchase order number (when required).
* Client name and address.
* Reference to the analytical methods performed.
* Sample identification.
* Results of analysis for each parameter requested.
* Annotations of unusual conditions or results of analysis.

A typical report of analysis form will be found in the appendix.

The laboratory clerk generates the final reports of analysis. All approved data and sample information is entered by using a custom software program (Analysis: Version 2.1) with a Commadore SP9000 computer. Reports are stored on floppy disks and are retrievable through the software. The laboratory is in the process of changing the program and computer to Lab Master software and an IBM XT, respectively.

Three copies of each report of analysis are printed. All of the reports issued are signed by the laboratory director. The client receives two copies and one copy is kept at the laboratory. All hard copy reports are filed under the clients name in locked file cabinets. The report files have been maintained since 1971.

Some of the common terms related to GLP are listed below:

ACCURACY. Measure of the degree of conformity of a value generated by a specific procedure to the accepted true value u includes both precision and bias.

ALIQUOT. Measured quantity and part of a sample which can be accurately analyzed and related to the whole sample. Many times an aliquot of a sample is analyzed rather than the entire sample.

ANALYTE. Material that is sought or measured by an analytical procedure.

ANALYTICAL METHOD. Specific detailed procedure that stands alone and contains all the information required for the analyst to administer the technique.

AUDIT. Systematic check to determine the quality of operation of some function or activity.

BLANK. Sample of the matrix in which the analyte is being measured. A blank is subjected to the same sampling and analytical procedures.

CONTROL CHART. Graphic record of values, results, samples, or controls recorded successively. These usually include averages and ranges to indicate the trends and reproductibility of values obtained of analysis.

CONTROL LIMITS. Limits on a control chart established at + or - 2 or 3 standard deviations from the mean. Values falling outside the control limits are considered to be out of control.

DETERMINATE ERROR. Error which contributes to variation and can be detected, its cause identified, and can be eliminated.

DUPLICATE ANALYSIS. Analysis performed at the same time on equal quantities taken from the same sample.

INDETERMINATE ERROR. Cause of error which does not have an assignable cause and follows the law of chance.

INTERFERENCE. There are two types of interferences, positive and negative. Positive interferences are those which add to the true value by giving a response similar to the material being sought. Negative interferences are those which subtract from the true result by disallowing the intended reaction or measurement to take place in the desired manner.

MATRIX. Material in which the analyte exists.

MEAN. Mean is equal to the sum of the units divided by the number of units.

MEDIAN. Value in a set of data having an equal number of occurrences on each side of that value.

PRECISION. Degree of agreement of repeated measurements of the same parameter expressed quantitatively as the standard deviation or relative standard deviation computed from the results of a series of determinations.

PROTOCOL. Document that gives an overview of the goals, experimental and quality assurance details for a study. It also contains a list of all documents that apply to the study.

QUALITY ASSURANCE. Planned systematic actions that are necessary to ensure that the specified quality control activities are achieved.

QUALITY CONTROL. A system of activities designed to achieve and maintain a previously specified level of quality in data collection, processing, and reporting.

RANGE. Difference between the largest and smallest values in a set.

RAW DATA. Laboratory worksheets, records, memoranda, notes, instrument charts, graphs, computer printouts, or exact copies thereof, that are the result of original observations and activities of a study.

REAGENT. Substance used in preparing a standard and/or sample or used as an agent to produce a desired chemical reaction as part of the analytical procedure.

STOCK STANDARD. Relatively concentrated (usually 0.1-1%) solution of a neat standard, prepared by accurately weighing an aliquot of the material and accurately diluting to a known volume with an appropriate solvent. Stock standards are typically assumed to be stable in concentration over extended periods of time (months) and are used to prepare working standards of lower concentration.

WORKING STANDARD. Dilute solutions of an analyte which span the concentration range of interest for an analysis (ranges between standards should not exceed one decade of concentration). Working standards are single or mixed component solutions prepared by successive accurate dilutions of stock standards. Working standards are used on a daily basis to establish or confirm the response functions (e.g. linearity, response factor, calibration [working] curve, etc.) for an analytical measurement technique. For chromatographic methods, the working standards also establish the retention characteristics of the analyte. If possible, the solvent for working standards should be the same as that in which the analyte is being determined.

ENVIRONMENTAL ANALYSIS, INCORPORATED
GLP Manual - Bibliography

1. Annual Book of ASTM Standards, Part 31, Philadelphia, Pa 19103 (1982).

2. Handbook for Analytical Control in Water and Wastewater Laboratories, National Environmental Research Center, Cincinnati, Ohio (June 1972).

3. Standard Methods for the Examination of Water and Wastewater, 15th Edition, APHA-AWWA-WPCF, Washington, DC 20005 (1980).

4. Scott's Standard Methods of Chemical Analysis, Fifth Edition, N. H. Furman, Editor, Volume One, The Elements and Volume Two, Special Subjects, D. Van Nostrand Company, New York.

5. "Perkin-Elmer Analytical Methods for Atomic Absorption Spectrophotometry", Norwalk, Connecticut (January, 1982).

6. "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods", SW-846, 1982 Edition USEPA, Washington, DC 20460.

7. "Perkin-Elmer Analytical Methods for Furnace Atomic Absorption Spectroscopy", Norwalk, Connecticut (February, 1980).

8. "Manual of Practice, Quality Control System Requirements for a Testing and Inspection Laboratory", published by American Council of Independent Laboratories, Inc., N.W. Washington, D.C. 20006 (1976).

9. "A Guide to Quality Control Practices for Waste and Potable Water Analysts", Environmental Resource Associates, William Carson (November, 1978).

10. "Guide to Preparing a Site Good Laboratory Practices Manual", Environmental Analytical Sciences Center, Monsanto Research Corp., Dayton, Ohio 45407 (June, 1981).

11. "Perkin-Elmer Analytical Methods for Gas Chromatography", Norwalk, Connecticut.

12. "Perkin-Elmer Analytical Methods for High Pressure Liquid Chromatograph", Norwalk, Connecticut.

STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, 16TH EDITION

--	Test Parameter	Std. Meth. 16 Ed.	Test Description	Page
01	Acidity	402	Electrometric Titration	265
02	Algicides		Gas Chromatography	
03	Alkalinity	403	Electrometric Titration	269
04	Aluminum	306.A	Atomic Absorption	183
05	Antimony	304	Atomic Absorption GTF	178
06	Arsenic	304	Atomic Absorption GTF	173
07	Bacteria, Fecal Coli.	909.C	Membrane Filter	886
08	Bacteria, Fecal Strep.	910.B	Membrane Filter	905
09	Bacteria, Total Coli.	909.A	Membrane Filter	887
10	Barium	304	Atomic Absorption GTF	173
11	Beryllium	304	Atomic Absorption GTF	173
12	Bismuth	304	Atomic Absorption GTF	173
13	Boron	404.B	Carmine Method	276
14	Bromide	405	Phenol red, Colorimetric	279
15	Cadmium	304	Atomic Absorption GTF	173
16	Calcium	311.A	Atomic Absorption	196
17	Chloride	407.B	Silver Nitrate	288
18	Chromium, Hexavalent	312.B	Diphenyl Carbazide	201
19	Chromium, Total	312.A	Atomic Absorption	201
20	Cobalt	303.A	Atomic Absorption	157
21	Color, APHA	204.A	Visual Comparison Method	67
22	Conductance, Specific	205	Wheatstone Bridge	76
23	Copper	313.A	Atomic Absorption	205
24	Cyanide	412.B-D	Distillation, Colorimetric	333-337
25	Fluoride	413.B	Selective Ion Electrode	357
26	Gravity, Specific	213.E	Gravimetric	132
27	Hardness, Total	314.A	Atomic Absorption	209
28	Iron	315.A	Atomic Absorption	215
29	Lead	304	Atomic Absorption GTF	173
30	Lithium	317.B	Flame Emission	224
31	Magnesium	318.A	Atomic Absorption	226
32	Manganese	319.A	Atomic Absorption	229
33	Mercury	320.A	Flameless Atomic Absorption	232
34	Molybdenum	303.C	Atomic Absorption	162
35	Nickel	321.A	Atomic Absorption	234
36	Nitrogen, Ammonia	417.E	Selective Ion Electrode	384
37	Nitrogen, Kjeldahl	420.A	Digestion, Ion Electrode	408
38	Nitrogen, Nitrate	418.B	Selective Ion Electrode	393
39	Nitrogen, Nitrite	419	Colorimetric Diazotization	404
40	Nitrogen, Organic	420	Digestion, Ion Electrode	406
41	Oil & Grease	503.A	Liquid Extraction (TCTFE)	497

29

STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, 16TH EDITION

	Test Parameter	Std. Meth. 16 Ed.	Test Description	Page
42	Organic Carbon, Total		U-V Oxidation Method	
43	Oxygen Demand, Biochemical	507	Probe	525
44	Oxygen Demand, Chemical	508.A	Dichromate Reflux	533
45	Oxygen, Dissolved	421.F	Membrane Electrode Method	422
46	Pesticides	509	Gas Chromatography	538
47	PCB's		Gas Chromatography	
48	pH Value	423	Electrode	429
49	Phenols	510.B	Chloroform Extraction-4 AAP	558
50	Phosphorus, Ortho	424.F	Colorimetric Ascorbic Acid Red.	448
51	Phorphorus, Total	424.C	Colorimetric Ascorbic Acid Red.	442
52	Potassium	322.A	Atomic Absorption	236
53	Selenium	304	Atomic Absorption GTF	173
54	Silicon	303.C	Atomic Absorption	162
55	Silver	304	Atomic Absorption GTF	173
56	Sodium	325.B	Flame Emission	246
57	Solids, Dissolved	209.C	Glass Fiber Filtration, 105 C	96
58	Solids, Settleable	209.F	Imhoff Cone	99
59	Solids, Suspended	209.D	Glass Fiber Filtration, 105 C	97
60	Solids, Total	209.A	Gravimetric, 105 C	93
61	Solids, Volatile	209.E	Gravimetric, 550 C	98
62	Strontium	326.B	Flame Emission	250
63	Sulfate	426.C	Turbidimetric	467
64	Sulfide	427.C	Methylene Blue	475
65	Sulfite	428	Iodide-Iodate, Titrimetric	479
66	Surfactants	512.A	Methylene Blue, Colorimetric	578
67	Tellurium	304	Atomic Absorption GTF	173
68	Thallium	303.A	Atomic Absorption	157
69	Tin	304	Atomic Absorption GTF	173
70	Titanium	303.C	Atomic Absorption	162
71	Turbidity	214.B	Visual Method, JTU	137
72	Vanadium	327.A	Atomic Absorption	252
73	Zinc	328.A	Atomic Absorption	254
74	Zirconium		Atomic Absorption	

REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES

Parameter	Container[1]	Preservative[2,12]	Maximum Holding Time[3]
Bacterial Tests			
1-4. Coliform, fecal and total	P,G	Cool, 4°C 0.008% $Na_2S_2O_3$[6]	6 hours
5. Fecal streptococci	P,G	Cool, 4°C 0.008% $Na_2S_2O_3$[6]	6 hours
Inorganic Tests			
1. Acidity	P,G	Cool, 4°C	14 days
2. Alkalinity	P,G	Cool, 4°C	14 days
4. Ammonia	P,G	Cool, 4°C H_2SO_4 to pH < 2	28 days
9. Biochemical oxygen demand	P,G	Cool, 4°C	48 hours
10. Biochemical oxygen demand, carbonaceous	P,G	Cool, 4°C	48 hours
12. Bromide	P,G	None required	28 days
15. Chemical oxygen	P,G	Cool, 4°C H_2SO_4 to pH < 2	28 days
16. Chloride	P,G	None required	28 days
17. Chlorine, total residual	P,G	None required	Analyze immediately
21. Color	P,G	Cool, 4°C	48 hours
23-24. Cyanide, total and amenable to chlorination	P,G	Cool, 4°C NaOH to pH 12 0.6g ascorbic acid[6]	14 days[9]
25. Fluoride	P	None required	28 days
27. Hardness	P,G	HNO_3 to pH < 2	6 months
28. Hydrogen ion (pH)	P,G	None required	Analyze immediately
31. Kjeldahl and organic 43. Nitrogen	P,G	Cool, 4°C H_2SO_4 to pH < 2	28 days
Metals[4]			
18. Chromium VI	P,G	Cool, 4°C	24 hours
35. Mercury	P,G	HNO_3 to pH < 2	28 days
Metals, except above	P,G	HNO_3 to pH < 2	6 months
38. Nitrate	P,G	Cool, 4°C	48 hours
39. Nitrate-nitrate	P,G	Cool, 4°C H_2SO_4 to pH < 2	28 days
40. Nitrite	P,G	Cool, 4°C	48 hours
41. Oil and grease	G	Cool, 4°C H_2SO_4 to pH < 2	28 days
42. Organic carbon	P,G	Cool, 4°C HCl or H_2SO_4 to pH < 2	28 days
44. Orthophosphate	P,G	Filter immediately Cool, 4°C	48 hours
46. Oxygen, Dissolved Probe	G bottle and top	None required	Analyze immediately
Winkler	G bottle and top	Fix on site and store in dark	8 hours
48. Phenols	G only	Cool, 4°C H_2SO_4 to pH < 2	28 days
49. Phosphorus (elemental)	G	Cool, 4°C	48 hours
50. Phosphorus, total	P,G	Cool, 4°C H_2SO_4 to pH < 2	28 days

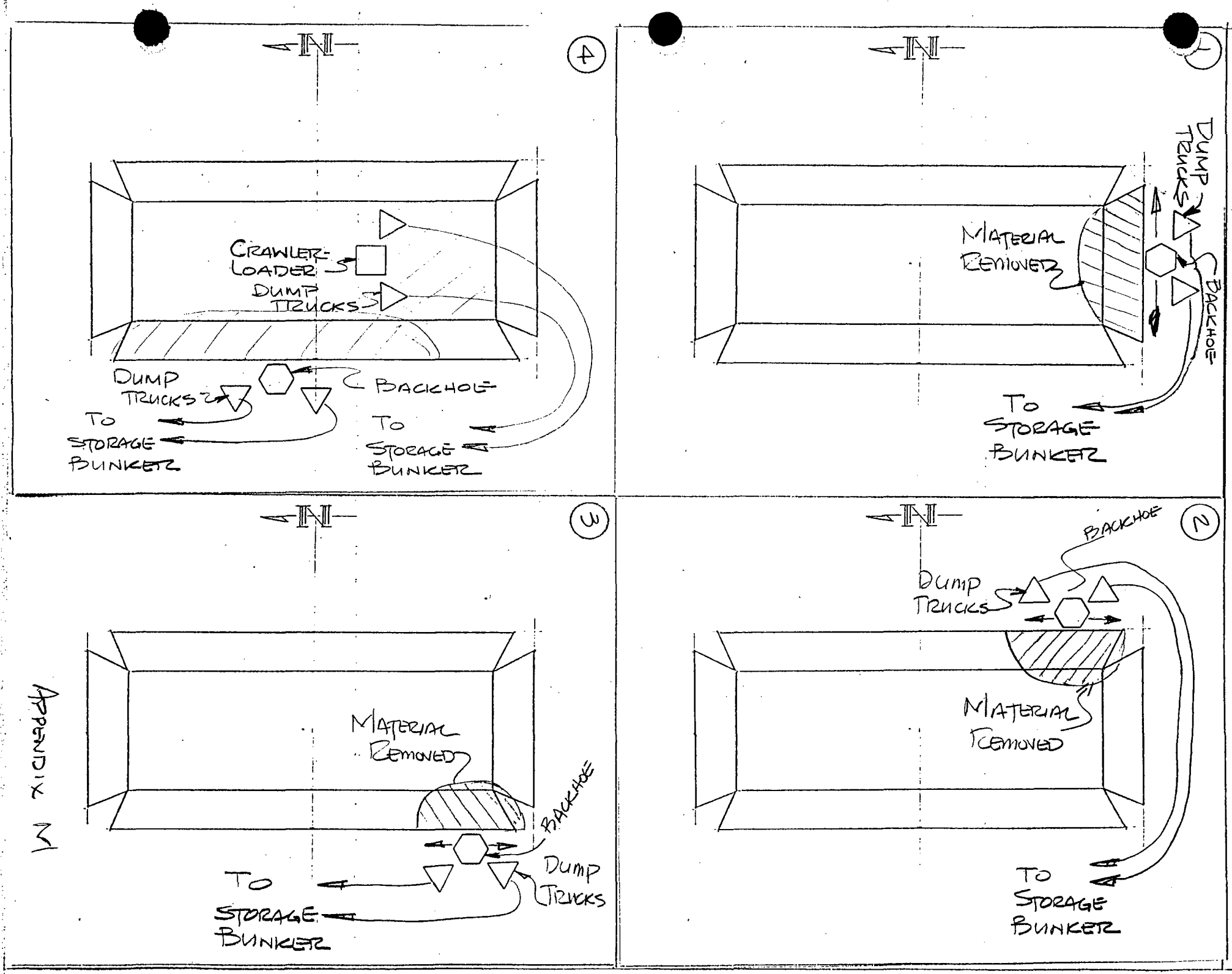
1. Polyethylene (P) or Glass (G).
2. Sample preservation should be performed immediately upon sample collection. For composite samples, each aliquot should be preserved at the time of collection. When use of an automatic sampler makes it impossible to preserve each aliquot, then samples may be preserved by maintaining at 4°C until compositing and sample splitting is completed.
3. Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still considered valid. Samples may be held for longer periods only if the permittee, or monitoring laboratory, has data on file to show that the specific types of samples under study are stable for the longer time. Some samples may not be stable for the maximum time period given in the table. A permittee, or monitoring laboratory, is obligated to hold the sample for a shorter time if knowledge exists to show this is necessary to maintain sample stability.
4. Samples should be filtered immediately on-site before adding preservative for dissolved metals.
5. Guidance applies to samples to be analyzed by GC, LC, or GC/MS for specific compounds.
6. Should only be used in the presence of residual chlorine.
7. For the analysis of diphenylnitrosamine, add 0.008% $Na_2S_2O_3$[6] and adjust pH to 7-10 with NaOH within 24 hours of sampling.

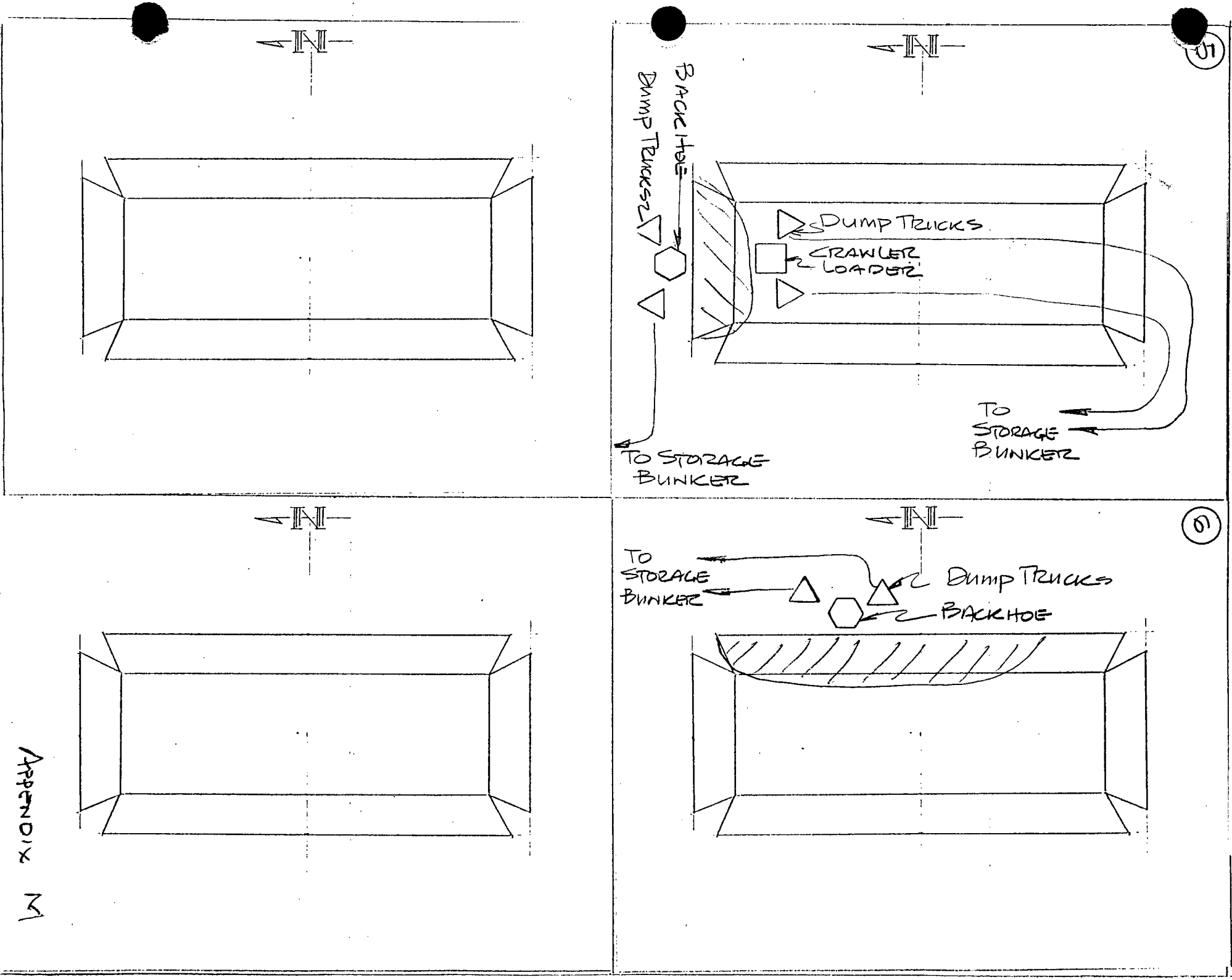
REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES

Parameter	Container[1]	Preservative[7, 12]	Maximum Holding Time[3]
53. Residue, total	P,G	Cool, 4°C	7 days
54. Residue, Filterable	P,G	Cool, 4°C	7 days
55. Residue, Non-filterable (TSS)	P,G	Cool, 4°C	7 days
56. Residue, settleable	P,G	Cool, 4°C	48 hours
57. Residue, volatile	P,G	Cool, 4°C	7 days
61. Silica	P	Cool, 4°C	28 days
64. Specific conductance	P,G	Cool, 4°C	28 days
65. Sulfate	P,G	Cool, 4°C	28 days
66. Sulfide	P,G	Cool, 4°C, add zinc acetate plus sodium hydroxide to pH > 9	7 days
67. Sulfite	P,G	Cool, 4°C	Analyze immediately
68. Surfactants	P,G	Cool, 4°C	48 hours
69. Temperature	P,G	None required	Analyze immediately
73. Turbidity	P,G	Cool, 4°C	48 hours
Organic Tests[8]			
Purgeable halocarbons	G, Teflon-lined septum	Cool, 4°C 0.008% $Na_2S_2O_3$[4]	14 days
Purgeable aromatics	G, Teflon-lined septum	Cool, 4°C 0.008% $Na_2S_2O_3$[4] HCl to pH < 2[10]	14 days
3,4. Acrolein and acrylonitrile	G, Teflon-lined septum	Cool, 4°C 0.008% $Na_2S_2O_3$[4] Adjust pH to 4-5[11]	14 days
Phenols	G, Teflon-lined cap	Cool, 4°C 0.008% $Na_2S_2O_3$[4]	7 days until extraction, 40 days after extraction
Benzidines	G, Teflon-lined cap	Cool, 4°C 0.008% $Na_2S_2O_3$[4]	7 days until extraction, 40 days after extraction
Phthalate esters	G, Teflon-lined cap	Cool, 4°C	7 days until extraction, 40 days after extraction
Nitrosamines[7]	G, Teflon-lined cap	Cool, 4°C store in dark 0.008% $Na_2S_2O_3$[4]	7 days until extraction, 40 days after extraction
PCB's	G, Teflon-lined cap	Cool, 4°C[6] pH 5-9	7 days until extraction, 40 days after extraction
Nitroaromatics and isophorone	G, Teflon-lined cap	Cool, 4°C	7 days until extraction, 40 days after extraction
Polynuclear aromatic hydrocarbons	G, Teflon-lined cap	Cool, 4°C 0.008% $Na_2S_2O_3$[4] store in dark[3]	7 days until extraction, 40 days after extraction
Haloethers	G, Teflon-lined cap	Cool, 4°C 0.008% $Na_2S_2O_3$[4]	7 days until extraction, 40 days after extraction
Chlorinated hydrocarbons	G, Teflon-cap	Cool, 4°C	7 days until extraction, 40 days after extraction
87. TCDD	G, Teflon-cap	Cool, 4°C 0.008% $Na_2S_2O_3$[4]	7 days until extraction, 40 days after extraction
Pesticides Tests			
1-70. Pesticides	G, Teflon-lined cap	Cool, 4°C pH 5-9[6]	7 days until extraction, 40 days after extraction
Radiological Tests			
1-5. Alpha, beta and radium	P,G	HNO_3 to pH < 2	6 months

8. The pH adjustment may be performed upon receipt at the laboratory and may be omitted if the samples are extracted with 72 hours of collection. For the analysis of aldrin, add 0.008% $Na_2S_2O_3$.
9. Maximum holding time is 24 hours when sulfide is present.
10. Sample receiving no pH adjustment must be analyzed within seven days of sampling.
11. Samples for acrolein receiving no pH adjustment must be analyzed within 3 days of sampling.
12. When any sample is to be shipped by common carrier or sent through the United States Mails, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172). The person offering such material for transportation is responsible for ensuring such compliance. For the preservation requirements of Table 17.1, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the Hazardous Materials Regulations do not apply to the following materials: Hydrochloric acid (HCl) in water solutions at concentrations of 0.04% by weight or less (pH about 1.96 or greater); Nitric acid (HNO_3) in water solutions at concentrations of 0.15% by weight or less[2] (pH about 1.62 or greater); Sulfuric acid (H_2SO_4) in water solutions at concentrations of 0.35% by weight or less (pH about 1.15 or greater); and Sodium hydroxide (NaOH) in water solutions at concentrations of 0.080% by weight or less (pH about 12.30 or less).

REMOVAL SEQUENCE





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APPENDIX E

AUTHORIZED SIGNATURE

⑈002942⑈ ⑆026007825⑆ 26735102⑈ ⑈0000052348⑈

J. HENRY SCHRODER BANK & TRUST COMPANY
New York, New York

HEMETCO P.O. BOX 187 FALTON, ILLINOIS 62002

1-782/260 No.

DATE

PAY TO THE ORDER OF ********** BANK OF ST LOUIS

DOLLARS $

OPERATING ACCOUNT

UNLIMITED WATER PROCESSING
ATTN. MR. ELLIOT HENRY
3200 HELEN STREET
ST. LOUIS, MISSOURI 63106

AUTHORIZED SIGNATURE

⑈002943⑈ ⑆026007825⑆ 26735102⑈ ⑈0000008820⑈

J. HENRY SCHRODER BANK & TRUST COMPANY
New York, New York

HEMETCO P.O. BOX 187 FALTON, ILLINOIS 62002

1-782/260 No. 56090

DATE 7/26/85

DOLLARS $ **43,264.35

OPERATING ACCOUNT

PAY TO THE ORDER OF ********** 43,264.35 ********

RICHARD VEST
P.O. BOX 317
COLLINSVILLE, IL 62234

AUTHORIZED SIGNATURE

⑈002944⑈ ⑆026007825⑆ 26735102⑈ ⑈0004326435⑈

RICHARD VEST
$43264.35

J. HENRY SCHRODER BANK & TRUST COMPANY
New York, New York

HEMETCO P.O. BOX 187 FALTON, ILLINOIS 62002

1-782/260 No. 56091

DATE 7/26/85

DOLLARS $ **2,220.00

OPERATING ACCOUNT

PAY TO THE ORDER OF ********** 2,220.00 ********

WELLS TRI/CITY TIRE CO.
2240 MADISON
GRANITE CITY, ILLINOIS 62040

AUTHORIZED SIGNATURE

⑈002945⑈ ⑆026007825⑆ 26735102⑈ ⑈0000228000⑈

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J. HENRY SCHROEDER
BANK & TRUST CO.
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1-782 ITEMS DRAWN ON AND PAYABLE AT 1
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BANK & TRUST CO.
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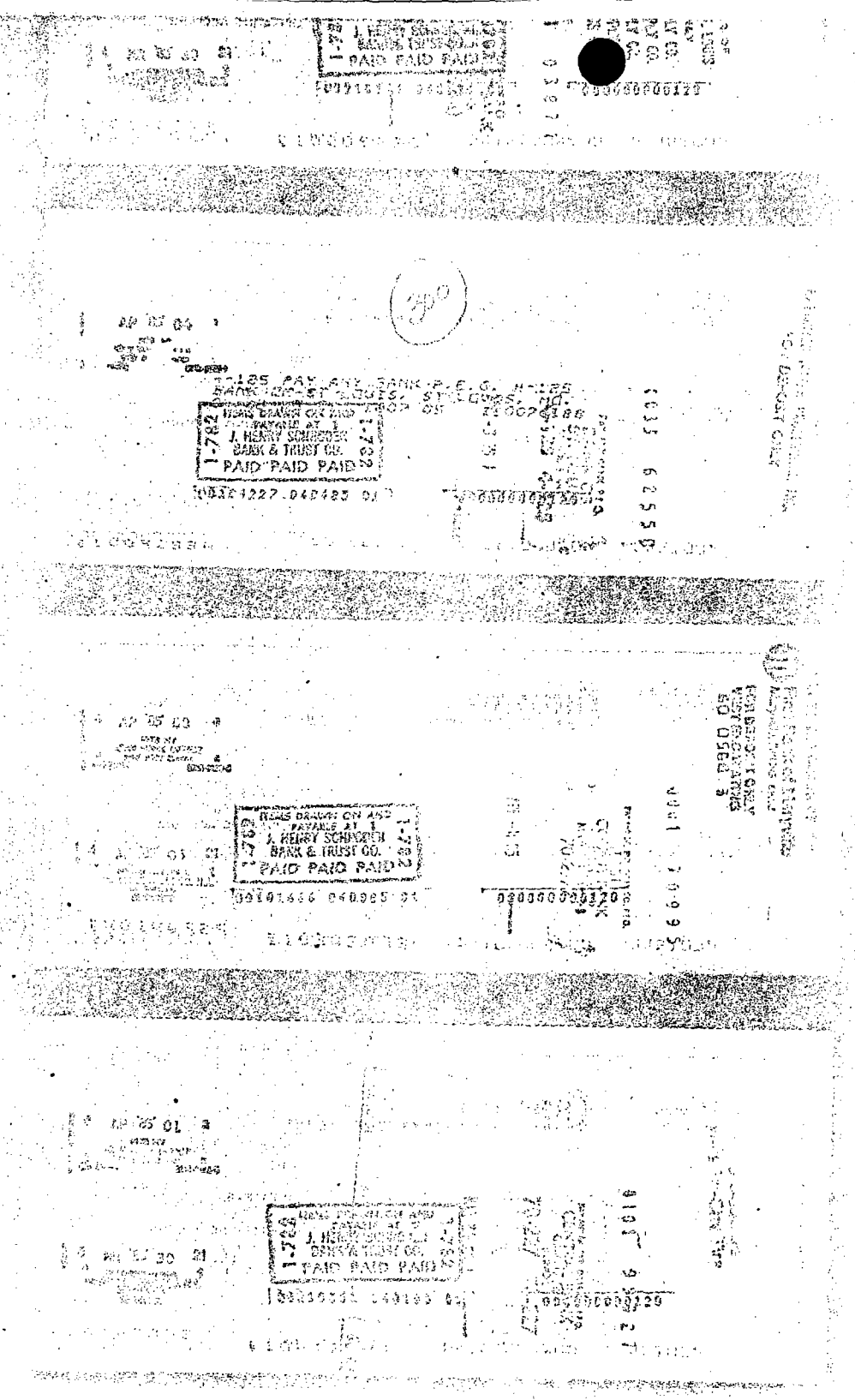

DEPOSIT ONLY
VEST EXCAVATING

INDUSTRIAL FAN & REPAIR
P. O. BOX 977
ALTON, ILLINOIS [illegible]

AUTHORIZED SIGNATURE

⑈001422⑈ ⑆026007825⑆ 26735102⑈ ⑇0000404500⑇

J. HENRY SCHRODER BANK & TRUST COMPANY
New York, New York

HEMETCO P.O. BOX 187 • ALTON, ILLINOIS 62002

1-782/260 No. 35694

DATE 2/26/85

PAY TO THE ORDER OF ********133.98********

DOLLARS $ ****133.98

OPERATING ACCOUNT

INMAC
[illegible] DRIVE
SCHAUMBURG, ILLINOIS 60193

002084 4026 004 65102266

AUTHORIZED SIGNATURE

⑈001423⑈ ⑆026007825⑆ 26735102⑈ ⑇0000013398⑇

J. HENRY SCHRODER BANK & TRUST COMPANY
New York, New York

HEMETCO P.O. BOX 187 • ALTON, ILLINOIS 62002

1-782/260 No. 35695

CERTIFIED
DAVIDSON CHEMICAL CORPORATION
MAR 1 3 1985
J. Henry Schroder Bank & Trust Co.
AUTHORIZED SIGNATURE

[illegible] 212.50********

[illegible] FILL SERVICE
[illegible]
[illegible] PENNSYLVANIA 19171

RETURNED UNDER FOR REASON INDICATED:
☐ ENDORSEMENT
☒ MISSING
☐ NOT AS DRAWN
☐ [illegible]

DATE 2/[illegible]

DOLLARS $ **6,212.50

☐ [illegible] COLLECTION
☐ INSUFFICIENT FUNDS
☐ HAVE TELEXED FOR AUTHORITY TO PAY.
☐ OTHER REASON (SPECIFY)

OPERATING ACCOUNT

AUTHORIZED SIGNATURE

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IMS
$6212.50

J. HENRY SCHRODER BANK & TRUST COMPANY
New York, New York

HEMETCO P.O. BOX 187 • ALTON, ILLINOIS 62002

1-782/260 No. 35696

DATE 2/26/85

PAY TO THE ORDER OF ********153.95********

DOLLARS $ ****153.95

OPERATING ACCOUNT

KIRKBRIDE SAW & KNIFE
2935 LOCUST ST.
ST. LOUIS, MISSOURI 63103

AUTHORIZED SIGNATURE

⑈001425⑈ ⑆026007825⑆ 26735102⑈ ⑇0000015895⑇

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The Boatmen's National Bank

APPENDIX I-1

SOIL CAP MATERIALS AND PROCEDURES

A. SURVEY CONTROL

A.1 Scope

The work included in this section shall consist of furnishing all labor and equipment to establish on-site survey control and grade stakes to establish limits of work for final covering and final grade elevations in conformance with the plans and specifications.

A.2 Survey Control

The Contractor shall provide all on-site horizontal and vertical survey control for the establishment of baseline(s) and limits and grades for the fill area as shown on the drawings.

The baselines shall be staked and labelled at one hundred (100) foot stations. The Contractor shall provide additional survey control as necessary for witness stakes, offset stakes, and line and grade stakes to establish the required control over the filling and to re-establish such control as may be removed or disturbed by construction.

B. BACKFILL

B.1 Scope

The work under this section includes the furnishing of all labor, equipment, materials and the performing of all operations in connection with furnishing, placing, grading and compacting backfill to the limits shown on the drawings.

B.2 Materials

Material for backfill shall be a natural soil composed of clay, sand, silt and/or gravelly sand and shall be from off-site sources. Backfill texture shall conform to one or more of the following soil groups as defined by the Unified Soil Classification System:

Symbol	Description
SW	well graded sands, gravelly sands, little or no fines
SM	silty sands, sand-silt mixtures
SP	poorly graded sands or gravelly sands, little or no fines
SC	clayey sands, sand-clay mixtures
CL	inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
CH	inorganic clays of high plasticity, fat clays

Prior to backfill placement, one representative sample from each source shall be submitted to an independent soil testing laboratory for the determination of optimum moisture content and maximum density according to ASTM Method D-698 Standard Proctor Test. The contractor shall be responsible for identifying the sources and shall obtain representative samples and submit the samples to an Owner-approved laboratory. The contractor shall provide the test results to the Owner. Testing and acceptance shall conform to the procedures described in Appendix I-2, "Construction Quality Assurance and Quality Control Plan".

B.3 Placement and Compaction

Backfill shall be placed within the fill limits shown on the drawings. Backfill shall be placed in layers and compacted according to the type of soil used as fill. For soil types SW, SM and SP, a track-type tractor or rubber tired roller shall be utilized. SW, SM and SP type backfill shall be placed in lifts so that the compacted layer is not thicker than 12 inches. Track type tractors shall weigh at least 30,000 lbs*. Rubber tired rollers shall have a wheel load in excess of 15,000* lbs. Each layer shall be compacted by not less than six passes of the equipment. A complete pass shall consist of the entire coverage of the layer with one trip of the equipment. Each trip shall over lap the adjacent trip by not less than two (2) feet.

For soil types SC, CL and CH, a rubber tired roller or tamping (sheepsfoot) roller will be used. If the rubber tired roller is selected, the compaction equipment requirement shall be the same as described in the above paragraph for soil types SW, SM and SP. If a sheepsfoot roller is selected, the layer thickness shall not be thicker than six (6) inches after compaction. The length of the foot on the sheepsfoot roller shall not be less than seven and one-half (7 1/2) inches. The *Corps of Engineers, Bureau of Land Reclamation recommendations in Soils Manual (The Asphalt Institute) loaded weight of the sheepsfoot roller shall not be less than 30,000 lbs*. Each layer compacted by the sheepsfoot roller shall be compacted by not less than six (6) passes. A complete pass shall consist of the entire coverage of the layer with one trip of the sheepsfoot roller. Each trip shall overlap the adjacent trip by not less than two (2) feet. The moisture content of the backfill shall be three (3) to five (5) percent above the optimum moisture content as determined by the Standard Proctor Test (ASTM D-698).

Each lift shall be compacted to at least 90% of maximum dry density as determined by the Owner's Inspector, as described in Appendix I-2, "Construction Quality Assurance and Quality Control Plan".

B.4 Grading

Backfill shall be placed in compacted lifts until a point has been reached that is 2 feet 6 inches below the final grade, as shown on the drawings. The completed backfill surface shall be rough graded and uniform.

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*EPA Seminar - Requirements for Hazardous Waste Landfill Design, Construction & Closure (Presentations, 1988).

C. CLAY COVER

C.1 Scope

The work under this section includes the furnishing of all labor, equipment, materials, and the performing of all operations in connection with furnishing, placing, grading, and compacting a clay cover over the backfill.

C.2 Materials

Cover material shall be a natural soil composed of clay and silt. It shall be free of boulders, brush, stumps, waste or debris, and similar materials. Cover material shall be uncontaminated and will be obtained from an off-site source. The responsibility for Quality Assurance shall be placed upon the contractor providing cover material. In delivering cover material the contractor shall provide to the Owner the source location and assurance that materials have not been removed from a previous industrialized location where contamination of the material is likely to have occurred.

Quality Control will be the responsibility of the Owner. QC measures will include confirmation of the source location and random visual inspections of the material as it is being delivered to the site to confirm the absence of any obvious unnatural staining and other foreign materials (e.g., broken bricks, concrete, rubber) which might indicate an unacceptable source or previous industrial application.

Cover material texture shall conform to one or more of the following soil groups as defined by the Unified Soil Classification System:

Symbol	Description
CL	inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
CH	inorganic clays of high plasticity, fat clays

Prior to cover placement one representative sample of cover material from each source shall be submitted to an independent soil testing laboratory for the determination of moisture content, grain size distribution, specific gravity, liquid and plastic limits, moisture-density relationship, and hydraulic conductivities at various densities and moisture contents. A sufficient number of tests

will be accomplished upon representative samples of the cohesive clay or silt (CL, or CH) proposed to be furnished for use in the clay cover to determine the most practical combination of densities and moisture contents to assure an in-place coefficient of permeability of not more than 1 x 10^{-7} cm/sec. At least one lab permeability test series shall be performed for every 10,000 cubic yards of soil to be used as the clay cover. The Contractor shall be responsible for identifying the sources, and shall obtain and submit the samples to an Owner-approved laboratory. The Contractor shall be responsible for identifying the sources, and shall obtain and submit the samples to an Owner-approved laboratory. The Contractor shall provide test results to the Owner. Testing and acceptance shall conform to the procedures described in Appendix I-4, "Construction Quality Assurance and Quality Control Plan".

C.3 Placement and Compaction

The cover shall be placed and spread in layers so that the total compacted thickness of the clay is not less than 18 inches. Each individual layer will not exceed six (6) inches. The cover shall be compacted by a sheepsfoot roller with feet 3ot less than seven and one half (7 1/2) inches in length. The loaded weight of the sheepsfoot roller shall not be less than 30,000 lbs. Each layer shall be compacted by not less than six (6) passes. A complete pass shall consist of the entire coverage of the layer with one trip of the roller. Each trip shall overlap the adjacent trip by not less than two (2) feet.

Each lift shall be placed to achieve a moisture content and dry density that is within the acceptable range for the required hydraulic conductivity. The acceptable range will be determined by material testing as described in C.2 above. The field density of the compacted final cover shall be field tested by the Owner's Inspector as described in Appendix I-4.

C.4 Grading

Cover material shall be placed in compacted lifts until a point has been reached that is 12 inches below the final grade, as shown on the drawings. The completed cover surface shall be rough graded and uniform.

C.5 Soil Testing

Soil testing shall be performed in accordance with Technical Specification F entitled "Soils Testing".

D. TOPSOILING

D.1 Scope

The work under this section includes the furnishing of all labor, equipment, materials, and the performing of all operations in connection with furnishing, placing, and grading topsoil over the compacted final cover surface.

D.2 Materials

Material for topsoil shall be natural surface soil, friable and loamy, free of debris, stumps, brush, litter, and stones larger than three (3) inches in diameter. The topsoil shall not contain toxic substances that may be harmful to plant growth. A pH range of 5.0 to 7.5 is acceptable. Topsoil shall have a minimum organic content of 2.75%. Prior to topsoil placement, the contractor shall test one representative sample of each source of material for acidity and organic content, as described in Appendix I-2, "Construction Quality Assurance and Quality Control Plan".

D.3 Placement and Grading

Topsoil shall be placed over the compacted final cover soils within the limits shown on the drawings and shall be evenly and smoothly spread over the surface. Topsoil shall be placed so that the total thickness is not less than twelve (12) inches after firming. Topsoil shall not be placed while in a frozen or muddy condition or when the final cover is excessively wet and soft or in a condition that may otherwise be detrimental to proper grading.

E. SEEDING AND EROSION CONTROL

E.1 Scope

The work included in this section includes the furnishing of all labor, equipment and materials, and in performing all operations in connection with the application of lime or sulfur, seeding, fertilizing, and mulching, of the area indicated on the drawings, completed and accepted, in accordance with the specifications and drawings.

E.2 Materials

E.2.1 Lime

Lime shall be agricultural ground dolomitic limestone conforming to the standards of the Association of Official Agricultural Chemists, and complying with all existing State and Federal Regulations. The materials must comply with the following gradation:

Square Mesh Sieves	% Passing by Weight
Pass #10	100
Pass #20	90
Pass #200	50

The minimum calcium carbonate equivalent shall be 90% by weight. The Owner reserves the right to draw such samples and to perform such tests as the Owner deems necessary to assure that these specifications are met.

E.2.2 Sulfur

Sulfur shall be commercial flour sulfur, unadulterated, and shall be delivered to the site in the original unopened containers or in bulk lots with the name of the manufacturer, material analysis and net weight specified.

E.2.3 Fertilizer

Fertilizer shall be a complete fertilizer containing 10% nitrogen, 20% potash, and 10% phosphorous and referred to as 10-20-10. The total nitrogen content shall either be derived from natural organic sources or be a urea-form fertilizer. The commercial fertilizer shall be delivered

to the site in the original unopened containers which shall bear the guaranteed statement of analysis of the manufacturer.

E.2.4 Seed Mixture

The seed mixture shall be delivered to the site in new, clean, sealed containers. Labels and contents shall conform to all State and Federal regulations. Seed shall be subject to the testing procedures of the Association of Official Seed Analysts. The seed shall be delivered to the site accompanied by a properly executed certificate from the supplier of each type of seed attesting to its freshness, components, proportion (if mixed), minimum purity, and minimum germination. The seed quality and certificates are subject to approval by the Owner prior to their being applied. Acceptable seed types and application rates include:

Seed Name	Application Rate
Bermuda Grass (cynodon dactylon)	7 lbs/acre
Annual Ryegrass (lolium multiflorum)	20 lbs/acre

E.2.5 Straw

Straw shall be small-grain straw or hay. As necessary, a liquid mulch binder such as emulsified asphalt, cutback asphalt, or synthetic or organic binders shall be used at the rates recommended by the manufacturer.

E.2.6 Water

Water used in this work will be furnished by the Owner and will be suitable for irrigation and free from oil, acid, alkali, salt and other substances harmful to plant life. The Contractor will provide all equipment including hose necessary to apply the irrigation water.

E.3 Season of Seeding

The preferred dates for seeding are May 1 to July 1. If these dates are missed, then alternate dates are August 1 to November 15.

E.4 Application

E.4.1 Application of Lime or Sulfur

Lime or sulfer shall be applied at rates determined by the Owner based on tests of the topsoil material, as described at D.2. When applied dry, the limestone or sulfur shall be spread evenly and then thoroughly incorporated into the top three (3) inches of the soil by approved means and shall produce a roughened seedbed. When applied hydraulically, no discing will be necessary.

E.4.2 Application of Fertilizer and Seed

The preferred method of applying fertilizer and seed shall be hydraulic, however, any agronomically acceptable and reasonable method of uniformly applying the seed and/or the fertilizer separately or together may be utilized that is approved by the Owner. The Owner shall reserve the right to temporarily halt any seeding operation during the presence of strong winds. Fertilizer shall be applied at the rate of 500 lbs per acre. Seed shall be applied at the rates recommended by the Supplier(s), subject to Owner-approval.

E.4.3 Application of Mulch

The straw mulch shall be applied hydraulically or by hand, at the rate of 2-2.5 tons per acre. As necessary, straw mulch shall be coated with a liquid mulch binder in accordance with the manufacturer's recommendations. Mulching shall be performed as a separate operation.

E.5 Maintenance

E.5.1 The Contractor

The Contractor shall be required to replant, using full amounts of all specified materials and all of the complimentary procedures, those areas damaged by wind, fire, erosion, equipment, or pedestrian traffic during the life of the contract, to the satisfaction of the Owner.

E.5.2 The Contractor

The Contractor shall be required to clean up and remove all debris resulting from the seeding operations on roads and other areas within and adjacent to the project.

F. SOIL TESTING

F.1 Scope

Furnish labor, materials and equipment necessary for the sampling, testing and reporting of soils materials from both on-site sources and approved off-site borrow sources proposed to be used for the Cover.

F.2 General

A. Following are major items of work included:

B. Collection of a sufficient quantity of soil samples representative of the on-site and borrow materials to be used for the Cover;

C. Transporting and preparation of the soil samples for the required testing,f whether in the field or in an approved commercial testing facility;

D. Testing the soil samples in accordance with all appropriate ASTM procedures, modified as may be specified in this Section and conforming to the testing schedule as detailed hereinafter;

E. Orally reporting the results directly to the Engineer in the field, and by follow-up written report within two (2) working days after completion of each test.

F.3 Testing Procedures

A. The contractor shall arrange for an approved commercial testing agency to sample, test and report the pertinent engineering characteristics of representative samples of all borrow materials proposed to be furnished for use on this project from any off-site sources at least two (2) weeks prior to the start of its intended use. The Engineer reserves the right to reject any material, source, or portion of a source which in his opinion will not provide the intended and specified function or end use of said material. In case of rejection, the Contractor shall propose an additional material or source from which he shall obtain the quantity of material required for project use.

F.4 Testing Schedule

A. Prior to the acceptance of any materials from any on-site or off-site source for any purpose, the Contractor shall arrange for a sufficient number of tests deemed acceptable by the Engineer to be accomplished in the testing laboratory to establish the following engineering characteristics of granular and cohesive materials:

1) Particle Size Analysis of Soils - ASTM D 1556

2) Amount of Materials in Soils finer than No. 200 Sieve - ASTM D 1140

3) Liquid Limit of Soils - ASTM D 423

4) Plastic Limit and Plasticity Index of Soils - ASTM D 424

5) Moisture Content of Soil - ASTM D 2216

6) Moisture - Density Relations of Soils - ASTM D 698

7) Permeability Test for Clay Liner in Cap System - Illinois EPA Method

Laboratory determination of permeability of fine grained soils shall be performed using the modified triaxial apparatus technique, including backpressure saturation, to determine the constant head, saturated permeability of "undisturbed" soil samples. Disturbance of the soil sample shall be minimized both before and durifng the determination in order to approximate actual field conditions. The permeant liquid shall be either tap water or a 0.005 N $CaSO_4$ solution. In any case, distilled water shall not be used. The effective stress (confining cell pressure minus the average of the headwater and tailwater pressures) applied to the soil sample in the triaxial apparatus shall be set as close as possible to the expected in situ-stress conditions to prevent excessive consolidation of the soil sample.

Laboratory permeability determination reports shall include a detailed description of both the sample collection and preparation techniques and the details (cell pressure, headwater pressure, tailwater pressure, driving pressure, gradient, sample size, permeant liquid, time, etc.) of the determination procedures. Tests shall be performed in two phases as specified below.

Phase I: Collect and prepare a sample and backpressure saturate. Subject the sample to a constant hydraulic gradient (driving force pressure expressed in centimeters of water divided by length of sample in centimeters) of less than 20 until the volume of permeant flowing out of the sample in a minimum period of three (3) hours is equal to the volume input in the same period. Compute the permeability at the conclusion of the steady state period.

Phase II: Prepare an identical sample and backpressure saturate. Subject the sample to a constant hydraulic gradient not exceeding 300. This gradient shall be maintained until at least two (2) pore volumes of permeant liquid have passed through this soil sample. Readings shall be taken and permeability computed at the lesser interval of 0.25 pore-volume or 24-hours. The results shall be plotted on an arithmetic scale to show permeability versus pore volume. If the measured permeability is relatively constant or decreases with the number of pore volumes passed through the sample, then it can be concluded that the permeant does not alter the soil skeleton so as to increase the specimen permeability from the Phase I test. However, should the measured permeability show an increasing trend, the procedure required for liners must be performed on that soil type to determine the sample's permeability.

B. A sufficient number of tests shall be accomplished upon samples of the cohesive clay or silt (CL or CH) proposed to be furnished for use in the cap to determine the most practical combination of densities and moisture contents to assure an in-place coefficient of permeability of not more than 1×10^{-7} cm/sec.

C. After materials from either on-site or off-site sources have been approved for use in the Cap on the project, a sufficient number of representative samples of the materials being placed shall be tested to insure that their properties are consistent with those established when approving these materials. The minimum numbers of both tests on Silt and Clay provided as the clay layer in the Cap materials are as follows:

1) At least one test per 1,000 cubic yards being placed:

a) Particle Size of Analysis of Soils

b) Materials finer than No. 200 Sieve

2) At least one test per 250 cubic yards being placed:

   a) Density (including Moisture Content) of soil in place by one of the following materials:

      Rubber-Balloon Method - A55M D 2167
      Sand-Cover Method - ASTM D1556
      Nuclear Method - D 2922/D 3217

3) At least one test per 5,000 yards being placed:

   a) Liquid Limit of Soils

   b) Plastic Limit and Plasticity Index of Soils

Justification for the sampling frequences is provided in the attached Table 1.

TABLE 1

Testing Frequencies

Recommendations for Construction Documentation of Clay-Lined Landfills by the Wisconsin Department of Natural Resources

Item	Testing	Frequency
1. Clay borrow source testing	Grain size	1,000 yd^3
	Moisture content	1,000 yd^3
	Atterberg limits (liquid limit and plasticity index)	5,000 yd^3
	Moisture-density curve	5,000 yd^3 and all changes in material
	Lab permeability (remolded samples)	10,000 yd^3
2 Clay liner testing during construction	Density (nuclear or sand cone)	5 tests/acre/lift (250 yd^3)
	Moisture content	5 tests/acre/lift (250 yd^3)
	Undisturbed permeability	1 test/acre/lift (1,500 yd^3)
	Dry density (undisturbed sample)	1 test/acre/lift (1,500 yd^3)
	Moisture content (undisturbed sample)	1 test/acre/lift (1,500 yd^3)
	Atterberg limits (liquid limit and plasticity index)	1 test/acre/lift (1,500 yd^3)
	Grain size (to the 2-micron particle size)	1 test/acre/lift (1,500 yd^3)
	Moisture-density curve (as per clay borrow requirements)	5,000 yd^3 and all changes in material
3. Granular drainage blanket testing	Grain size (to the No. 200 sieve)	1,500 yd^3
	Permeability	3,000 yd^3

Source: Gordon et al., 1984.

APPENDIX I-2

CONSTRUCTION QUALITY ASSURNACE AND QUALITY CONTROL PLAN

I-2 CONSTRUCTION QUALITY ASSURANCE AND QUALITY CONTROL PLAN

1 Quality Assurance Organization and Responsibilities

The Owner will have ultimate responsibility for activities undertaken at the site, including responsibility for overseeing construction. A qualified construction firm will be selected for this project. The Owner or his Engineer will provide guidance to the selected firm during construction. an independent registered professional engineer in the State of Illinois will provide inspections, as necessary, to ensure that construction of the final cover is conducted within prudent engineering principals. The independent professional engineer will then certify the construction of the final cover. Figure 1 depicts the organizational chart for this construction project.

Owner

The Owner will have the ultimate responsibility for the construction of the final cover. The Owner has the authority to commit the necessary resources to accomplish closure. The Owner will be kept apprised of progress and situations involved with closure by his Engineer. The Owner will inform IEPA when closure activities begin and are completed.

Contracted Construction Firm

A qualified construction firm will be retained by the Owner to accomplish closure. The firm will be managed by competent individuals who have had prior experience with these types of construction operations. The firm will follow construction designs and specifications that will be developed and approved for the closure activities.

Owner's Engineer

The Owner's Engineer will act as liaison between the Owner and the construction firm. He shall coordinate all construction activities with the contracted firm and immediately report any problems or deviations from designed construction operations to the Owner. He will be involved in the day-to-day management of construction activities at the closure site.

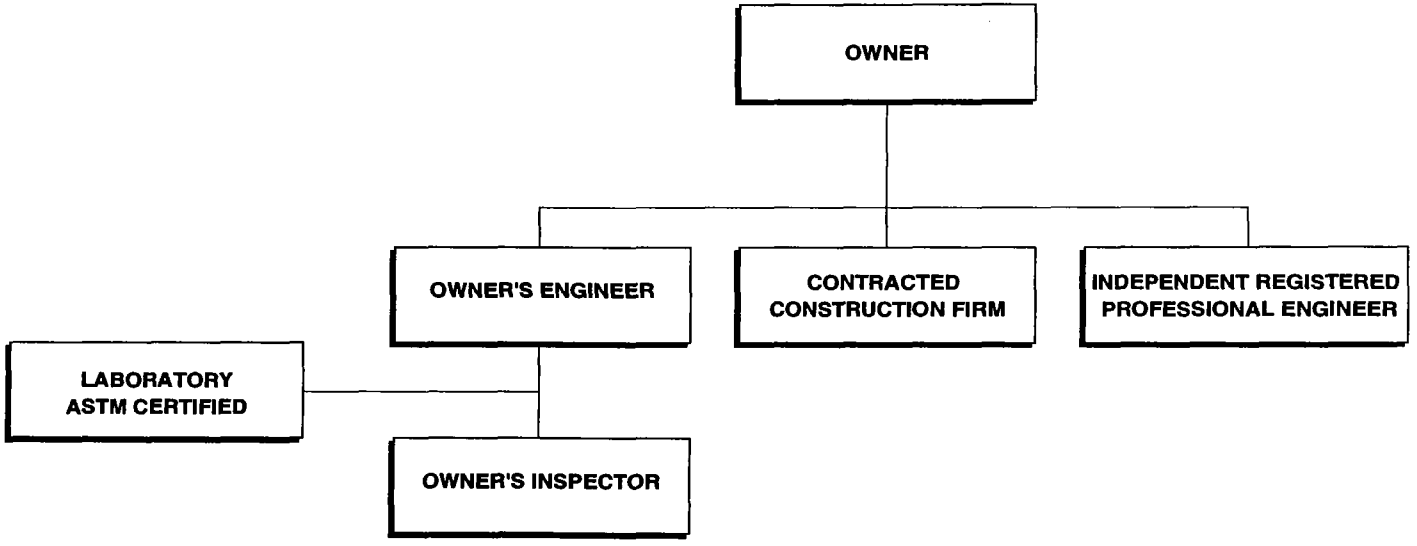

FIGURE 1
Closure Construction Project Organization Chart

Owner's Inspector

The Owner's Inspector shall observe the daily construction activities of the final cover. He will immediately report any problems or deviations from design specifications or drawings to the Owner's Engineer. The inspector will collect the required number of samples needed to ensure the final cover has met all the design standards and ship them to a laboratory certified to conduct soil analysis.

Laboratory

The laboratory will analyze all soil samples according to the ASTM methods stipulated in the next section of this QA/QC Plan. The laboratory will be staffed with professionals experienced in soil analysis and shall be certified to conduct ASTM analysis.

Registered Professional Engineer

An independent registered professional engineer will inspect closure activities to ensure that closure has been conducted pursuant to 35 Ill. Adm. Code 725.410 requirements. The engineer will certify and seal all certification documentation and send such documentation to the IEPA after closure activities are completed.

0.1 Closure Construction Testing Protocol

Soil Source Acceptance

The contractor will test each offsite source of backfill, clay cover, and topsoil that is proposed to be used in the cover system. The following test results will be submitted to the Owner before acceptance of any soil material:

- Backfill testing for moisture-density relationship.
- Clay cover testing for moisture content, grain size distribution, specific gravity, liquid and plastic limits, moisture-density relationship, and hydraulic conductivities at 85, 90, and 95 percent of standard Proctor maximum dry density at various moisture contents.
- Topsoil testing for acidity and organic content.

The soils shall be tested by an ASTM-certified laboratory, which shall provide QA/QC documentation on procedures and calibration. The allowable test methods and acceptance criteria are provided in Table 1. The Owner's Inspector will sample each initially accepted material and repeat the above analyses prior to final acceptance and use of any of the materials

TABLE 1

Soil Acceptance Test Methods and Criteria

Parameter	Test Method	Acceptance Criteria
Moisture-Density Relationship	ASTM D-698	None*
Moisture Content	ASTM D-2216	None*
Grain Size Distribution	ASTM D-422	100% finer than 0.75 inch, 30% finer than No. 200
Specific Gravity	ASTM D-854	None
Liquid/Plastic Limits	ASTM D-4318	Liquid Limit >30% Plasticity
Hydraulic Conductivity	ASTM D-2434	index $\geq 10^{-7}$ cm/sec
Acidity		pH = 5.0 - 7.5
Organic Content		O.C. ≥2.75%

*No limits, but test must conclusively show material characteristics to the satisfactino of the Owner's Engineer.

in onsite construction. Sampling and analysis may be repeated at any time during construction, and material acceptance may be suspended or revoked based on such tests.

Constructed Cover Acceptance

The Owner's Inspector will perform in-place density tests on constructed sections of backfill and clay final cover, to verify proper compaction and minimum permeabilities. Test methods, frequencies, and acceptance criteria are provided in Table 2. Tested sections failing acceptance criteria will be reworked, or removed and replaced, by the contractor until meeting such criteria.

2. Recordkeeping

All construction and sampling activities will be documented by the Owner's Engineer. The documentation will be in the form of field records and will contain all activities conducted during construction, including any deviance from design plans and specification. Any physical anomaly that may affect the construction of the final cover will be denoted as well (i.e., weather). A copy of the field record will be submitted to IEPA with the closure certification documents. The original field records will be archived by the Owner until the end of post-closure care.

TABLE 2

Constructed Cover In-Place Test Methods and Acceptance Criteria

Parameter	Frequency	Test Method	Acceptance Criteria
Backfill Density	1/lift/day	ASTM D-2922	90% of maximum dry density
Clay Cover Density	1/lift/day	ASTM D-2922	In range to provide H.C. $<10^{-7}$ cm/sec.

APPENDIX I-3

COMPOSITE CAP MATERIALS AND PROCEDURES

A. SURVEY CONTROL

A.1 Scope

The work included in this section shall consist of furnishing all labor and equipment to establish on-site survey control and grade stakes to establish limits of work for final covering and final grade elevations in conformance with the plans and specifications.

A.2 Survey Control

The Contractor shall provide all on-site horizontal and vertical survey control for the establishment of baseline(s) and limits and grades for the fill area as shown on the drawings.

The baselines shall be staked and labelled at one hundred (100) foot stations. The Contractor shall provide additional survey control as necessary for witness stakes, offset stakes, and line and grade stakes to establish the required control over the filling and to re-establish such control as may be removed or disturbed by construction.

B. BACKFILL

B.1 Scope

The work under this section includes the furnishing of all labor, equipment, materials and the performing of all operations in connection with furnishing, placing, grading and compacting backfill to the limits shown on the drawings.

B.2 Materials

Material for backfill shall be a natural soil composed of clay, sand, silt and/or gravelly sand and shall be from off-site sources. Backfill texture shall conform to one or more of the following soil groups as defined by the Unified Soil Classification System:

Symbol	Description
SW	well graded sands, gravelly sands, little or no fines
SM	silty sands, sand-silt mixtures
SP	poorly graded sands or gravelly sands, little or no fines
SC	clayey sands, sand-clay mixtures
CL	inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
CH	inorganic clays of high plasticity, fat clays

Prior to backfill placement, one representative sample from each source shall be submitted to an independent soil testing laboratory for the determination of optimum moisture content and maximum density according to ASTM Method D-698 Standard Proctor Test. The contractor shall be responsible for identifying the sources and shall obtain representative samples and submit the samples to an Owner-approved laboratory. The contractor shall provide the test results to the Owner. Testing and acceptance shall conform to the procedures described in Appendix I-4, "Construction Quality Assurance and Quality Control Plan".

B.3 Placement and Compaction

Backfill shall be placed within the fill limits shown on the drawings. Backfill shall be placed in layers and compacted according to the type of soil used as fill. For soil types SW, SM and SP, a track-type tractor or rubber tired roller shall be utilized. SW, SM and SP type backfill shall be placed in lifts so that the compacted layer is not thicker than 12 inches. Track type tractors shall weigh at least 30,000 lbs*. Rubber tired rollers shall have a wheel load in excess of 15,000* lbs. Each layer shall be compacted by not less than six passes of the equipment. A complete pass shall consist of the entire coverage of the layer with one trip of the equipment. Each trip shall over lap the adjacent trip by not less than two (2) feet.

For soil types SC, CL and CH, a rubber tired roller or tamping (sheepsfoot) roller will be used. If the rubber tired roller is selected, the compaction equipment requirement shall be the same as described in the above paragraph for soil types SW, SM and SP. If a sheepsfoot roller is selected, the layer thickness shall not be thicker than six (6) inches after compaction. The length of the foot on the sheepsfoot roller shall not be less than seven and one-half (7 1/2) inches. The loaded weight of the sheepsfoot roller shall not be less than 30,000 lbs**. Each layer compacted by the sheepsfoot roller shall be compacted by not less than six (6) passes. A complete pass shall consist of the entire coverage of the layer with one trip of the sheepsfoot roller. Each trip shall overlap the adjacent trip by not less than two (2) feet. The moisture content of the backfill shall be three (3) to five (5) percent above the optimum moisture content as determined by the Standard Proctor Test (ASTM D-698).

Each lift shall be compacted to at least 90% of maximum dry density as determined by the Owner's Inspector, as described in Appendix I-4, "Construction Quality Assurance and Quality Control Plan".

B.4 Grading

Backfill shall be placed in compacted lifts until a point has been reached that is 5 feet below the final grade, as shown on the drawings. The completed backfill surface shall be rough graded and uniform.

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*Corps of Engineers, Bureau of Land Reclamation recommendations in Soils Manual (The Asphalt Institute).

**EPA Seminar - Requirements for Hazardous Waste Landfill Design, Construction & Closure (Presentations, 1988).

C. CLAY COVER

C.1 Scope

The work under this section includes the furnishing of all labor, equipment, materials, and the performing of all operations in connection with furnishing, placing, grading, and compacting a clay cover over the backfill.

C.2 Materials

Cover material shall be a natural soil composed of clay and silt. It shall be free of boulders, brush, stumps, waste or debris, and similar materials. Cover material shall be uncontaminated and will be obtained from an off-site source. The responsibility for Quality Assurance shall be placed upon the contractor providing cover material. In delivering cover material the contractor shall provide to the Owner the source location and assurance that materials have not been removed from a previous industrialized location where contamination of the material is likely to have occurred.

Quality Control will be the responsibility of the Owner. QC measures will include confirmation of the source location and random visual inspections of the material as it is being delivered to the site to confirm the absence of any obvious unnatural staining and other foreign materials (e.g., broken bricks, concrete, rubber) which might indicate an unacceptable source or previous industrial application.

Cover material texture shall conform to one or more of the following soil groups as defined by the Unified Soil Classification System:

Symbol	Description
CL	inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
CH	inorganic clays of high plasticity, fat clays

Prior to cover placement one representative sample of cover material from each source shall be submitted to an independent soil testing laboratory for the determination of moisture content, grain size distribution, specific gravity, liquid and plastic limits, moisture-density relationship, and hydraulic conductivities at various densities and moisture contents. A sufficient number of tests

will be accomplished upon representative samples of the cohesive clay or silt (CL, or CH) proposed to be furnished for use in the clay cover to determine the most practical combination of densities and moisture contents to assure an in-place coefficient of permeability of not more than 1 x 10^{-7} cm/sec. At least one lab permeability test series shall be performed for every 10,000 cubic yards of soil to be used as the clay cover. The Contractor shall be responsible for identifying the sources, and shall obtain and submit the samples to an Owner-approved laboratory. The Contractor shall provide test results to the Owner. Testing and acceptance shall conform to the procedures described in Appendix I-4, "Construction Quality Assurance and Quality Control Plan".

C.3 Placement and Compaction

The cover shall be placed and spread in layers so that the total compacted thickness of the clay is not less than 24 inches. Each individual layer will not exceed six (6) inches. The cover shall be compacted by a sheepsfoot roller with feet not less than seven and one half (7 1/2) inches in length. The loaded weight of the sheepsfoot roller shall not be less than 30,000 lbs. Each layer shall be compacted by not less than six (6) passes. A complete pass shall consist of the entire coverage of the layer with one trip of the roller. Each trip shall overlap the adjacent trip by not less than two (2) feet.

Each lift shall be placed to achieve a moisture content and dry density that is within the acceptable range for the required hydraulic conductivity. The acceptable range will be determined by material testing as described in C.2 above. The field density of the compacted final cover shall be field tested by the Owner's Inspector as described in Appendix I-4.

C.4 Grading and Surface Preparation

Cover material shall be placed in compacted lifts until a point has been reached that is 36 inches below the final grade, as shown on the drawings. The completed cover surface shall be rough graded and uniform. The surface shall be free of sharp rocks, vegetation, or foreign materials that are capable of puncturing the synthetic liner during placement. The surface shall be kept free of such materials until the synthetic liner is fully installed, as determined by the Owner's Inspector as described in Appendix I-4.

C.5 Soil Testing

Soil testing shall be performed in accordance with Technical Specification I entitled "Soils Testing".

D. SYNTHETIC LINER

D.1 Scope

The work under this section includes the furnishing of all labor, equipment, materials, and the performing of all operations in connection with furnishing, placing, seaming, and protecting a synthetic liner.

D.2 Materials and Storage

Liner material shall be procured from a Manufacturer subject to approval of the Owner. The Manufacturer shall supply the following items for Owner approval:

- Material specifications including tensile strength, elongation at break, tear strength, puncture resistance, ozone resistance, low temperature flexibility, seam strength, and seam continuity.

- Installation instructions including field seam locations, field seam procedures, field repair procedures, and protective measures.

- Written guarantee against manufacturing defects and against deterioration due to normal weathering for a period of 10 years.

The accepted material shall be manufactured no sooner than 3 months prior to the installation date specified by the Owner. Liner material shall be packaged in fully-enclosed containers to prevent damage during shipment. The Contractor shall store liner material on pallets onsite in a secure area in the original containers until installation. The storage area shall include protection of material from direct sun and temperatures exceeding ambient.

D.3 Placement and Seaming

The Contractor shall place liner sections on surfaces approved by the Owner's Inspector, following the Manufacturer's layout plan and installation procedures. Each liner section will be placed immediately prior to field seaming and will be protected from adverse affects of high wind. Field seams and field joints of any kind will be constructed following the Manufacturer's procedures and shall be smooth and free of wrinkles. Each field seam and joint will be subject to 100% inspection and testing by the Owner's Inspector prior to acceptance. Field seam and joint acceptance shall conform to the procedures described in Appendix I-4, "Construction Quality

Assurance and Quality Control Plan". Unacceptable field seams or joints, and punctures or distressed material identified by the Contractor or Owner's Inspector, will be repaired following the Manufacturer's procedures and reinspected by the Owner's Inspector.

D.4 Protection of Placed Liner

Liner material will be protected from puncturing by following the Manufacturer's installation procedures, including restricting traffic on installed sections. Placed liner sections will be covered with drainage material as soon as practicable, and no later than 7 days after placement. Each section will be subject to 100% inspection by the Owner's Inspector immediately before covering. Acceptance of placed sections shall conform to the procedures described in Appendix I-4, "Construction Quality Assurance and Quality Control Plan".

E. DRAINAGE LAYER

E.1 Scope

The work under this section includes the furnishing of all labor, equipment and materials, and the performing of all operations in connection with furnishing, placing, and grading a drainage layer over the synthetic liner.

E.2 Materials

The drainage layer shall consist of layers of geotextile, sand, and geotextile, as shown on the drawings. The geotextile shall consist of a spun bond fabric having a minimum density of 3 ounces per square yard and a minimum cross-plane permeability of 0.1 cm/sec. Manufacturer's specifications for the geotextile shall be submitted to the Owner for approval. The sand shall consist of a clean natural sand having no lumpy clay or organic material, with a minimum permeability of 1×10^{-3} cm/sec at about 70 percent of relative density.

Prior to placement of the drainage layer, the Contractor shall submit a representative sample from each source of sand to an Owner-approved independent soil testing laboratory for determination of physical properties. Testing and acceptance shall conform to the procedures described in Appendix I-4, "Construction Quality Assurance and Quality Control Plan". The Contractor shall provide test results to the Owner.

E.3 Placement

Sand and geotextiles shall be installed over the liner as shown on the drawings. The Contractor shall install geotextile following the Manufacturer's procedures and exercising extreme caution so as to prevent puncturing the liner. Sand shall be dumped, spread, and leveled in such a fashion as to minimize traffic on the liner and prevent any direct contact of machinery with the liner. A minimum 6-inch thickness of sand will be maintained between any machinery and the geomembrane, as determined by the Owner's Inspector. Sand shall be placed and graded until a point has been reached that is 24 inches below the final grade, as shown on the drawings.

F. FILL LAYER

F.1 Scope

The work under this section includes the furnishing of all labor, equipment, materials and the performing of all operations in connection with furnishing, placing, grading and compacting the upper fill layer to the limits shown on the drawings.

F.2 Materials

Material for fill shall be a natural soil composed of clay, sand, silt and/or gravelly sand and shall be from off-site sources. Material texture shall conform to one or more of the following soil groups as defined by the Unified Soil Classification System:

Symbol	Description
SW	well graded sands, gravelly sands, little or no fines
SM	silty sands, sand-silt mixtures
SP	poorly graded sands or gravelly sands, little or no fines
SC	clayey sands, sand-clay mixtures
CL	inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
CH	inorganic clays of high plasticity, fat clays

Prior to fill placement, one representative sample from each source shall be submitted to an independent soil testing laboratory for the determination of optimum moisture content and maximum density according to ASTM Method D-698 Standard Proctor Test. The contractor shall be responsible for identifying the sources and shall obtain representative samples and submit the samples to an Owner-approved laboratory. The contractor shall provide the test results to the Owner. Testing and acceptance shall conform to the procedures described in Appendix I-4, "Construction Quality Assurance and Quality Control Plan".

F.3 Placement and Compaction

Material shall be placed within the fill limits shown on the drawings. Material shall be placed in layers and compacted according to the type of soil used as fill. For soil types SW, SM and SP, a track-type tractor or rubber tired roller shall be utilized. SW, SM and SP type fill shall be placed in lifts so that the compacted layer is not thicker than 12 inches. Track type tractors shall weigh at least 30,000 lbs*. Rubber tired rollers shall have a wheel load in excess of 15,000* lbs. Each layer shall be compacted by not less than six passes of the equipment. A complete pass shall consist of the entire coverage of the layer with one trip of the equipment. Each trip shall over lap the adjacent trip by not less than two (2) feet.

For soil types SC, CL and CH, a rubber tired roller or tamping (sheepsfoot) roller will be used. If the rubber tired roller is selected, the compaction equipment requirement shall be the same as described in the above paragraph for soil types SW, SM and SP. If a sheepsfoot roller is selected, the layer thickness shall not be thicker than six (6) inches after compaction. The length of the foot on the sheepsfoot roller shall not be less than seven and one-half (7 1/2) inches. The loaded weight of the sheepsfoot roller shall not be less than 30,000 lbs**.

Each layer compacted by the sheepsfoot roller shall be compacted by not less than six (6) passes. A complete pass shall consist of the entire coverage of the layer with one trip of the sheepsfoot roller. Each trip shall overlap the adjacent trip by not less than two (2) feet. The moisture content of the backfill shall be three (3) to five (5) percent above the optimum moisture content as determined by the Standard Proctor Test (ASTM D-698).

Each lift shall be compacted to at least 90% of maximum dry density as determined by the Owner's Inspector, as described in Appendix I-4, "Construction Quality Assurance and Quality Control Plan".

F.4 Grading

Fill shall be placed in compacted lifts until a point has been reached that is 6 inches below the final grade, as shown on the drawings. The completed fill surface shall be rough graded and uniform.

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*Corps of Engineers, Bureau of Land Reclamation recommendations in Soils Manual (The Asphalt Institute).

**EPA Seminar - Requirements for Hazardous Waste Landfill Design, Construction & Closure (Presentations, 1988).

G. TOPSOILING

G.1 Scope

The work under this section includes the furnishing of all labor, equipment, materials, and the performing of all operations in connection with furnishing, placing, and grading topsoil over the compacted final cover surface.

G.2 Materials

Material for topsoil shall be natural surface soil, friable and loamy, free of debris, stumps, brush, litter, and stones larger than three (3) inches in diameter. The topsoil shall not contain toxic substances that may be harmful to plant growth. A pH range of 5.0 to 7.5 is acceptable. Topsoil shall have a minimum organic content of 2.75%. Prior to topsoil placement, the contractor shall test one representative sample of each source of material for acidity and organic content, as described in Appendix I-2, "Construction Quality Assurance and Quality Control Plan".

G.3 Placement and Grading

Topsoil shall be placed over the compacted final cover soils within the limits shown on the drawings and shall be evenly and smoothly spread over the surface. Topsoil shall be placed so that the total thickness is not less than 6 inches after firming. Topsoil shall not be placed while in a frozen or muddy condition or when the final cover is excessively wet and soft or in a condition that may otherwise be detrimental to proper grading.

H. SEEDING AND EROSION CONTROL

H.1 Scope

The work included in this section includes the furnishing of all labor, equipment and materials, and in performing all operations in connection with the application of lime or sulfur, seeding, fertilizing, and mulching, of the area indicated on the drawings, completed and accepted, in accordance with the specifications and drawings.

H.2 Materials

H.2.1 Lime

Lime shall be agricultural ground dolomitic limestone conforming to the standards of the Association of Official Agricultural Chemists, and complying with all existing State and Federal Regulations. The materials must comply with the following gradation:

Square Mesh Sieves	% Passing by Weight
Pass #10	100
Pass #20	90
Pass #200	50

The minimum calcium carbonate equivalent shall be 90% by weight. The Owner reserves the right to draw such samples and to perform such tests as the Owner deems necessary to assure that these specifications are met.

H.2.2 Sulfur

Sulfur shall be commercial flour sulfur, unadulterated, and shall be delivered to the site in the original unopened containers or in bulk lots with the name of the manufacturer, material analysis and net weight specified.

H.2.3 Fertilizer

Fertilizer shall be a complete fertilizer containing 10% nitrogen, 20% potash, and 10% phosphorous and referred to as 10-20-10. The total nitrogen content shall either be derived from natural organic sources or be a urea-form fertilizer. The commercial fertilizer shall be delivered

to the site in the original unopened containers which shall bear the guaranteed statement of analysis of the manufacturer.

H.2.4 Seed Mixture

The seed mixture shall be delivered to the site in new, clean, sealed containers. Labels and contents shall conform to all State and Federal regulations. Seed shall be subject to the testing procedures of the Association of Official Seed Analysts. The seed shall be delivered to the site accompanied by a properly executed certificate from the supplier of each type of seed attesting to its freshness, components, proportion (if mixed), minimum purity, and minimum germination. The seed quality and certificates are subject to approval by the Owner prior to their being applied. Acceptable seed types and application rates include:

Seed Name	Application Rate
Bermuda Grass (cynodon dactylon)	7 lbs/acre
Annual Ryegrass (lolium multiflorum)	20 lbs/acre

H.2.5 Straw

Straw shall be small-grain straw or hay. As necessary, a liquid mulch binder such as emulsified asphalt, cutback asphalt, or synthetic or organic binders shall be used at the rates recommended by the manufacturer.

H.2.6 Water

Water used in this work will be furnished by the Owner and will be suitable for irrigation and free from oil, acid, alkali, salt and other substances harmful to plant life. The Contractor will provide all equipment including hose necessary to apply the irrigation water.

H.3 Season of Seeding

The preferred dates for seeding are May 1 to July 1. If these dates are missed, then alternate dates are August 1 to November 15.

H.4 Application

H.4.1 Application of Lime or Sulfur

Lime or sulfer shall be applied at rates determined by the Owner based on tests of the topsoil material, as described at D.2. When applied dry, the limestone or sulfur shall be spread evenly and then thoroughly incorporated into the top three (3) inches of the soil by approved means and shall produce a roughened seedbed. When applied hydraulically, no discing will be necessary.

H.4.2 Application of Fertilizer and Seed

The preferred method of applying fertilizer and seed shall be hydraulic, however, any agronomically acceptable and reasonable method of uniformly applying the seed and/or the fertilizer separately or together may be utilized that is approved by the Owner. The Owner shall reserve the right to temporarily halt any seeding operation during the presence of strong winds. Fertilizer shall be applied at the rate of 500 lbs per acre. Seed shall be applied at the rates recommended by the Supplier(s), subject to Owner-approval.

H.4.3 Application of Mulch

The straw mulch shall be applied hydraulically or by hand, at the rate of 2-2.5 tons per acre. As necessary, straw mulch shall be coated with a liquid mulch binder in accordance with the manufacturer's recommendations. Mulching shall be performed as a separate operation.

H.5 Maintenance:

H.5.1 The Contractor

The contractor shall be required to replant, using full amounts of all specified materials and all of the complimentary procedures, those areas damaged by wind, fire, erosion, equipment, or pedestrian traffic during the life of the contract, to the satisfaction of the Owner.

H.5.2 The Contractor

The Contractor shall be required to clean up and remove all debris resulting from the seeding operations on roads and other areas within and adjacent to the project.

I. SOIL TESTING

I.1 Scope

Furnish labor, materials and equipment necessary for the sampling, testing and reporting of soils materials from both on-site sources and approved off-site borrow sources proposed to be used for the Cover.

I.2 General

A. Following are major items of work included:

B. Collection of a sufficient quantity of soil samples representative of the on-site and borrow materials to be used for the Cover;

C. Transporting and preparation of the soil samples for the required testing, whether in the field or in an approved commercial testing facility;

D. Testing the soil samples in accordance with all appropriate ASTM procedures, modified as may be specified in this Section and conforming to the testing schedule as detailed hereinafter;

E. Orally reporting the results directly to the Engineer in the field, and by follow-up written report within two (2) working days after completion of each test.

I.3 Testing Procedures

A. The contractor shall arrange for an approved commercial testing agency to sample, test and report the pertinent engineering characteristics of representative samples of all borrow materials proposed to be furnished for use on this project from any off-site sources at least two (2) weeks prior to the start of its intended use. The Engineer reserves the right to reject any material, source, or portion of a source which in his opinion will not provide the intended and specified function or end use of said material. In case of rejection, the Contractor shall propose an additional material or source from which he shall obtain the quantity of material required for project use.

I.4 Testing Schedule

A. Prior to the acceptance of any materials from any on-site or off-site source for any purpose, the Contractor shall arrange for a sufficient number of tests deemed acceptable by the Engineer to be accomplished in the testing laboratory to establish the following engineering characteristics of granular and cohesive materials:

1) Particle Size Analysis of Soils - ASTM D 1556

2) Amount of Materials in Soils finer than No. 200 Sieve - ASTM D 1140

3) Liquid Limit of Soils - ASTM D 423

4) Plastic Limit and Plasticity Index of Soils - ASTM D 424

5) Moisture Content of Soil - ASTM D 2216

6) Moisture - Density Relations of Soils - ASTM D 698

7) Permeability Test for Clay Liner in Cap System - Illinois EPA Method

Laboratory determination of permeability of fine grained soils shall be performed using the modified triaxial apparatus technique, including backpressure saturation, to determine the constant head, saturated permeability of "undisturbed" soil samples. Disturbance of the soil sample shall be minimized both before and durifng the determination in order to approximate actual field conditions. The permeant liquid shall be either tap water or a 0.005 N $CaSO_4$ solution. In any case, distilled water shall not be used. The effective stress (confining cell pressure minus the average of the headwater and tailwater pressures) applied to the soil sample in the triaxial apparatus shall be set as close as possible to the expected in situ-stress conditions to prevent excessive consolidation of the soil sample.

Laboratory permeability determination reports shall include a detailed description of both the sample collection and preparation techniques and the details (cell pressure, headwater pressure, tailwater pressure, driving pressure, gradient, sample size, permeant liquid, time, etc.) of the determination procedures. Tests shall be performed in two phases as specified below.

Phase I: Collect and prepare a sample and backpressure saturate. Subject the sample to a constant hydraulic gradient (driving force pressure expressed in centimeters of water divided by length of sample in centimeters) of less than 20 until the volume of permeant flowing out of the sample in a minimum period of three (3) hours is equal to the volume input in the same period. Compute the permeability at the conclusion of the steady state period.

Phase II: Prepare an identical sample and backpressure saturate. Subject the sample to a constant hydraulic gradient not exceeding 300. This gradient shall be maintained until at least two (2) pore volumes of permeant liquid have passed through this soil sample. Readings shall be taken and permeability computed at the lesser interval of 0.25 pore-volume or 24-hours. The results shall be plotted on an arithmetic scale to show permeability versus pore volume. If the measured permeability is relatively constant or decreases with the number of pore volumes passed through the sample, then it can be concluded that the permeant does not alter the soil skeleton so as to increase the specimen permeability from the Phase I test. However, should the measured permeability show an increasing trend, the procedure required for liners must be performed on that soil type to determine the sample's permeability.

B. A sufficient number of tests shall be accomplished upon samples of the cohesive clay or silt (CL or CH) proposed to be furnished for use in the cap required in Section C to determine the most practical combination of densities and moisture contents to assure an in-place coefficient of permeability of not more than 1×10^{-7} cm/sec.

C. After materials from either on-site or off-site sources have been approved for use in the Cap on the project, a sufficient number of representative samples of the materials being placed shall be tested to insure that their properties are consistent with those established when approving these materials. The minimum numbers of both tests on Silt and Clay provided as the clay layer in the Cap materials are as follows:

1) At least one test per 1,000 cubic yards being placed:

a) Particle Size of Analysis of Soils

b) Materials finer than No. 200 Sieve

2) At least one test per 250 cubic yards being placed:

a) Density (including Moisture Content) of soil in place by one of the following materials:

Rubber-Balloon Method - A55M D 2167
Sand-Cover Method - ASTM D1556
Nuclear Method - D 2922/D 3217

3) At least one test per 5,000 yards being placed:

a) Liquid Limit of Soils

b) Plastic Limit and Plasticity Index of Soils

Justification for the sampling frequences is provided in the attached Table 1.

TABLE 1

Testing Frequencies

Recommendations for Construction Documentation of Clay-Lined Landfills by the Wisconsin Department of Natural Resources

Item	Testing	Frequency
1. Clay borrow source testing	Grain size	1,000 yd^3
	Moisture content	1,000 yd^3
	Atterberg limits (liquid limit and plasticity index)	5,000 yd^3
	Moisture-density curve	5,000 yd^3 and all changes in materials
	Lab permeability (remolded samples)	10,000 yd^3
2 Clay liner testing during construction	Density (nuclear or sand cone)	5 tests/acre/lift (250 yd^3)
	Moisture content	5 tests/acre/lift (250 yd^3)
	Undisturbed permeability	1 test/acre/lift (1,500 yd^3)
	Dry density (undisturbed sample)	1 test/acre/lift (1,500 yd^3)
	Moisture content (undisturbed sample)	1 test/acre/lift (1,500 yd^3)
	Atterberg limits (liquid limit and plasticity index)	1 test/acre/lift (1,500 yd^3)
	Grain size (to the 2-micron particle size)	1 test/acre/lift (1,500 yd^3)
	Moisture-density curve (as per clay borrow requirements)	5,000 yd^3 and all changes in material
3. Granular drainage blanket testing	Grain size (to the No. 200 sieve)	1,500 yd^3
	Permeability	3,000 yd^3

Source: Gordon et al., 1984.

APPENDIX I-4

CONSTRUCTION QUALITY ASSURANCE AND QUALITY CONTROL PLAN

I-4 CONSTRUCTION QUALITY ASSURANCE AND QUALITY CONTROL PLAN

1. Quality Assurance Organization and Responsibilities

The Owner will have ultimate responsibility for activities undertaken at the site, including responsibility for overseeing construction. A qualified construction firm will be selected for this project. The Owner or his Engineer will provide guidance to the selected firm during construction. an independent registered professional engineer in the State of Illinois will provide inspections, as necessary, to ensure that construction of the final cover is conducted within prudent engineering principals. The independent professional engineer will then certify the construction of the final cover. Figure 1 depicts the organization chart for this construction project.

Owner

The Owner will have the ultimate responsibility for the construction of the final cover. The Owner has the authority to commit the necessary resources to accomplish closure. The Owner will be kept apprised of progress and situations involved with closure by his Engineer. The Owner will inform IEPA when closure activities begin and are completed.

Contracted Construction Firm

A qualified construction firm will be retained by the Owner to accomplish closure. The firm will be managed by competent individuals who have had prior experience with these types of construction operations. The firm will follow construction designs and specifications that will be developed and approved for the closure activities.

Owner's Engineer

The Owner's Engineer will act as liaison between the Owner and the construction firm. He shall coordinate all construction activities with the contracted firm and immediately report any problems or deviations from designed construction operations to the Owner. He will be involved in the day-to-day management of construction activities at the closure site.

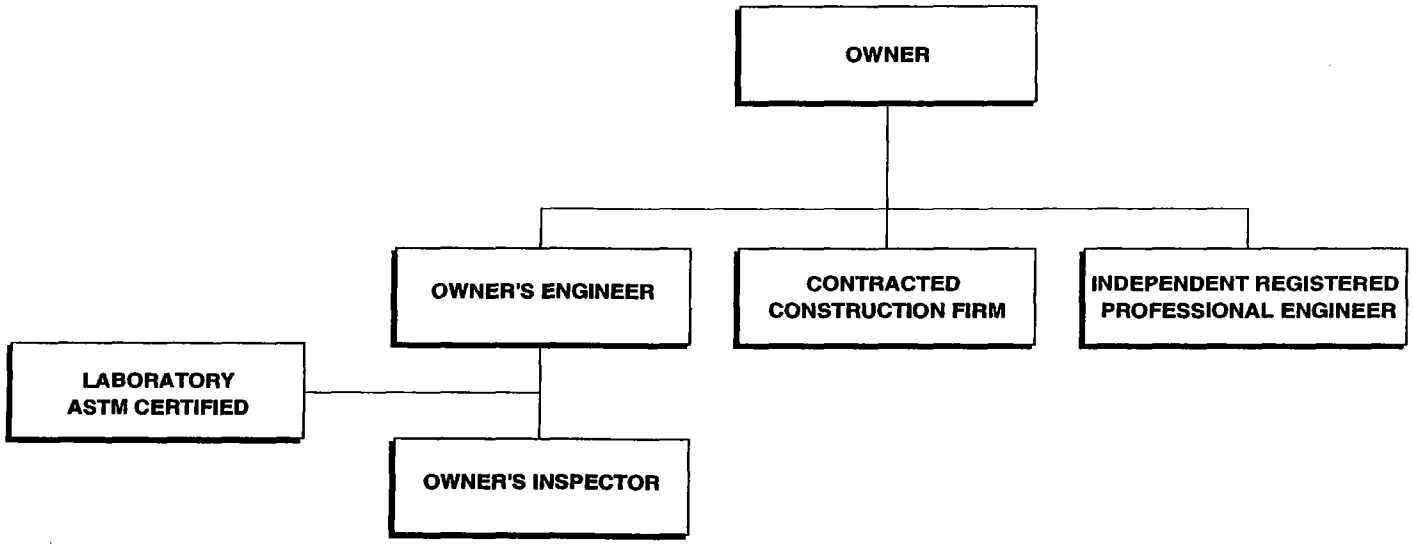

FIGURE 1
Closure Construction Project Organization Chart

Owner's Inspector

The Owner's Inspector shall observe the daily construction activities of the final cover. He will immediately report any problems or deviations from design specifications or drawings to the Owner's Engineer. The inspector will collect the required number of samples needed to ensure the final cover has met all the design standards and ship them to a laboratory certified to conduct soil analysis.

Laboratory

The laboratory will analyze all soil samples according to the ASTM methods stipulated in Section 2. The laboratory will be staffed with professionals experienced in soil analysis and shall be certified to conduct ASTM analysis.

Registered Professional Engineer

An independent registered professional engineer will inspect closure activities to ensure that closure has been conducted pursuant to 35 Ill. Adm. Code 725.410 requirements. The engineer will certify and seal all certification documentation and send such documentation to the IEPA after closure activities are completed.

2. Closure Construction Testing Protocol

Soil Source Acceptance

The contractor will test each offsite source of backfill, clay cover, drainage layer sand, fill material, and topsoil that is proposed to be used in the cover system. The following test results will be submitted to the Owner before acceptance of any soil material:

- Backfill and fill material testing for moisture-density relationship.
- Clay cover testing for moisture content, grain size distribution, specific gravity, liquid and plastic limits, moisture-density relationship, and hydraulic conductivities at 85, 90, and 95 percent of standard Proctor maximum dry density at various moisture contents.
- Drainage layer sand testing for moisture content, grain size distribution, maximum and minimum density, and hydraulic conductivity at about 70 percent relative density.
- Topsoil testing for acidity and organic content.

The soils shall be tested by an ASTM-certified laboratory, which shall provide QA/QC documentation on procedures and calibration. The allowable test methods and acceptance criteria are provided in Table 1. The Owner's Inspector will sample each initially accepted material and repeat the above analyses prior to final acceptance and use of any of the materials in onsite construction. Sampling and analysis may be repeated at any time during construction, and material acceptance may be suspended or revoked based on such tests.

Constructed Cover Acceptance

The Owner's Inspector will perform field tests on constructed cover sections, to verify proper construction. Test methods, frequencies, and acceptance criteria are provided in Table 2. Tested sections failing acceptance criteria will be reworked, or removed and replaced, by the contractor until meeting such criteria.

3. Recordkeeping

All construction and sampling activities will be documented by the Owner's Engineer. The documentation will be in the form of field records and will contain all activities conducted during construction, including any deviance from design plans and specification. Any physical anomaly that may affect the construction of the final cover will be denoted as well (i.e., weather). A copy of the field record will be submitted to IEPA with the closure certification documents. The original field records will be archived by the Owner until the end of post-closure care.

TABLE 1

Soil Acceptance Test Methods and Criteria

Parameter	Test Method	Acceptance Criteria
Moisture-Density Relationship	ASTM D-698	None*
Maximum Density	ASTM D-4253	None*
Minimum Density	ASTM D-4254	None*
Moisture Content	ASTM D-2216	None*
Grain Size Distribution	ASTM D-422	Clay: 100% finer than 0.75 inch, 30% finer than No. 200 Sand: None*
Specific Gravity	ASTM D-854	None*
Liquid/Plastic Limits	ASTM D-4318	Liquid Limit >30% Plasticity index ≥15%
Hydraulic Conductivity	ASTM D-2434	Clay: H.C. $\leq 10^{-7}$ cm/sec Sand: H.C. $\geq 10^{-7}$ cm/sec
Acidity		pH = 5.0 - 7.5
Organic Content		O.C. ≥2.75%

*No limits, but test must conclusively show material characteristics to the satisfaction of the Owner's Engineer.

TABLE 2

Constructed Cover In-Place Test Methods and Acceptance Criteria

Parameter	Frequency	Test Method	Acceptance Criteria
Backfill Density	1/lift/day	ASTM D-2922	90% of maximum dry density
Clay cover density	1/lift/day	ASTM D-2922	In range to provide H.C. $<10^{-7}$ cm/sec
Base surface for liner placement	100% immediately prior to placement	Visual	Free of sharp objects
Liner field seam/joint integrity	100% after full cure	Vacuum Box	No visible leaks
Placed liner integrity	100% immediately prior to covering	Visual	No punctures, distressed material, or underlying projections
Drainage Sand thickness	1/lift/hour	*	≥6 inches after placement, prior to machinery traffic
Fill layer	1/lift/day	ASTM D2922	90% of maximum dry density

*Excavate by hand and measure; fill excavation with sand and hand tamp to original thickness.

APPENDIX I-5

CLOSURE COST ESTIMATE

CLOSURE COST ESTIMATE

Activity	Unit	Quantity	Unit Cost[1]	Total Cost[2]
ZINC OXIDE BUNKER				
Decontamination of Unit				
Open bunker wall to allow equipment access 8" reinforced concrete	SF	200	8.86	770
Remove ZnO contents from bunker using front end loader (3 CY wheel-mounted)	CY	63,000	0.70	100
Transport to Reclamation Facility (assume same volume)	Ton	63,000	60.00	3,780,000
Scrape and sweep bunker to remove residue (Chemetco equip.)	Day	2	500.00	1,000
High pressure wash to clean bunker (Chemetco equip.)	Day	3	500	1,500
High pressure wash to clean filter press and slurry tank system	Day	3	500	1,500
Analyze rinsate samples metals (Pb and Cd)	Sample	10	35	350
Decontamination of Adjacent Area				
Sweep concrete pad	Day	2	500	1000
Drill concrete - 4" diameter 8" reinforced concrete	Each	5	30	150
Collect soil samples 24 samples with hand auger	Day	1	600	600
Analyze soil samples: Total metals (Pb & Cd) E.P. toxicity (Pb & Cd)	Each	 24 12	 45 80	 1,080 960
Excavate contaminated soils with backhoe (3 CY hydraulic backhoe)	CY	20		300

CLOSURE COST ESTIMATE
(Cont'd)

Activity	Unit	Quantity	Unit Cost[1]	Total Cost[2]
Transport to Reclamation Facility	Ton	100	60	6,000
Backfill excavation with slag (75 HP, 50' haul, sand and gravel)	CY	20		300
Subtotal 3,840,540 20% Contingency 768,108 10% Administration 384,054 Total $4,992,701				
COOLING WATER CANAL				
Dewater open sections of canal with 4" pump, 8 hr/day, attended 2 hr/day.	Day	3.0	110.0	330
Remove east drying pad	SF	5,000	3.4	17,000
Place and compact fill to establish cover base elevations	CY	8,000	7.5	60,000
Place and compact clay layer	CY	8,200	10.0	82,000
Place and compact topsoil layer	CY	5,500	15.0	82,000
Hydroseed and mulch	SR	16,000	0.35	5,600
Engineering oversight (70 days)	Hr	560	60	34,000
PE Certification (15 days)	Hr	120	80	9,600
Subtotal 290,000 20% Contingency 58,000 10% Administration 29,000 Total $380,000				
ZINC OXIDE LAGOONS				
Place and compact fill to establish cover base elevations	CY	3,000	7.5	23,000
Place and compact clay layer	CY	2,000	10.0	20,000
Place and compact topsoil	CY	1,300	15.0	20,000

CLOSURE COST ESTIMATE
(Cont'd)

Activity	Unit	Quantity	Unit Cost[1]	Total Cost[2]
Hydroseed and mulch	SY	3,900	0.35	1,400
Engineering oversight (20 days)	Hr	160	60.0	9,600
PE Certification (6 days)	Hr	48	80	3,80
Subtotal 78,000 20% Contingency 7,800 10% Administration 15,600 Total $100,000				
FLOORWASH WATER IMPOUNDMENT				
Place and compact backfill	CY	1,200	7.5	9,000
Place and compact clay	CY	1,200	10.0	12,000
Place and seam membrane	SY	1,800	5.0	9,000
Place and seam fabric	SY	1,800	1.4	2,500
Place and compact sand	CY	600	15.0	9,000
Place and seam fabric	SY	1,800	1.4	2,500
Place and compact fill	CY	900	10	9,000
Place and compact topsoil	CY	300	15	4,500
Hydroseed and mulch	SY	1,800	0.35	630
Engineering oversight (35 days)	Hr	280	60	17,000
PE Certification (9 days)	Hr	72	80	5,800
Subtotal 81,000 20% Contingency 16,000 10% Administration 8,100 Total $119,000 TOTAL CLOSURE COSTS $5,582,702				
ADJUSTED TOTAL COSTS BASED ON INFLATION FACTOR[3]: $6,279,780				

CLOSURE COST ESTIMATE
(Cont'd)

Activity	Unit	Quantity	Unit Cost[1]	Total Cost[2]

[1]Unit costs are based on Means Building Construction Cost Data, 1989 vendor prices, and standard labor rates.
[2]All total costs are rounded to the nearest dollar.
[3]Inflation factor based on Implicit Price Deflator from 1989-1991

APPENDIX I-6

FINANCIAL ASSURANCE MECHANISM

Deloitte
Haskins+Sells

Ten Broadway
Saint Louis, Missouri 63102-1791
(314) 231-1123
ITT Telex: 4995648

Mr. William Cassiday
Chemetco, Incorporated
Route 3 and Oldenburg Rd.
Hartford, Illinois 62048

May 3, 1989

Dear Bill:

We are pleased to enclose three (3) copies of our letter on the Environmental Protection Agency agreed-upon procedures for Chemetco, Incorporated.

Sincerely,

Tom

Thomas E. Shepperd

Enclosures

Deloitte
Haskins+Sells

Ten Broadway
Saint Louis, Missouri 63102-1791
(314) 231-1123
ITT Telex: 4995648

May 3, 1989

Chemetco, Incorporated
Route 3 and Oldenburg Road
Hartford, Illinois 62048

Dear Sirs:

We have audited, in accordance with generally accepted auditing standards, the financial statements of Chemetco, Incorporated for the year ended December 31, 1988, and have issued our report thereon dated January 20, 1989. We have not performed any auditing procedures beyond the date of our report on the financial statements; accordingly, this report is based on our knowledge as of that date and should be read with that understanding.

At your request, we have performed the procedures enumerated below with respect to the accompanying letter from William Cassiday to the Director of Illinois Environmental Protection Agency dated May 2, 1989. It is understood that this report is solely for filing with the Environmental Protection Agency and is not to be used for any other purpose. The procedures that we performed are summarized as follows:

1. We compared the amounts included in items 2, 4, 5 and 6 under the caption Alternative I in the letter referred to above with the corresponding amounts in the financial statements referred to in the first paragraph.

2. We recomputed from, or reconciled to, the financial statements referred to in the first paragraph the information included in items 3 and 7 under the caption Alternative I in the letter referred to above.

Because the procedures referred to in the preceding paragraph were not sufficient to constitute an audit made in accordance with generally accepted auditing standards, we do not express an opinion on any of the information or amounts listed under the caption Alternative I in the aforementioned letter. In performing the procedures referred to above, however, no matters came to our attention that caused us to believe that the information or amounts included in items 2, 3, 4, 5, 6 and 7 should be adjusted.

Yours truly,

Deloitte Haskins & Sells

LETTER FROM CHIEF FINANCIAL OFFICER

(Assurance of closure and/or post-closure care)

Director
Illinois Environmental Protection Agency
[illegible] Churchill Road
Springfield, Illinois 62706

Dear Sir or Madam:

I am the chief financial officer of Chemetco, Incorporated (1).

This letter is in support of this firm's use of the financial test to demonstrate financial assurance, as specified in Subpart H of 40 CFR Parts 264 and 265 and/or Subpart H of 35 Illinois Administrative Code Parts 724 and 725.

See Instruction (2)

1. This firm is the owner or operator of the following facilities for which financial assurance for closure and/or post-closure care is demonstrated through the financial test specified in Subpart H of 35 Ill. Adm. Code Parts 724 and 725. The current closure and/or post-closure cost estimates covered by the test are shown for each facility: (LIST ALL THE ILLINOIS FACILITIES USING THE FINANCIAL TEST)

	Closure Amount (4)	Post-Closure Amount (5)	Closure and Post-Closure Amounts (6)
USEPA I.D. No. ILD048843809 (3)			
Name Chemetco, Incorporated			
Address Rt. 3 and Oldenberg Road	$3,924,700	$93,000	$4,017,700
City Hartford, Illinois 62048			
USEPA I.D. No. N/A			
Name			
Address			
City			

Please attach a separate page if more space is needed for all facilities.

2. This firm guarantees, through the corporate guarantee specified in Subpart H of 35 Ill. Adm. Code Parts Parts 724 and 725, the closure and/or post-closure care of the following facilities owned or operated by subsidiaries of this firm. The current cost estimates for closure and/or post-closure care so guaranteed are shown for each facility: (LIST ALL THE ILLINOIS FACILITIES USING THE CORPORATE GUARANTEE)

	Closure Amount (4)	Post-Closure Amount (5)	Closure and Post-Closure Amounts (6)
USEPA I.D. No. N/A (3)			
Name			
Address			
City			
USEPA I.D. No.			
Name			
Address			
City			

Please attach a separate page if more space is needed for all facilities.

This Agency is authorized to require this information under Illinois Revised Statutes, 1981, Chapter 111 1/2, Section 21(f). Disclosure of this information is required. Failure to do so may result in a civil penalty not to exceed $25,000 per day of violation. Falsification of this information may constitute a Class 4 felony, which also carries a fine of up to $25,000 per day of violation for the first offense. This form has been approved by the Forms Management Center.

3. For states other than Illinois this firm, as owner or operator or guarantor, is demonstrating financial assurance for the closure and/or post-closure care of the following facilities through the use of a test equivalent or substantially equivalent to the financial test specified in Subpart H of 40 CFR Parts 264 and 265. The current closure and/or post-closure cost estimates covered by such a test are shown for each facility: (LIST ALL FACILITIES WHICH ARE NOT IN ILLINOIS BUT ARE SUBJECT TO A STATE OR FEDERAL FINANCIAL ASSURANCE REQUIREMENT THAT ARE ASSURED BY A FINANCIAL TEST OR CORPORATE GUARANTEE)

USEPA I.D. No. N/A (3)	Closure Amount (4)	Post-Closure Amount (5)	Closure and Post-Closure Amounts (6)
Name			
Address			
City			
USEPA I.D. No.			
Name			
Address			
City			

Please attach a separate page if more space is needed for all facilities.

4. This firm is the owner or operator of the following hazardous waste management facilities for which financial assurance for closure or, if a disposal facility, post-closure care, is *NOT* demonstrated either to IEPA, USEPA or a State through the financial test or any other financial assurance mechanism specified in Subpart H of 40 CFR Parts 264 and 265 or equivalent or substantially equivalent state mechanisms. The current closure and/or post-closure cost estimates not covered by such financial assurance are shown for each facility: (LIST FACILITIES IN RCRA AUTHORIZED STATES WHERE THERE IS NO STATE FINANCIAL ASSURANCE REQUIREMENT)

USEPA I.D. No. N/A (3)	Closure Amount (4)	Post-Closure Amount (5)	Closure and Post-Closure Amounts (6)
Name			
Address			
City			
USEPA I.D. No.			
Name			
Address			
City			

Please attach a separate page if more space is needed for all facilities.

This firm is not required (7) to file a Form 10K with the Securities and Exchange Commission (SEC) for the latest fiscal year.

The fiscal year of this firm ends on December 31 (8) *. The figures for the following items marked with an asterisk are derived from this firm's independently audited, year-end financial statements for the latest completed fiscal year, ended December 31, 1988 (9).

See Instruction (10) (Letter From Chief Financial Officer)

Alternative I

	Sum of current closure and post-closure cost estimates (total of all cost estimates shown in the four paragraphs above)	$ 4,017,700
*2.	Total liabilities (if any portion of the closure or post-closure cost estimates is included in total liabilities, you may deduct the amount of that portion from this line and add that amount to lines 3 and 4)	$ 1,631,000
*3.	Tangible net worth	$13,925,000
*4.	Net worth	$13,925,000
*5.	Current assets	$ 3,569,000
*6.	Current liabilities	$ 1,631,000
7.	Net working capital (line 5 minus line 6)	$ 1,938,000
*8.	The sum of net income plus depreciation, depletion, and amortization 3 month year ended 12/31/88 $1,298,000 x 4 = $5,192,000	$ 5,192,000
*9.	Total assets in U.S. (required only if less than 90% of firm's assets are located in the U.S.)	$ N/A

		Yes	No
10.	Is line 3 at least $10 million?	X	
11.	Is line 3 at least 6 times line 1?		X
12.	Is line 7 at least 6 times line 1?		X
*13.	Are at least 90% of firm's assets located in the U.S.?	X	
	If not, complete line 14.		
14.	Is line 9 at least 6 times line 1?	-	-
15.	Is line 2 divided by line 4 less than 2.0?	X	
16.	Is line 8 divided by line 2 greater than 0.1?	X	
17.	Is line 5 divided by line 6 greater than 1.5?	X	

Signature: William C. Cassiday

Typed name: William C. Cassiday

Title: Controller

Date: May 3, 1989

See Instruction (10) (Letter From Chief Financial Officer)

Alternative II

	Sum of current closure and post-closure cost estimates (total of all cost estimates shown in the four paragraphs above)	$ 4,017,700
2.	Current bond rating of most recent issuance of this firm and name of rating service	N/A
3.	Date of issuance of bond	N/A
4.	Date of maturity of bond	N/A
*5.	Tangible net worth (if any portion of the closure and post-closure cost estimates is included in "total liabilities" on your firm's financial statements, you may add the amount of that portion to this line)	$ 13,925,000
*6.	Total assets in U.S. (required only if less than 90% of firm's assets are located in the U.S.)	$ N/A

		Yes	No
7.	Is line 5 at least $10 million?	X	
8.	Is line 5 at least 6 times line 1?		X
*9.	Are at least 90% of firm's assets located in the U.S.? If not, complete line 10.	X	
10.	Is line 6 at least 6 times line 1?		X

Signature William C. Cassiday

Typed name William C. Cassiday

Title Controller

Date May 3, 1989