

UNITED STATES GOVERNMENT

Memorandum

TO : Files

DATE: April 10, 1964

FROM : W. P. Ellis, Radiation Specialist, Region II,
Division of Compliance, Atlanta, Georgia

W. P. Ellis

SUBJECT: HEALTH AND SAFETY EVALUATION, THE CARBORUNDUM COMPANY, PARKERSBURG,
WEST VIRGINIA PLANT, LICENSE NUMBER STB-440.

CO:II:WPE:bsb

The licensee has an adequate monitoring and bio-assay program to insure reasonable safe operations. Instrumentation appears to be adequate although it appears that the licensee should have a portable alpha survey meter. Personnel appears to be knowledgeable of radiation hazards. Thorium materials are adequately secured.

Should operations be discontinued within the next few months, it may be necessary to determine how the licensee will dispose of 240 tons of thorium.

A21

21

8510170060 850927
PDR FOIA
KOWALSK85-375 PDR



1801 GRAND CENTRAL AVE
VIENNA, WEST VIRGINIA 26181
AREA CODE (304) PHONE 295-4177

SOLD TO: ☐

Amex Specialty Material, Inc.
P. O. box 52
Albion, New York 14001

DATE

INVOICE NO.

YOUR ORDER NO. 510341

SHIPPED FROM:

DATE	DESCRIPTION	UNIT PRICE	TOTAL
5-5-73	Back Lorry-Hauling 2-4 Dozer--		
6-3-73	D-4 Dozer Work---	20.00	
5-7-73	D-4 Dozer Work---	10.00	

Handwritten: Paid 7/6/73 CK #40402

AMAX SPECIALTY METALS, INC.

A SUBSIDIARY OF AMERICAN METAL CRYMAX, INC.

Post Office Box 1748 • Parkersburg, W. Va. • 26101
Invoice with copy of Original Bill of Lading to above

ORDER •
FROM

Ohio Valley Contractors
1801 Grand Central Ave.
Vienna, WV 26101

Date 6/4/73	Purchase Order No. 5563
Show Purchase Order No. On All Cartons	
S H I P O AMAX SPECIALTY METALS, INC. P. O. Box 15 Route 1 Washington, West Virginia 26181 Telephone 863-3341 Area Code 304	

Attn:

Please advise immediately if
delivery date cannot be met

F.O.B.		Routing		Terms	Delivery Required 6/5/73
Item	Quantity/Unit	Amax Part Number	and/or Description		Price/Unit
1	1		D-4 Dozer for covering Dump		20.00/hr.
			Send Invoice to:		
			AMAX SPECIALTY METALS, INC. P.O. BOX 32 AKRON, NEW YORK 14001		
			Confirmed 6/1/73		
This order subject to all terms and conditions on reverse side					

Will accept — — — 0% overshipments

mjg

Buyer H. K. Smith

Am J Boyer

THIS ORDER IS SUBJECT TO WEST VIRGINIA SALES AND USE TAX
UNLESS INDICATED EXEMPT BELOW.
ACCOUNT IDENTIFICATION NUMBER 01-000-566-032 56

☒ TAX EXEMPT



1801 GRAND CENTRAL AVE.
VIENNA, WEST VIRGINIA 26101
AREA CODE (304) PHONE 295-4177

SOLD TO: ☐

DATE

Amax Specialty Metals, Inc.
P. O. Box 32
Akron, New York 14001

INVOICE NO.

YOUR ORDER NO. P-10065

SHIPPED FROM

DATE

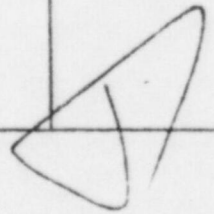
DESCRIPTION

UNIT PRICE

TOTAL

5-3-73

Mack Lowboy-Moving D-4 Dozer
D-4 Dozer Work--



AMAX SPECIALTY METALS, INC.

A SUBSIDIARY OF AMERICAN METAL CLIMAX, INC.

Post Office Box 1748 • Parkersburg, W. Va. • 26101
Invoice with copy of Original Bill of Lading to above

ORDER •
FROM

Ohio Valley Contractors
1801 Grand Central Ave.
Vienna, WV 26101

Date	Purchase Order No.
5/2/73	10055

Show Purchase Order No. On All Orders

S
H
I
P
O
AMAX SPECIALTY METALS, INC.
P. O. Box 15 Route 1
Washington, West Virginia 26181
Telephone 864-3341 Area Code 304

Attn: _____
Please advise immediately if
delivery date cannot be met

F.O.B.		Routing	Terms	Delivery Required
			N/30	5/3/73
Item	Quantity/Unit	Amex Part Number	and/or Description	
1			D-4 Dozer work for dump	
			Send Invoice to	
			AMAX SPECIALTY METALS, INC.	
			J. J. K. #2	
			AKPO NEW YORK 14001	
			Confirmed	
This order subject to all terms and conditions on reverse side				

Will accept _____ 0% overshipments

m.j.

Buyer

H. K. Smith

[Signature]

IMPORTANT

THIS ORDER IS SUBJECT TO WEST VIRGINIA SALES AND USE TAX
UNLESS INDICATED EXEMPT BELOW.
ACCOUNT IDENTIFICATION NUMBER 01-000-566-032-56

☒ TAX EXEMPT



1861 GRAND CENTRAL AVE
VIENNA, WEST VIRGINIA 26101
AREA CODE (304) PHONE 295-4177

SOLD TO: ☐

Amex Specialty Metals, Inc.
P. O. Box 32
Akron, New York 14001

DATE 10-1-73

INVOICE NO.

YOUR ORDER NO. P 6794

SHIPPED FROM:

DATE	DESCRIPTION	UNIT PRICE	TOTAL
1-30-73	Mack Lowboy-Moving D-4 Dozer---		
	D-4 Dozer Work--- Hours	20.00	
1-30-73	D-4 Dozer Work---		

AMAX SPECIALTY METALS, INC.

A SUBSIDIARY OF AMERICAN METAL CLIMAX, INC.

Post Office Box 1748 • Parkersburg, W. Va. • 26101
Invoice with copy of Original Bill of Lading to aboveORDER •
FROMOhio Valley Contractors, Inc.
1801 Grand Central Ave.
Vienna, WV 26105

Date	Purchase Order No.
3/29/73	3794

Show Purchase Order No. On All Cartons

S
H **AMAX SPECIALTY METALS, INC.**
I P. O. Box 1748 Route 1
P Washington, West Virginia 26101
T
O Telephone 863-3341 Area Code 304Attn: _____
Please advise immediately if
delivery date cannot be met.

Item	Quantity	Unit	Amaz Part Number	and/or Description	Price/Unit
1				Bulldozing work on dump with D-4 machine	20.00/hr
Send invoice to:					
AMAX SPECIALTY METALS, INC.					
P.O. BOX 32					
AKRON, NEW YORK 14001					
Confirmed by phone 3/28/73					
for Friday work 3/30/73					
This order subject to all terms and conditions on reverse side.					

Will accept — — — 0% overshipments

RM

Buyer

H. K. Smith

M. J. Hayes

IMPORTANT TAX INFORMATION

THIS ORDER IS SUBJECT TO WEST VIRGINIA SALES AND USE TAX
UNLESS INDICATED EXEMPT BELOW.

ACCOUNT IDENTIFICATION NUMBER 01-000-566-032-56

☒ TAX EXEMPT



OHIO VALLEY
CONTRACTORS
INC.

1801 GRAND CENTRAL AVE
VIENNA, WEST VIRGINIA 26105
AREA CODE (304) PHONE 295-4177

SOLD TO:

Amax Specialty Metals, Inc.
P. O. Box 1748
Parkersburg, WV. 26101

DATE July 9, 1973

INVOICE NO. 4168

YOUR ORDER NO. P11117

SHIPPED FROM:

DATE	DESCRIPTION	UNIT PRICE	TOTAL
6-27-73	K. W. Lowboy-Moving D-6 Dozer---		\$ 25.00
	Permit---		5.00
	D-6 Dozer Work@-- 5 1/2 Hours	@ 25.00	137.50
6-28-73	D-6 Dozer Work--- a "	@ 25.00	225.00
			<u>1,396.50</u>

AMAX SPECIALTY METALS, INC.

A SUBSIDIARY OF AMERICAN METAL CLIMAX, INC.

Post Office Box 1748 • Parkersburg, W. Va. • 26101
Invoice with copy of Original Bill of Lading to above

ORDER FROM

Ohio Valley Contractors
1801 Grand Central Ave.
Vienna, WV 26105

Date	6/25/73	Order Number	11117
Show Purchase Order to be filled in			
S			
H	AMAX SPECIALTY METALS, INC.		
I	P.O. Box 1748, Route 1		
P	C. L. Lewis, Jr., President		
T			
Q	Telephone 263-1341 Area Code 204		

Attn: _____

Please advise carrier of delivery date contact to be made

FOR		Routing	Terms	Delivery Required
				6/27/73
Item	Quantity/Unit	Amaz Part Number	and or Description	Price Unit
1			Dozer Work at Dump to Cover Dump & Bury Chlorinator Residue. (per D. Lewis)	20.00 hr.
Send Invoice to:				
AMAX SPECIALTY METALS, INC.				
P.O. BOX 1748				
VIENNA, NEW YORK 14001				
Confirmed				

Will accept _____ 0% overshipments

mjg

Buyer H. K. Smith

called 6/26/73 - advised that D.G. Dyer was 25.00 per hour - given O.K. -

IMPORTANT

THIS ORDER IS SUBJECT TO WEST VIRGINIA SALES AND USE TAX
UNLESS INDICATED EXEMPT BELOW.

ACCOUNT IDENTIFICATION NUMBER 01-000-566-032-56

☒ TAX EXEMPT

MEMORANDUM

November 1, 1962

TO: Mr. George Chapman, Manager
Carborundum Metals Company
Parkersburg, West Virginia

FROM: D.E. Barber, J.W. Baum, and G. Hoyt Whipple
School of Public Health
University of Michigan
Ann Arbor, Michigan

SUBJECT: Thorium and Uranium Wastes

The following summarizes permissible quantities of various types of waste which may be buried as specified in Section 20.304 of the AEC regulations. These quantities are based on percentages of thorium and uranium reported in Mr. Wulfert's September 20, 1962 letter to D.E. Barber.

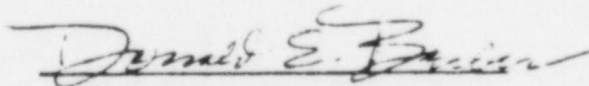
	<u>Sample</u>	<u>Permitted Burial Per Location* (pounds)</u>
Salt Drop 8-18-62	1. Scrap Salt-Top	17,900
	2. Scrap Salt-Middle	16,900
	3. Scrap Salt-Bottom	23,000
Sampled Receiver 8-14-62	4. Oxide from Receiver (Scrubber) 100% Nigerian Operation	1,570
	5. Oxide Residue Remaining After Sublimation Analysis of Sample #4	1,250
Sampled 8-24-62	6. Belt Pickings from Nigerian Carbide Operation	13,800
	7. Fused Salt from Nigerian Carbide Operation	22,000
Bed Pulled 8-14-62	8. Bed Residue "A" Unit 100% n-XCP (Light)	4,870
	9. Bed Residue "A" Unit 100% n-XCP (Dark)	10,300
8-27-62	10. 2F-1 Solids	Not High Enough Concentration to Be Licensed
7-25-62	11. Washed Still Bottom Crystals	

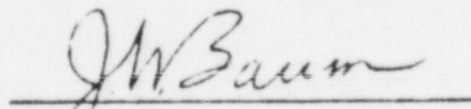
*Note: The regulations do not define a location. It could mean either the entire burial ground or a single burial hole.

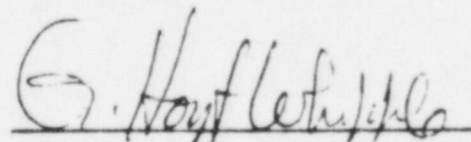
November 1, 1962

Since the regulations do not define a location it is not clear whether or not you can bury twelve times the above amounts per year by using 12 different holes. We recommend therefore that a letter be sent to the Assistant Director for Materials Standards, Mr. Lester R. Rogers, asking for clarification of the term "location" (see proposed letter attached).

In the meantime, any burials made should be based on the assumption that a total of only one times the quantity indicated for a given sample may be buried. Should two or more types of waste be buried in a given location, the quantities of each should be reduced so that the total buried does not exceed 100% of permissible. For example, 10% of the permitted quantity of Sample 1 may be buried with 90% of any of the other listed quantities. Or, 10% of the permitted quantity of Sample 1 may be buried with 20% of the permitted quantity of Sample 2 plus 70% of any of the other permitted quantities, etc.


Donald E. Barber


John W. Baum


G. Hoyt Whipple

GHW/JWB/DEB/bk

Attachment (1)

cc. Mr. Spink

A30

November 1, 1962

Proposed Letter to Mr. Lester R. Rogers:

Mr. Lester R. Rogers
Division of Licensing and Regulation
U.S. Atomic Energy Commission
Washington 25, D.C.

Dear Mr. Rogers:

We plan to bury waste material containing uranium and thorium in accordance with part 20.304 of the AEC regulations. However, it is not clear to us whether the term "location" refers to our entire burial ground or to an individual burial hole. We are writing to ask for a definition of the word "location" in part 20.304 (a).

Thank you.

A30

AMAX Specialty Metals Corporation
Attn: G. R. Couch, President
One Greenwich Plaza
Greenwich, Connecticut 06830

License Nos. SMA 1219
STB 440

Gentlemen:

This refers to the investigation conducted by our Region II (Atlanta) office between April and December 1978 of activities previously authorized ^{by} NRC License Nos. SMA-1219 and STB-440 at your plant site near Parkersburg, West Virginia. Our findings were discussed in meetings conducted with your representatives by James P. O'Reilly, the Region II Director, in the Atlanta office on April 28 and June 22, ^{1978.} ~~This also refers to meetings conducted with AMAX representatives at NRC Headquarters on May 12 and November 11, 1978.~~

Areas examined during this investigation are discussed in the enclosed report. Within these areas, the investigation involved examination of representative records, interviews with current and former ~~licensee~~ ^{as AMAX} employees, ~~and~~ observations by the investigators and independent measurements by radiation specialists.

This investigation confirmed that licensable quantities of source material were buried outside restricted areas previously established under License No. ^S SMA-1219 and STB-440. Neither the amount of material buried nor the method of burial meet the requirements of 10 CFR 20. The NRC (AEC) licenses previously issued for activities at this site did not authorize burial of source material. This material resulted in surface radiation levels which range from 0.1 to 1.0 millirem per hour over 18-20 acres of the 100-acre site and 4-6 millirem per hour in an excavated area for a building under construction.

The problem of buried source material was discussed in meetings with AMAX representatives in the Region II office in Atlanta on April 28, 1978, and in the NRC Headquarters office on May 12, 1978. During the May 12 meeting, AMAX agreed to provide a thorough assessment survey plan; this agreement was confirmed in an Immediate Action Letter dated May 25, 1978, to AMAX from the Region II Director.

AMAX consultants performed an in-depth survey and also confirmed that licensable quantities of source material are buried at the Parkersburg site. A meeting was held on November 7, 1978, at the licensee's request to discuss ^{the survey results} ~~their findings~~ and proposed corrective actions. Based on discussion at this meeting between AMAX representatives, the NRC Office of Nuclear Material Safety and Safeguards and the NRC Office of Inspection and Enforcement, it is our understanding that AMAX will take the following actions:

1. Perform feasibility studies including cost estimates for the following ultimate disposal alternatives for all areas where radioactivity is greater than five picocuries per gram:
 - a. Remove source material to an authorized burial site.
 - b. Remove source material for disposal beyond the continental shelf under the provisions of 40 CFR 227.
 - c. Remove source material for burial at the Parkersburg site under the provisions of 10 CFR 20.302.
2. Submit by July 1, 1979, the results of these studies to the ^{U.S. Nuclear Regulatory Commission,} Office of Nuclear Materials Safety and Safeguards, Director of Fuel Cycle and Material Safety, Washington, DC, 20555, with a copy to this office.

3. Dispose of buried source material by an alternative considered mutually acceptable by the NRC and AMAX.

The lead responsibility for NRC evaluation of disposal alternatives has been transferred to the Office of Nuclear Material Safety and Safeguards (NMSS). If your understanding of this matter is different from that stated above, please contact NMSS or this office promptly.

Sincerely,

John G. Davis, Acting Director
Office of Inspection and Enforcement

Enclosure: Investigation Report

cc w/encl:
L. B. Foster Company

bcc w/encl:
normal
State of West Virginia
Mayor of Washington, W.VA.
NMSS

Presented @ IEHQ Meeting on 11/7/78
by Mr. Hiestand, Eng for AMAX, Inc

11/7/78

Parkersburg Chronology

Parkersburg Site: Ownership and Activities

1957-1961

Carborundum Company produced zirconium sponge metal for Naval Reactors under a contract with AEC.

1961-1964

Carborundum Company processed Nigerian ore for hafnium content as well as zirconium. The Nigerian ore contained 6% Th O₂ and 0.2% UO₂. Processing of Nigerian ore was discontinued in 1964. The ore and residues on hand were stored on site in drums. Carborundum continued to process other zirconium ores.

1965

AMAX and Carborundum entered into a joint venture covering the Parkersburg facility. At that time approximately 1100 tons of Nigerian ores and residues were in storage on site.

1965-1967

The AMAX/Carborundum joint venture operated the Parkersburg facility using zirconium ores. No Nigerian ores were processed.

1967

AMAX acquired Parkersburg facility and the co-venture with Carborundum was dissolved.

1967-1974

ASMC used the Parkersburg facility to process zirconium ores and to produce zirconium sponge metal. The processing steps changed in 1969 when ASMC shifted to purchasing zirconium tetrachloride. ASMC terminated production of zirconium sponge metal in 1974.

The Nigerian ores and residues remaining from Carborundum's 1961-1964 operations were removed from the site by ASMC in 1969.

Nov. 1974-1975

ASMC used the Parkersburg facility to conduct laboratory scale experiments of Baddeleyite ore (Zr O₂) which contained approximately 0.06% uranium and 0.02% thorium. In 1975 ASMC ceased its activities in zirconium metal. The remaining

Baddeleyite ore was sold, and the laboratory processed ore and its residues were shipped off site for burial. (In 1977 it was determined that 12 drums of Baddeleyite tested ore were still on site.)

1976-1977

The Parkersburg site was maintained in "stand by" and no processing or testing work was conducted by ASMC. In March 1977 the site and office buildings were sold to L. B. Foster Company. The sale to Foster permitted access for the purpose of removing or demolishing ASMC facilities and property.

ASMC removed from the site 12 drums of laboratory tested Baddeleyite ore and some 70 drums of earth from the area where Nigerian ore had been stored. A re-survey of the areas in February 1978 by ASMC found no evidence of residual contamination from Baddeleyite ore or residue.

1978

AMAX reacquired the Parkersburg site from L. B. Foster Company. The only activities conducted on the site by ASMC have been radiological surveys and inspection.

AEC Licensing Actions

STB-440 (Nigerian ores)

Carborundum Company obtained AEC License No. STB-440 in 1961 to possess and process Nigerian ore. In 1967 ASMC requested an extension to STB-440 to cover the stored Nigerian ores and residues.

ASMC advised AEC in 1969 that the Nigerian ores and residues had been removed from the site and buried at a licensed facility. AEC conducted a close-out survey with respect to STB-440 in May 1970. A few hot spots were identified in the former storage area which were eliminated. In April 1971 ASMC notified AEC that a survey had been conducted and all AEC guidance on unrestricted release of the site had been met. Subsequently AEC terminated license STB-440.

SMA-1219 (Baddeleyite ores)

ASMC obtained a license from AEC in 1974 to receive, store and conduct laboratory tests on Baddeleyite ore. After the tests the remaining ore and residues were removed from the site in March 1977 and ASMC conducted a radiation survey.

In September and October 1977 NRC conducted a close-out inspection of license SMA-1219 which was due to expire on November 30, 1977. The inspection disclosed that 12 drums of Baddeleyite ore and residue remained on the site. These drums were shipped off site for burial and a subsequent NRC survey in June 1978 confirmed there was no residual contamination in the area from which these drums were removed.

The NRC close-out inspection in 1977 for license SMA-1219 also identified above background radiation readings in the areas where Nigerian ores and residues had been stored. ASMC subsequently removed some 70 drums of earth from these areas.

In April 1978 NRC conducted a follow-up inspection of the Parkersburg site. Two of the infractions identified in NRC's December 2 letter were closed. The report identified 3 areas that had not been decontaminated and the existence of radioactive material in the "Pit" area of building B and in the vicinity of building B. Above background radiation levels also were detected at other locations on the site.

In May and June 1978 NRC took background radiation measurements at perimeter locations on the site and at off-site locations, and collected environmental samples (water, soil, and vegetation). No items of noncompliance or deviations were identified.

In July and August 1978 NRC took background measurements at the site area and collected TLD dosimeters previously placed on the site. No items of noncompliance were identified.

In August 1978 NRC collected environmental samples, evaluated radiation levels in the storm drainage system, and reviewed data from an aerial survey. No items of noncompliance or deviations were identified.

In September 1978 NRC conducted an on-site evaluation of the ATCOR survey, collected environmental samples, conducted sub-surface radiation measurements, obtained sub-surface soil samples, and collected off-site water samples. No items of noncompliance or deviations were identified.

NRC Notice of Violations

By letter dated Dec. 2, 1977 NRC notified ASMC of 4 license infractions with respect to SMA-1219. ASMC responded by letter dated Dec. 15, 1977.

By letter dated May 25, 1977 NRC confirmed an understanding reached at a meeting on May 12 that ASMC would prepare a survey proposal for the Parkersburg site.

By letter dated June 6, 1978 NRC notified ASMC of 3 license infractions and 1 deficiency with respect to licenses STB-440 and SMA-1219 as follows:

- A. ASMC did not conduct appropriate surveys with respect to the removal of contaminated soil. This was stated to be repeat infraction identified in NRC's Dec. 2 letter.
- B. Radioactive material was distributed in unrestricted areas creating radiation levels in excess of a continuous permissible dose for an individual. This was stated to be a repeat infraction identified in NRC's Dec. 2 letter.
- C. Licensed material was transferred to an unauthorized recipient. This was stated to be an infraction.
- D. An area of the site contained quantities of licensed material in excess of Appendix C limits was not posted. This was stated to be a deficiency.

ASMC responded to NRC's Notice of Violations by letter dated June 30, 1978. In this letter ASMC reaffirmed its intent to conduct a radiological survey of the Parkersburg site in accordance with procedures discussed with NRC.

July 1978

Thorium Residue Problem at L. B. Foster Company Site
Near Parkersburg, West Virginia

Background:

An industrial site near Parkersburg, West Virginia, owned by the AMAX Specialty Metals Corporation was sold to the L. B. Foster Corporation in March 1977 for use as a steel pipe fabrication plant. AMAX (and its predecessor, Carborundum) had used the site for a pilot plant to produce zirconium oxide and hafnium oxide from Nigerian ores and South African ores under STB 440 and SMA 1219 licenses, respectively. In addition to zirconium and hafnium, the ores contained uranium and thorium, both of which are radioactive.

As part of its standard procedures for terminating the license for the South African ores, the Nuclear Regulatory Commission (NRC) performed closeout inspections in September and October 1977. The inspections identified three areas in the formerly restricted areas that required further cleanup of low-level surface thorium contamination. AMAX committed to clean up these areas by December 31, 1977.

In April 1978 NRC was informed by the L. B. Foster Corporation that they suspected thorium and zirconium were buried outside of the formerly restricted area. Subsequently, NRC made some verifying surveys and directed AMAX to prepare a detailed plan for surveying the entire site. The final plan is expected in early July; the survey probably will be completed by mid-August.

Basic Problem

The problem has two parts. the first part consists of about 18-20 areas within the 100-acre industrial site which have radiation levels of 0.1 to 1 millirem per hour and one unoccupied area inside a building which has radiation levels of 4 to 6 millirem per hour. This low-level radiation is evidently caused by buried thorium residue from the Nigerian ore process.

A complete survey of the site is necessary to determine the depth of the buried thorium and to define what must be done to eliminate the long term problem for any future inhabitants of this site. It should be noted that there is no immediate threat to workers at the site since the workers would have to be continuously in the vicinity of most of the contaminated areas for hundreds of hours before their radiation exposure would equal the annual radiation exposure (~100 millirem) which the average person living in West Virginia receives from natural cosmic and terrestrial sources. Permissible levels of radiation exposure for members of the general public under NRC regulations are 500 millirem per year.

The second, and major, part of the problem comes from the buried zirconium residue which is not radioactive but is pyrophoric; that is, when exposed to air, the zirconium sponge residue often vigorously bursts into flame.

Sequence of Recent and Projected Events

March 18, 1977: Licensed industrial site sold by AMAX to Foster, unknown to the NRC.

September 20, 1977: NRC conducted a closeout inspection for License SMA 1219, ~~and~~ found three areas of surface contamination in the formerly restricted area requiring further cleanup by AMAX, and ~~learned~~ th ~~disclosed~~ that ^A property had been sold. X

October 13, 1977: NRC conducted followup inspection; laboratory results indicated that the surface contamination might have been from License STB 440 rather than SMA 1219. STB 440 was terminated in 1971, based on a certificate of disposition letter from AMAX in 1969.

December 15, 1977: AMAX replied to NRC's Notice of Violation issued following the October inspection, stating that final shipments of surface contamination would be drummed and sent ^{for} ~~disposal~~ to Barnwell, South Carolina by December 31, 1977. X

January-March 1978: Snow cover and frozen ground delayed followup inspection on the AMAX commitment to remove surface contamination.

April 15, 1978: Foster Corporation representative called NRC to express concern about possible buried radioactivity and pyrophoric zirconium fires outside of the formerly restricted area.

April 17-20, 1978: NRC inspectors found 18-20 spots outside of the formerly restricted area emitting low-level radiation. Buried thorium ores and residues were suspected by NRC inspectors.

April 28, 1978: NRC met with AMAX and Foster representatives in separate meetings in Atlanta NRC office to discuss the problem.

May 5, 6, 1978: NRC staff meeting involving regional and headquarters ^{staff} to develop cleanup criteria for the buried thorium ore and residues. Tentative values were developed by the staff.

May 12, 1978: Representatives from AMAX, Foster, EPA, and NRC met in Washington to discuss the problem. It was agreed that AMAX would prepare a plan for a thorough assessment survey and decontamination of the site.

A33

May 25, 1978:

NRC sent an Immediate Action Letter to AMAX confirming the agreement reached in the May 25 meeting.

May 25, 1978:

Interim NRC letter to Sheriff Bechtold of Wood County, noting lack of immediate health hazard and committing NRC to reply in greater detail later.

May 25, 1978:

NRC letter to Foster noting lack of immediate health hazard, but need for worker protection for longer term. Workers briefed by NRC staff.

June 6, 1978:

NRC sent AMAX a formal Notice of Violation citing four infractions of NRC rules: failure to perform a proper survey, excessive radiation levels in unrestricted areas, unauthorized transfer of radioactive material, and failure to post radiation areas with warning signs. (This Notice documented the April 17 inspection.)

June 7, 1978

NRC sent a second letter to Sheriff Bechtold, citing the detailed results of inspections and pointing out that although contamination areas are higher than allowed by NRC regulations for the long term, there is no immediate (or short-term) danger to workers.

June 22, 1978:	In a meeting in Atlanta, representatives of AMAX, Foster, EPA, and NRC commented on the AMAX survey plan. It was agreed that AMAX would make some changes to the plan in order to satisfy NRC requirements.
June 30, 1978:	AMAX replied to NRC's Notice of Violation of June 6, denying all citations.
July 3, 1978:	AMAX submitted request for delay until July 11 for submittal of revised survey plan to NRC.
Receipt of revised survey plan plus two working days.*	NRC will direct AMAX to perform the survey and complete it within 45 days.
August 15, 1978:*	Depending on survey results, NRC will likely direct AMAX to perform excavation of shallow radioactive materials above the maximum permissible acceptable concentration, estimated to be 5 pCi/gm.
September 30, 1978:*	NRC will direct ultimate disposition of excavated and deeply buried radioactive material based on an environmental impact assessment.

*Projected Target Dates

Enclosure

The second, and major, part of the problem comes from the buried zirconium metal residue which is not radioactive but is pyrophoric; that is, when exposed to air, the zirconium metal residue often vigorously bursts into flame. The NRC does not control zirconium since it is not radioactive. However, its pyrophoric nature will be considered in arriving at a solution concerning the radioactive material.

Future Actions

Future actions in resolving this matter concerning radioactive material will be strongly influenced by the results of the detailed survey of the site. AMAX has committed to completion of the survey plan by mid-July. Completion of the survey is anticipated within 60 days after development of a satisfactory plan. Action will be taken, as appropriate, to resolve this matter based on an environmental impact assessment following the survey.

Chronology of Events Concerning the AMAX/FOSTER Site

Sequence of Recent Events

- March 18, 1977: Industrial site where NRC licensed ore processing had been conducted was sold by AMAX to Foster.
- September 20, 1977: NRC conducted a closeout inspection for License SMA 1219 (Thorium) and identified three areas of surface contamination in the formerly restricted area requiring further cleanup by AMAX. NRC learned that the property had been sold by AMAX to Foster.
- October 13, 1977: NRC conducted a followup inspection. Laboratory results indicated that the surface contamination might have been from License STB 440 rather than SMA 1219. STB 440 was terminated in 1971, based on a certificate of disposition letter from AMAX in 1969. (AMAX was issued a Notice of Violation as a result of this inspection.)
- December 15, 1977: In reply to NRC's Notice of Violation, AMAX stated that, by December 31, 1977, the remaining radioactive material would be drummed and shipped for licensed disposal at Barnwell, South Carolina.
- January-March 1978: Snow cover and frozen ground delayed NRC followup inspection on the AMAX commitment to remove surface contamination.

April 15, 1978:

Saturday

Foster representative called NRC to express concern about possible buried radioactive material and zirconium fires outside of the formerly restricted area.

April 17-20, 1978:

NRC inspectors found 18-20 spots outside of the formerly restricted area emitting low-level radiation. Buried thorium ores and residues were suspected by NRC inspectors.

April 28, 1978:

NRC met with AMAX and Foster representatives in separate meetings in the NRC Atlanta office to discuss the situation.

May 5, 6, 1978:

NRC staff developed tentative cleanup criteria for the buried thorium ore and residues.

May 12, 1978:

Representatives from AMAX, Foster, EPA, and NRC met. AMAX agreed to prepare a plan for a thorough assessment survey and decontamination of the site.

May 25, 1978:

NRC by letter to AMAX confirmed the agreement reached in the May 12 meeting.

Interim NRC letter to Sheriff of Wood County, West Virginia, noted the lack of immediate health hazard and committed NRC to reply in greater detail later.

NRC letter to Foster noted lack of immediate health hazard, but need for worker protection for longer term. Workers briefed by NRC staff.

June 6, 1978:

As a result of the April 17, 1978 inspection, NRC sent AMAX a Notice of Violation citing four infractions of NRC rules: failure to perform a proper survey, excessive radiation levels in unrestricted areas, unauthorized transfer of radioactive material, and failure to post radiation areas with warning signs.

June 7, 1978:

NRC sent a second letter to Sheriff of Wood County, describing the results of inspection and pointing out that although radiation levels are higher than allowed by NRC regulations for the long term, there is no immediate (or short-term) danger to workers.

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June 22, 1978: AMAX, Foster, EPA, and NRC met to comment on the AMAX survey plan. AMAX agreed to changes to the plan in response to comments.

June 30, 1978: AMAX replied to NRC's Notice of Violation of June 6, denying all citations.

July 3, 1978: AMAX submitted a request for delay until July 11 for submittal of revised survey plan to NRC.

July 13, 1978: NRC concurs with revised survey plan

July - October 1978: AMAX/ATCOR performance of surface and subsurface radiological measurements

August - September 1978: AMAX, Inc and L.B. Foster, Inc begin to implement agreements culminating in reconveyance of the land back to AMAX, Inc and relocation of the manufacturing facilities closer to the river.

August 7-11, 1978: Aerial Radiological Survey performed by EG&G Inc

November 7, 1978: AMAX, Inc, at their request, meets with the Acting Director, OIE, and staff and was advised of the need for a follow-on feasibility study of disposal alternatives.

December 4, 1978: AMAX/ATCOR radiological survey report received by NRC and accepted as characterizing general extent of subsurface thorium residues.

December 28, 1978: OIE transfers lead responsibility for determining optimal remedial action to ONR/SS.

January 23, 1978: EG&G reviews final aerial survey results with Region II staff.

ENVIRONMENTAL SAMPLING AT AMAX

A. General

Inspectors visited the AMAX/Foster Site on May 4, 18, 31, June 27, July 18, August 10, 11, and 29, to collect environmental samples. Sample locations, sample dates and results of analyses are shown in Enclosure A, Tables 1, 2, and 3, where AMW, AMS, and AMV refer to water, soil, and vegetation, respectively.

Radiochemical analyses included gross alpha and gross beta for water samples and gamma spectroscopy for soil and vegetation. Isotopic thorium and uranium analyses were also requested for selected soil and vegetation samples. All samples were analyzed by the DOE/RESL facility at Idaho Falls, Idaho.

B. Water Samples

The U.S. Environmental Protection Agency (EPA) Maximum Contaminant Level for gross alpha radioactivity in community water systems is 15 picocuries per liter (pCi/l). Analyses of drinking water samples taken at the AMAX/Foster site (see Enclosure A, Table 1) reveal

that the gross alpha concentration is well below the 15 pCi/l limit and that the gross beta radioactivity level is well below the EPA action level of 50 pCi/l, which requires identification of the radionuclides. The gross alpha and beta concentrations upstream and downstream in the Ohio River show no significant differences. Some surface water samples (AMW-4, AMW-5, AMW-9/10, and AMW-11) showed slightly elevated gross alpha and/or beta concentrations, however, these values are still within EPA drinking water limits and would not indicate an adverse affect on the drinking water in this area.

C. Soil Samples

Soil samples were collected by removing the s^cupper 2 centimeters (cm) over an area of approximately 100 square cm. Primary emphasis was placed on sampling near the site perimeter to determine if surface contamination has been primarily confined to the site. Gamma spectral analyses of the soil samples revealed the presence of ²¹⁴Pb, ²²⁸Ac, and ²¹²Pb, which are daughters from the ²³⁸U and ²³²Th natural radioactivity series (See Enclosure A, Table 2). The highest concentrations were for ²²⁸Ac and ²¹²Pb from the ²³²Th chain. Since these radionuclides are naturally occuring, these

concentrations must be compared to typical background samples in other eastern states where ^{232}Th levels in soil have been reported to be about 1 pCi/g. Four areas were identified where the ^{228}Ac and ^{212}Pb concentrations were higher than the expected natural soil concentrations.

The first area (around AMS-2 and AMS-3) is just northwest of the water tower, approximately five feet south of the access road, and revealed concentrations of around 3.6 pCi/g. This area is near a former ore storage ~~year~~^{and} and the elevated levels may have resulted from these operations.

The second area (around AMS-17 and 18) with soil concentrations in excess of background levels is a ravine on the south site boundary. Samples from the ravine on the south site <<< ravine were taken from inside the site boundary out to a hayfield which is approximately 1/2 mile south of the boundary. The highest levels of about 85 pCi/g were observed in the AMS-18 sample onsite near the property boundary. Contaminated soil was detected in the ravine out to 1/8 mile (AMS-20) from the site where ^{228}Ac and ^{212}Pb concentrations were 7.4 pCi/g and 6.3 pCi/g, respectively.

The third area (AMS-29) is at the outfall of a storm sewer which was established during the tenure of the Carborundum Metals Company, Inc., at the site. This offsite sediment sample was from a storm sewer holdup basin where suspended solids settle out of the sewer runoff water before it flows into the Ohio River. Concentrations of ^{228}Ac and ^{212}Pb were 32.0 pCi/g and 32.9 pCi/g, respectively. Water samples taken from this basin (AMW-9/10, AMW-11 and AMW-12) do not show significant levels of contamination. A sample designated AMS-31 was collected from the shoreline of the River about 50 feet downstream of the storm drain outfall. This sample was taken from an area which indicated approximately twice natural background as measured with a 1 inch Ludlum NAI scintillation crystal. Analysis of this sample does not indicate significant contamination.

The fourth area with higher than expected ^{228}Ac and ^{212}Pb concentrations in the soil was located in a field just south of the Foster property. The area in question is on property owned by Monongahela Power and is approximately 1000 feet south of the Foster property line and 400 to 500 feet east of the Ohio River. Concentrations of ^{228}Ac and ^{212}Pb in this area were

10 pCi/g and 7.0 pCi/g, respectively.

D. Vegetation

Vegetation samples were collected and analyzed by gamma spectroscopy and the results are shown in Enclosure A, Table 3. Not included in Table 3 are the results of an analysis of a sample of corn for ^{228}Th , ^{232}Th , and ^{232}Th . The corn was taken from the western part of the L. G. B. Foster property and contained no significant amounts of the above mentioned nuclides.

The radionuclide concentrations in vegetation samples were quite low and with the exception of AMV-1, appeared to be consistent with naturally occurring levels. The ^{228}Ac and ^{212}Pb levels in a grass sample, AMV-1 appear to be elevated, but would not result in a significant transfer of radioactivity to humans if the grass were consumed by grazing animals.

E. Aerial Monitoring Survey

The EG&G survey, summarized in Enclosure B, confirmed the previous NRC ground surveys which showed that

contamination was primarily confined to the process area and a ravine on the south side of the site. The survey also identified a slightly contaminated area located on Monongahela Power property. This area is not shown in the final survey report because the radiation levels were less than 1.5 times the background. A soil sample, AMS-30, was subsequently taken to determine if this area was contaminated. The sample results were presented in the section on soils.

The survey also suggested that radioactivity has not migrated from the site to the Ohio River via surface water runoff.

F. Conclusions

The environmental survey suggests that the operations at the AMAX site have not resulted in serious contamination in areas adjacent to the site. The survey identified a few contaminated areas near the site, but the concentrations were not high enough to pose a hazard to the public or preclude the use of the land for recreational or agricultural purposes.

There was no indication of ground water contamination as evidenced by the low radioactivity levels in water from onsite wells. The use of those wells for drinking water would not result in additional radiation exposure to the consumers.

ENCLOSURE A

ENVIRONMENTAL DATATable 1, Water Analysis

Gross activity is given in units of picocuries per liter (pCi/l). The first six samples were collected on May 4, 1978. Samples 7, 8, and 9/10 were collected on May 18, May 31, and July 18, 1978, respectively, and samples 11 and 12 were collected on August 10 and 29, respectively.

<u>Sample No.</u>	<u>Location</u>	<u>Gross Alpha</u>	<u>Gross Beta</u>
AMW-1	Ohio River - upstream	0.2±0.2	4.0±7
AMW-2	S.E. Corner drainage	1.0±0.3	14±6
AMW-3	Ohio River - downstream	0.8±0.2	3.0±6
AMW-4	Ravine, Offsite, south	9.0±0.9	30±7
AMW-5	Drainage, by ponds	7.3±0.6	22±6
AMW-6	Drinking water	1.7±0.4	5.0±6
AMW-7	Drinking water	1.7±0.3	2.0±2
AMW-8	Drinking water	1.8±0.3	1.0±5
AMW-9/10	Storm Sewer discharge to Ohio River	2.8±0.4	0±1
AMW-11	Storm Sewer discharge to Ohio River	5.5±0.8	1±1
AMW-12	Storm Sewer discharge to Ohio River	1±1	2±5

Table 2, Soil Samples

Concentrations are given in units of picocuries per gram (pCi/g) for the indicated isotopes. The first 24 samples were collected on May 4, 1978, and samples 25 through 28 were collected on May 18, 1978. Sample 29 was collected on July 18 and samples 30 and 31 were collected on August 11, 1978.

<u>Sample No.</u>	<u>Location</u>	<u>U-Series</u>	<u>Th-Series</u>	
		$\frac{^{214}\text{Pb}}{\text{pCi/g}}$	$\frac{^{228}\text{Ac}}{\text{pCi/g}}$	$\frac{^{212}\text{Pb}}{\text{pCi/g}}$
AMS-1	North perimeter	1.0±0.1	2.0±0.2	1.9±0.1
AMS-2	North perimeter	2.1±0.2	3.9±0.4	3.6±0.2
AMS-3	North perimeter	2.0±0.2	3.5±0.3	3.9±0.2
AMS-4	North perimeter	1.2±0.1	1.6±0.2	1.7±0.1
AMS-5	North perimeter	0.6±0.1	0.92±0.17	1.0±0.09
AMS-6	West perimeter	0.72±0.11	1.3±0.2	1.27±0.09
AMS-7	West perimeter	0.6±0.1	0.54±0.17	0.9±0.09
AMS-8	West perimeter	0.8±0.1	1.1±0.2	1.16±0.09
AMS-9	South perimeter	1.0±0.2	1.0±0.2	1.49±0.1
AMS-10	South perimeter	1.0±0.1	1.2±0.1	1.2±0.1
AMS-11	South perimeter	1.6±0.1	2.4±0.3	2.0±0.1
AMS-12	South perimeter	0.80±0.12	1.9±0.2	1.8±0.1
AMS-13	South perimeter	0.79±0.09	1.02±0.14	1.4±0.1
AMS-14	East perimeter	1.3±0.1	1.8±0.16	2.0±0.1
AMS-15	East perimeter	0.71±0.09	1.02±0.2	0.81±0.07
AMS-16	Offsite, east of ravine	0.58±0.09	0.8±0.2	0.81±0.08

Table 2, Continued

AMS-17	Onsite, ravine stream bed	2.2±0.2	4.9±0.3	5.1±0.3
AMS-18	Onsite, side of ravine	33±2	87±3	84±3
AMS-19	Boundary, ravine stream bed	0.91±0.04	2.5±0.1	2.7±0.01
AMS-20	Offsite, ravine at hay field	0.96±0.14	7.4±0.4	6.3±0.3
AMS-21	Offsite, west of ravine	0.90±0.04	1.17±0.06	1.22±0.04
AMS-22	Onsite, north of pond	1.1±0.1	1.2±0.2	1.4±0.1
AMS-23	Offsite, north of office	1.3±0.1	1.8±0.2	1.6±0.1
AMS-24	Offsite, 0.5 mi NNW of office	0.95±0.05	1.44±0.06	1.59±0.07
AMS-25	Offsite, NW of Foster Drive	0.88±0.04	0.99±0.05	1.1±0.04
AMS-26	Offsite, 0.25 mile south	0.73±0.05	1.1±0.06	1.3±0.04
AMS-27	Offsite, 0.25 mile south	0.93±0.06	1.1±0.06	1.37±0.05
AMS-28	Offsite, 0.25 mile south	0.94±0.04	1.1±0.06	1.2±0.05
AMS-29	Sediment at outfall to Ohio River	7.84±0.26	32.0±0.8	32.9±1.0
AMS-30	Monongahela Power property	2.16±0.27	10.0±0.6	7.03±0.35
AMS-31	Downstream Ohio River	1.17±0.12	1.41±0.21	2.01±0.12

Table 3, Vegetation

Vegetation samples 1 and 2 were collected on May 31, 1978. Samples 3 through 6 were collected on June 27, 1978. Results reported in units of picocuries per gram (pCi/g) for the isotopes noted.

<u>Sample No.</u>	<u>Location</u>	<u>^{214}Pb</u>	<u>^{228}Ac</u>	<u>^{212}Pb</u>
AMV-1	Offsite, grass south of ravine	$<0.1 \pm 0.1$	1.1 ± 0.3	0.54 ± 0.10
AMV-2	Offsite, alfalfa north of office	<0.1	<0.2	<0.1
AMV-3	Grass, 75' east of fence	$.16 \pm 0.03$	$<.1$	<0.1
AMV-4	Hay, northeast of pond	<0.1	$<.1$	$.12 \pm 0.03$
AMV-5	Oats, ravine outfall offsite	<0.1	0.23 ± 0.05	0.09 ± 0.03
AMV-6	Oats, hill adjacent to #5	<0.1	<0.1	<0.1

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- B. SUMMARY OF MEETING WITH L.B. FOSTER COMPANY ON APRIL 28, 1978
- C. Memorandum from Barber, Baum and Whipple, University of Michigan to Chapman and Spink, Carborundum Metals Company dated September 17, 1962
- D. Letter from R.W. Ritchey, Carborundum Metals Climax, Inc. to the AEC dated April 20, 1967.
- E. Inspector's Memorandum to files dated May 18, 1967
- F. Letter from S.A. Thielke, AMAX to NRC dated July 31, 1978 w/attachments.

INTRODUCTION

On September 16, 1974, AMAX Specialty Metals, Inc. submitted an application for a license to import, possess and store up to 40,000 pounds of ore concentrate containing small amounts of uranium (0.2% U_3O_8 by weight) and thorium (0.3% ThO_2). The primary components of the ore were zirconium oxide and hafnium oxide and AMAX planned to evaluate the ore as a raw material source for the production of zirconium and hafnium metals. On October 14, 1974 AMAX submitted an amendment to the application to include the processing of 20 long tons of ore. Source Material License No. SMA 1219 was issued ^{to AMAX} by the then Atomic Energy Commission on November 26, 1974. The license authorized the import, possession, storage and use of 40,000 pounds of ore, containing

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up to 200 pounds of uranium and thorium, at a plant site (described by AMAX as 7.2 acres in size) located one mile south of Washington, West Virginia.

In accordance with an application for amendment dated February 25, 1975, License^{No.} SMA 1219 was amended on April 25, 1975 to increase the limits for possession, storage and use to 1,500,000 pounds of ore containing up to 4,050 pounds of thorium and uranium.

In a letter to the NRC dated March 23, 1977, AMAX stated that they would not renew Source Material License No. SMA 1219 which would expire on November 30, 1977. The letter also indicated that the ore had been removed from the site and stated that a survey of the plant was made which assured that the plant was free of any radioactivity. A36

As part of its standard procedures for terminating a license, the NRC performed closeout inspections on September 20 and October 13, 1977. This inspection, documented in IE Inspection Rpt. No. SMA-1219/77-1, identified three areas inside the formerly restricted area where radioactive contamination levels exceeded permissible levels for an unrestricted area and, therefore, required further cleanup. The inspection also disclosed that twelve drums of "leached ore" with a gamma radiation exposure rate of forty times background rate and a steel vessel containing unknown materials with a gamma radiation exposure rate of fifty times background had not been removed from the site. The inspector was ~~also~~ informed during the inspection that the 100-acre industrial site which included the ~~72-acre~~ formerly restricted area had been sold by AMAX to the L.B. Foster Company (LBFC) in March 1977.

A Notice of Violation was issued to AMAX on December 2, 1977. In their response dated December 15, 1977, AMAX stated that all materials identified during the inspection had been removed for proper disposal. Snow cover and frozen ground during January - March 1978 delayed followup inspection of the site to verify that the radioactive materials had been removed. On April 3, 1978, Region II contacted an AMAX representative by telephone and was informed that all materials had been removed and the site was ready for reinspection.

On April 4, 1978 a representative of LBFC contacted Region II and stated that their consultant, CTL Engineering^(CTLE) of Columbus, Ohio had performed a radiation survey at the site on April 2, 1978, and a desk-top-size area next to the railroad track/loading area exhibited radiation levels significantly higher than

background level. This information was discussed by Region II with a representative of AMAX on April 7, 1978. The AMAX representative stated that the survey data would be verified and arrangements would be made to have any radioactive material removed from the site. On April 14, 1978, Region II was informed by the AMAX representative that surveys had identified three areas at the site where gamma radiation levels were significantly higher than background. Readings ranged from 120,000 to 500,000 counts per minute ^(cpm) with a background reading of less than 5,000 cpm. The information provided indicated that radioactive contamination was not limited to the formerly restricted area. The AMAX representative reported that activity levels of 120,000 cpm had been measured in a new building in an area which was approximately 300 feet outside the formerly restricted area.

Region II radiation specialists were dispatched to the site and

an announced inspection was performed on April 17-21, 26 and
to follow up on the previous closeout survey and to evaluate a report from CTUE that
"... a significant radiation hazard does exist..." at the plant site

27, 1978^y. The results of this inspection, which are documented

in IE Rpt. No. SMA-1219/78-1, indicated that the radioactively

contaminated areas identified in the NRC's letter to AMAX

dated December 2, 1977 had not been adequately decontaminated.

In addition, radiation surveys performed during this inspection

identified several areas outside the formerly restricted area

which exhibited significant levels of radioactive contamination

Moreover, information obtained during the inspection indicated

the existence of one or more burial sites outside the formerly

restricted area which involved not only radioactive materials,

but included pyrophoric materials as well.

Region II personnel met with representatives of AMAX in the Region II office on April 28, 1978 to discuss the contamination problem and possible courses of action. A summary of the meeting, including a list of attendees, is included as Exhibit A. Following the meeting with AMAX, a separate meeting was conducted in the Region II office on the same day with representatives of LBFC. A summary of this meeting is included as Exhibit B.

Based on the information obtained during the inspection and the subsequent meetings with AMAX and LBFC regarding the possible unauthorized burial of radioactive/pyrophoric material, an investigation was initiated under the authority provided by Section 1.64 of Title 10, Code of Federal Regulations.

II. SCOPE OF INVESTIGATION

The investigation included the following activities:

- A. Complete review of all available AEC/NRC documents dealing with the Parkersburg site.
- B. Interviews with current and former AMAX / Carborundum employees, and contractors who performed work associated with burial of materials.
- C. ^{Independent} radiological environmental surveys of the site performed by NRC personnel and contractors (EG & G).
- D. Observation by NRC personnel of radiological surveys performed by AMAX's consultant (ATCOR) and review of the data obtained.
- E. Examination of available records regarding shipment and/or burial of materials.

DETAILS OF INVESTIGATION

A. ALLEGATION

That an unknown amount of low-level radioactive material was buried in various locations within the 100-acre industrial site near Parkersburg, West Virginia in violation of NRC regulations.

B. DISCUSSION

This investigation had two major aspects which were accomplished concurrently and to some extent independently. Radiological surveys including direct radiation readings and environmental sample analyses were performed to determine the location, type and quantity of radioactive materials involved and the associated hazards. Records reviews and interviews were conducted ^{by the investigators} in an attempt to determine what materials had been

buried, when and by whom. These two areas are addressed separately in this report.

1. Review of NRC Records

A review of all available NRC records dealing with licensed activities at the site was conducted during the investigation, and the following information was obtained:

a. Licensing History

The records indicate that the following ^{source material} licenses were issued or amended, affecting the site

by the AEC/NRC on the dates and for the purposes indicated:

11/12/59 - License No. C-4922^(Docket 40-4937) was issued to the Carborundum Company and authorized possession of 900,000 pounds of ore containing up to 8-percent thorium for storage only.

12/22/59 - License No. C-4960 (Docket 40-5001) was issued to the Carborundum Company and authorized processing of 900,000 pounds of ore containing thorium.

2/23/60 - License No. C-4922 was amended to authorize possession of nine hundred tons of ore containing up to 8-percent thorium for storage only.

4/1/60 - License No. C-4960 was amended to authorize further processing of the ore to complete chlorination and liquid-liquid extraction steps.

1/10/61 - License No. STA-9 (Docket ~~40~~ 40-5001) was issued. This license replaced C-4960 and authorized possession of the thorium-bearing ore for an additional six months.

10/2/61 - License No. STB-440 (Docket 40-5001) was issued as a continuation of C-4922 and STA-9.

10/1/64 - License No. STB-440 was renewed for a period of three years. The license authorized possession of unlimited quantities of source material containing thorium only and limited possession of residues containing thorium and uranium to 130 tons. The license authorized storage only of the uranium and thorium residues.

6/65 - AMAX entered into a joint venture with Carborundum including the Parkersburg facility.

5/67 - AMAX purchased Carborundum's interest in the joint venture and became sole owner of the Parkersburg facility.

6/13/69 AMAX requested a close-out inspection in preparation for termination of license STB-440

4/6/71 AMAX made formal application for termination of STB-440

4/27/71 License STB-440 was terminated

11/26/74 License No. SMA-1219 (Docket 40-8355) was issued to AMAX and authorized the import, possession, storage and processing ^{at the Bakersburg facility} of 40,000 pounds of ore containing up to 200 pounds of thorium and uranium.

4/25/75 License No. SMA-1219 was amended to authorize possession of 1,500,000 pounds of ore containing up to 4,050 pounds of thorium and uranium

3/23/77 AMAX notified the NRC of its intent not to renew SMA-1219 which would expire on 11-30-77.

IV

b. Source Material Possession History

Various documents in the NRC files were reviewed in an attempt to determine the quantities of uranium and thorium received at the Parkersburg facility under the various licenses and the ultimate disposition of the material. Documents reviewed included inspection reports, inspectors' field notes and various documents provided by Carborundum and AMAX representatives.

The information contained in inspection reports and field notes was based on the inspectors' review of licensee inventory documents and/or statements made by licensee representatives to the inspectors during the inspection covered in a particular report.

The investigator calculated the amount of source material which had been received by the licensee at the time of each inspection by multiplying the total amount of ore received by the estimated

percentage of source material contained in the ore. The investigator then calculated the total amount of source material contained in unprocessed ore, process residues and wastes in storage at the site from the information available in the inspection reports or field notes. The total amount of source material contained in the unprocessed ore, process residues and wastes in storage at the site was then compared to the ^{total} amount of source material contained in the ore which had been received at the site with the following results:

Inspection Report dated July 5, 1960 - Thorium content of material in storage or processing at the time of the inspection was from 4,077 to 4,369 lbs less than received at site up to date of inspection.

Inspection Report dated December 19, 1961 - Thorium content of

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ore received through date of inspection was between 171,608 and 205,930 lbs. Wastes and ore in storage were not discussed in the report.

Inspection Notes dated April 10, 1964 - Based on the figures contained in these notes, ^{including documents provide by the licensee,} and earlier reports, the licensee had received a total of 8,043,189 lbs of ore containing from 448,269 to 482,591 lbs. of thorium. At the time of this inspection the licensee had 2,427,682 lbs of unprocessed ore, ~~and~~ process wastes and residues with a calculated thorium content of between 114,642 and 182,549 lbs. This is from 300,042 to 333,627 lbs. less than received in the ore. The inspection notes, however, indicate that a licensee representative stated that no disposals had been made and all thorium received at the plant was still on hand. A36

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Inspection Notes dated February 18, 1965 - These notes indicated

that no additional ^{thorium bearing} ore had been received since the last inspection. The information contained in the notes indicate that the licensee had 2,211,000 lbs of unprocessed ore, process residues and wastes which the investigator calculated to contain between 138,019 and 177,104 lbs of thorium.

This is from 305,487 to 310,250 lbs less thorium than was calculated to be contained in the ore received.

Inspection Notes dated July 29, 1966 - These notes

indicated that the licensee had 2,660,910 lbs of unprocessed ore, process residue and wastes on hand at the time of the inspection with a calculated thorium content of between 329,267 and 232,440 lbs which is from 219,002 to 250,151 lbs less than the calculated thorium content of

W
S
the ore received.

and Compliance Inquiry Memorandum dated May 18, 1967 official
Inspection ~~Notes~~ dated May 16, 1967 - The inspection

notes state that the licensee's inventory was the same as previously reported; however, the inspector's field notes contain quantities of various wastes ^{and estimated thorium percentages} which differ slightly from the previous report. These figures indicate the licensee had 2,612,388 lbs of unprocessed ore, process residues and wastes at the time of the inspection with a calculated thorium content of between 153,129 lbs. This is from 295,140 to 329,462 lbs. less thorium than was calculated to have been received in the ore.

The Compliance Inquiry Memorandum written at the conclusion of this inspection contains estimated thorium percentages which are different than those in the field

notes. The most significant differences in thorium content estimates ^{are} ~~is~~ for scrubber acid wastes. The field notes indicate an estimated thorium content of 35.85%, whereas the memorandum indicates a thorium content ranging from 36 to 58% for these wastes. The memorandum also erroneously states that the licensee purchased and received 1,701,660 lbs of ore. Earlier inspection reports indicate that a total of 8,043,189 lbs of ore were received at the site. Using the figures contained in the memorandum, calculations indicate the thorium inventory to be ^{from} 155,646 to 233,972 lbs which is from 248,619 to 292,623 lbs less than what was received in the ore.

One other unexplained discrepancy ^{in the memorandum} was identified by the investigator. The memorandum contains a list of ^{the unprocessed} ~~various~~ ^{ore and} ~~various~~
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residues and wastes in storage and indicates the quantities on-hand. The memorandum then states that "these materials were stored in 55-gallon drums, each containing about 700 pounds of material or about 1750 drums." The investigator determined that the quantities of unprocessed ore, process residues and wastes given in the memorandum totaled 2,612,500 lbs which, at 700 lbs per drum, would require 3732 drums, rather than the 1750 indicated.

Inspector's Notes dated August 1, 1968 - The inspector's notes contain a copy of ^{the} portion of the memorandum discussed above and the notes ^{state} ~~indicate~~ that no receipts, transfers or disposals have occurred since the last inspection.

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Inspector's Notes dated April 28, 1970 - These notes indicate

that the licensee transferred 3,059,400 lbs of waste to the
Nuclear Engineering Company ^{(NECO) burial facility} at Moorehead, Kentucky between

October 1968 and May 1969. ^{Calculations based on} Figures contained in inspection

notes for earlier inspections indicated the total quantity of
unprocessed ore, process residues and wastes to be between
2.6 and 2.7 million pounds. A comparison of the
quantities of the various types of residues and wastes with
those contained in earlier reports revealed an unexplained
difference in the quantity of chlorinator residues. Earlier
reports had indicated that approximately 543,000 lbs was
on hand, whereas these notes indicated that 480,000 lbs of
chlorinator residues were shipped to NECO.

14
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These inspection notes did not include information regarding the percentage of thorium contained in the various residues and wastes; however, using the percentage of thorium in chlorinator residue established in earlier reports^(7%), the amount of thorium in the unexplained additional 426,000 lbs of chlorinator residue would be 29,820 lbs.

The amount of thorium transferred to NECO would still be from 218,000 to 261,000 lbs. less than was estimated to have been ~~what was~~ received in the ore.

Inspection Notes dated September 17, 1975 - These notes indicate that the licensee^{had purchased} received one metric ton of ore from Palabora Mining Company in August 1974 and additional shipments of 20 metric tons and 200 metric tons in February and May 1975, respectively. Information contained

A36

14
10
in a letter from AMAX to the NRC dated October 1, 1975 indicated that 21 tons of ore had been processed.

INSERT
NEXT
PAGE →

Letter from AMAX to NRC dated March 23, 1977 - This letter stated that the ^{Baddeleyite} ore which had been stored at the Parkersburg facility under license SMA 1219 had been shipped to Norton Abrasives in Canada. During the course of the investigation ^{copies of} a Bill of Lading and a Prepaid Freight Bill both dated January 25, 1977, were made available to the NRC. These documents indicate that 112 drums of ore with a net weight of 123,312 pounds were shipped to the Norton ~~Abrasives~~ Company. Comparing this figure with the inspector's notes dated September 17, 1975, indicates an unexplained difference between what was received and what was subsequently shipped off site ~~of~~ approximately 315,000 pounds of unprocessed ore.

It should be noted that a full scale production license was never issued for processing the Baddeleyite ore.

IV
10A.
INSERT

Letter from AMAX to NRC dated October 1, 1975 - This letter transmitted additional information to the ^{NRC's} Division of Materials and Fuel Cycle Facility Licensing in support of a request for a license for full scale production using the Boddleyite ore. The information provided by AMAX indicates that 21 metric tons of ore had been processed during the pilot studies.

c. Other Information in NRC Files

Information obtained from the NRC files indicate that both Carborundum and AMAX considered on site disposal by burial and one document indicates that Carborundum actually spread process residues containing an estimated 1.5-percent thorium.

A memorandum to Carborundum representatives from their consultants, Barber, Baum and Whipple of the University of Michigan, dated September 17, 1962 is attached as Exhibit C. Pages 10, 11 and 12 clearly show that consideration was being given to on-site burial. Moreover, Table 7 on page 11 indicates that "used fused salt" containing 1.5-percent thorium had been "dumped on plant property" prior to the date of the memorandum.

14
12

In a letter to the AEC dated April 20, 1967, (Exhibit D) R. W. Ritchey, Plant Manager for Carborundum Metals Climax (the joint-venture company) indicated his concern regarding the process residues stored on site and requested that an AEC representative visit the Parkersburg site to discuss permanent disposal of the residues. An AEC inspector visited the site on May 2, 1967. His observations ^{of the site} and discussions with R. W. Ritchey were documented in a Memorandum to Files dated May 18, 1967 (Exhibit E). This memorandum indicates that Mr. Ritchey had stated ^{to the inspector} that the licensee did not want the expense (either of) storage facilities or that of commercial burial and he was considering an application to bury the thorium waste on the property.

In a letter to the AEC dated June 13, 1969 (Exhibit 2) AMAX stated that all radioactive material ^{had been} removed from the site and shipped to Nuclear Engineering Company, Inc. (NECO) at Morehead, Kentucky. An inspection was performed on May 28, 1970. The inspector's notes indicate that several small areas of ground contamination were identified, but that the ore and process residues had been removed from the site. It should be noted that the inspector's surveys were limited to the restricted portion of the site and did not include the dump area because there was no reason at that time to believe radioactive material had been disposed of in the unrestricted area.

iv
4

2. Licensee Records

In a letter to The Carborundum Company dated July 12, 1978, the NRC requested information or records which related to the disposal of source material at the Parkersburg facility. In their response dated July 19, 1978, Carborundum stated that they had been unable to locate such records in their files and that all records, data and information was transferred to AMAX when AMAX acquired Carborundum's interest in the joint venture. The investigator contacted

Carborundum's General Counsel by telephone on July 30, 1979 and was informed ~~that~~ that no records had been located.

An AMAX Vice President was contacted by telephone on March 16, 1978 and was asked to provide any records or information that AMAX possessed regarding disposals at the Parkersburg

15
facility. The representative stated that any records available would be provided. A former AMAX plant manager was contacted by telephone on May 18, 1978 and he informed the investigator that most records were destroyed when the plant was sold. He stated that he did not believe that there are any such records currently in existence.

The investigator contacted AMAX's Manager of Industrial Hygiene on July 29, 1979 and asked if any records had been located regarding ^{material inventory and} disposal by burial at the

Parkburg site. ~~In a subsequent call on the same day the AMAX representative stated that all such records had~~
~~been destroyed.~~ ^{AMAX did not bury any radioactive materials, hence no such records}

In a subsequent call on the same day the AMAX representative stated that AMAX had not buried any radioactive materials, therefore, there would be no burial records. He also stated that all other inventory and disposal records had been destroyed.

N
16

A representative of NECO was contacted by an NRC investigator by telephone on May 9, 1978 and was asked to provide any information available in NECO's files regarding shipments for burial received from the Parkersburg site during 1968-1969.

This information was subsequently provided by NECO to AMAX, who in turn provided it to the NRC by letter dated July 31, 1978 (Exhibit F).

3. Interviews

~~An~~ NRC investigators interviewed ~~nine~~ former Carborundum and/or AMAX employees and several bulldozer operators from the surrounding area. For the most part, the results of these interviews were inconclusive. Most of the individuals stated that barrels and other materials were buried in the dump during both Carborundum and

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①

Inspection Report dtd 7-5-60

Purchases - thru 5-23-60

London Tm	675,560	Est 5-6% Th (8.07)
Kennecott	<u>1,032,100</u>	(3.85 Th)
Total	1,707,660	

85,383 - 102,460 (A)

Storage

London Tm	523,800	(8.01)
Kennecott	<u>529,947</u>	(3.85)
Total	1,053,747	

Est 5-6% Th 52,687 - 63,225 (B)

Process 276,584 Est 5-6% Th

13,829 - 16,595 (C)

18,867 - 22,640 (D = A + B + C)

WASTES

Crude Tet 161,253 Est 1% = 1613 (E)

Old Mix 176,400 Est 6-7 (6.17) 10,584 - 12,348 (F)

Chl Res 23,008 Est 10-20 2301 - 4602 (G)

14,498 - 18,563 (H = E + F + G)

Processed
377,329

Error 304 - 8,142 (DXH)

Missing
A - (B + C + H)

4,369 - 4,077

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(2)

Inspection Report dtd 12-19-61

Purchases

Previous 1,707,660

Since last insp 1,724,506

3,432,166

5-6%

171,608 - 205,930

Waste & Storage not discussed

Ratios of volumes

Ser Oxide	30,000 lb/mo	5
Carb Belt Pick	15,000 "	2.5
Fused Sand	6,000 "	$R=1$
Chl Bed Res	15,000 "	2.5
Fused salt	5,000 "	0.83

3

Inspection Notes/Record Copy dated 4/10/64

Purchases

Previous	3,432,166	5-6%	171,608 - 205,930
Since 11/61	<u>4,611,023</u>	6%	276,661
	8,043,189		448,269 - 482,591 (A)

Storage	1,565,578	(5-6%)	78,279 - 93,935 (B)
---------	-----------	--------	---------------------

> From doc provided by Carborundum on 3/18/64

Old Mix	143,130	1%	1431
Carbide	163,516	3-4%	4905 - 6541
Scrub Oxide Res	163,717	10-40%	16,372 - 65,487
" Salt Res	105,458	1%	1055
Carb Chlor Res	300,000	1.7%	5,100
Fused Sand Res	150,000	5-6%	<u>7500 - 9,000</u>

36,363 - 88,614 (C)

2,427,682

Missing

333,627 - 300,042 (D)

D = A - (B + C)

48,279	93,935
36,363	88,614
<u>114,642</u>	<u>182,549</u>

A36

④

Inspection Notes/Record Copy dtd 2-18-65

Purchases - None

- Previous 8,043,189 (5-6%)

448,269 - 482,591

Storage

→ One ^{1,565,578 6}
~~540,110 6%~~
Scrub Acid 145,422 20-40%
Slug 500,000 3-5%
2,211,000
Mistake by inspector

93,935

29,084 - 58,169

15,000 - 25,000

138,019 - 177,104

"No work since Jan 1964 involving Thorium in any manner"

310,250 - 305,487

540,110
145,422
500,000
1195,532

A36

⑤

Insp Notes / Record Copy 7-29-66

Purchases None

Previous 8,043,189

448,269 - 482,591

Storage

* One 1,541,415 6%

92,485

* Old Mx 479,655 5%

23,983

* One Carb 317,313 4.5%

12,693 - 15,866

* Sc Acid Ox Res 163,391 58% (35.85 Th + 5.9 U)

94,767

* Sludge → Chd Res 53,678 7%

3,757

* Spent Salt 105,458 1.5% (2.5% H₂O ?)

1,582

229,267 - 232,440

2,660,910

Missing

219,002 - 250,151

* Ref field notes.

(6)

Inspector's field notes

(Previous)
not mentioned

8,043,189

448,269 - 482,591

One	1,539,539	(3.85%)	59,272
Salt Residues	105,443	2.5%	2636
Carbide BP+NC	310,682	(3.85)	11961
Old Mix	439,655	(3.85)	16,927
Carb Chlor Res	53,678	(?) [from ⑤]	37,57
Scrubber Oxide	163,391	(35.85%)	58,576

2,612,388

153,129

295,140 - 329,462

Documents attached give analyses of ore, vaporizer residue
and old mix

2-29-60	One Ken	ThO ₂ 3.85%	0.24 U ₃ O ₈
	Lond	8.07%	0.16 "
10-20-66	Old Mix	Th + Re 6.17%	
	↳ Vap Res	35.85% ThO ₂	

⑦

Compliance Inquiry Memorandum dated 5-18-67

Purchase 1,707,660 (4-6%)

WRONG

8,043,189

448,269 - 482,591

Storage

Ore 1,540,000 (4-6) ~

61,600 - 92,400

Old Mix 440,000 (4-5) ~

17,600 - 22,000

Carb Chl Res 53,700 (7)

3759

Sc Acid 163,000 (36-58) ~

58,680 - 94,540

Chl Salt 105,000 (1.5-2.5) ~

1575 - 2625

ant

Carbide 59,800 (4-6)

2392 - 3588

Nig Carb 251,000 (4-6)

10,040 - 15,060

2612,500

155,646 - 233,972

292,623 - 248,619

Ritchey

Report says plant manager did not want expense of storage facilities or commercial burial

⑧ Copy of ⑦ list only

⑨.

Inspectors Notes 5-29-70

Purchases Not mentioned

Storage - None

Disposal

* Sc Salts & Oxides	271,400	✓	
Chlor Res	480,000		
* Nig Carb (one)	✓ 1,540,000	✓	4-6
* Old Mix	✓ 480,000	✓	
* Carb Mix	✓ 288,000	✓	

< 2,059,400 > wrong

3,059,400

License terminated 4-6-71

10. ~~Data~~ Insp Notes 9/17/75

Purchase (Palabora ^{Mining Co Ltd}) < .05% Th + U

7/74	1 MT	}	188,938 lbs 487,320
2/75	20 MT		
→ 5/75	200 MT		

1 MT = $\frac{1}{.99}$ (2000)

New Licence	U	0.2%	Th	0.3%	40,000
-------------	---	------	----	------	--------

Amend to app		0.06%		.02%	
--------------	--	-------	--	------	--

11/74	40,000 lbs	(200
-------	------------	------

Amend	1,500,000	U ₃	.07	Th	0.2
-------	-----------	----------------	-----	----	-----

4/75

Process 21 tons

125⁷⁷ Shipped

132,160 lbs Gross

123,312 Net.

INTRODUCTION

LICENSES ISSUED AT SITE (DOCKET No.s)

C4922 11-12-59 Carborundum (40-4937)

C4960 12-22-59 " (40-5001)

STA-9 1-10-61 " [Replaces C4960] (40-5001)

STB-440 10-2-61 " [Replaces C4922 and STA-9]

1966 - American Metals Chimney in 50-50 joint venture

1967 - AMAX full owner

3/23/77 The Baddeleyite ore that was stored by AMAX...
shipped to Norton Abrasives in Canada license PSL 54/77

A survey of the plant was made which assured that the
plant was free of any radioactivity.

8/23/77 Request from NMSS + OIE for close out inspection
To FFMS RII on 8-29-77
To Woodruff on 9-7-77

12-5-77 Call from Dr Kall

SMA 1219 40-8355

Requested 9-16-74 Import, Possession & Storage - Palabora Ore

40,000 lbs U_3O_8 0.2% (80lbs max at one time)

ThO_2 0.3% (120 lbs max at one time)

98% Zirconium Oxide and hafnium oxide

Eval - Make zinc & half metals sponge

Amended Request 10-14-74 - Import, Possess, Process, Storage - Palabora Ore

40,000 lbs U_3O_8 0.06% *

ThO_2 0.02% *

* Revised physicals based on later info from supplier

From 40,000 lbs ore (200 lbs U & Th)

Leach & Wash solutions 85 lbs ThO_2 , 67 lbs U_3O_8 - Plastic tanks

Residue - Chlorinator (6,800 lbs) 5.2 lbs ThO_2 , 4.1 lbs U_3O_8 - Metal drums

Filtrate 19 lbs ThO_2 20.1 lbs U_3O_8 - Settling Pond

Residue Chlorinator (4000 lbs) 1 lbs ThO_2 0.2 lbs U_3O_8 - 55 gal metal drums

Residue - Tet can (3,500 lbs) 0.8 ThO_2 1.9 lbs U_3O_8 - 55 gal metal drums

Amendment Requested 2-25-75

Import, Storage and Possession only

4050 lbs

1,500,000

U_3O_8

0.07%
1050 lbs

ThO_2

0.2%

3000 lbs

30 gal metal drums wt ~ 1000 lbs/drum

A36

5-9-75 OIE letter. assigns XJM for material transfer reports

Filter cakes have contained about 5% U+Th

1. Arrive by truck - drums logged by SN

If spilled material contains dust - mixture is put in drum and buried

2. Production Control Office - bound book
Drum SN, weight, disposition

3. When processed

Log Sheet 1st step - Copy to Production Control Office
Drum SN, weight, Date, Batch No

Prod. Control Tickets provide record of movement through process

You should provide for proper accountability and disposal of all waste materials deriving from process operation whether or not these materials contain less than 0.05% source material

11-10-59

TWX

Carborundum to AEC

The Carborundum Company

Requests license to possess 900,000 lbs of Nigerian ore up to 8% Th

2-9-60

LTR

Carborundum to AEC

SMLicense C4922 dtd 11/12/59 in possession / storage

Doc 40-4937

C4960 3 (12/22/59)

/ processing

40-5001

Requests C-4922 change from 900,000 lbs to 900 tons

Says processed 260 tons of ore between 1-7-60 and 1-20-60

SEE BACK
→

7-13-60

LTR

Carborundum to AEC

(1) Refers to 4-1-60 Amend 1 to C4960 (issued 4-1-60)

(2) Requests full term license

(3) Includes 2 Reports Consultants to Carborundum

3-10-60 • Says between 1-6/2-19 material w/up to 6% Th processed under C4960

Cyclone residues collected dry in 55 gal drums and recycled thru furnace

• Ore on contact 11-12 mr/hr

Old mix 4 mr/hr

Specific activity of natural Th = $\frac{5000 \mu\text{C}}{16.5 \text{ lbs}}$
 $\frac{500 \mu\text{C}}{27.5}$

7-25-60 *

4-20-60 Kennecott ore .16-1.2% Th

London Tin ore 0.8-1.6% Th

ZrCl₄ 55 gal drum > 0.75 mr/hr

385 0.24

2-29-60 by Tedoux

3.07 ThO₂ .16 U₃O₈

Old mix 0.17% R₂₃₂Th

10-25-60

LTR Carborundum to AEC

Requests 1 yr license or extension of Amend No 2

A36

2.

4-27-60 LTR AEC to Car > Encl Temporary license C4960 as amended

8-9-60 C-4960 Amend 2 Extends 3 months

1-10-61 LTR TO Carb License STA-9 - six months (40-5001)

7-5-60

Inspection Report
S-31-60

Nigerian Zircon Sand 5-6% Thorium
Hafnium and Zirconium
Mined in Nigeria - Sold thru Kennecott Ltd
and London Tin, Ltd

11-16-59 > 5-23-60 9 purchases total 1,707,660^{lb}

Old Mix - unreacted ore-coke mixture remaining
after firing process - pkgd in 55 gal drums

Chlorination Process - Nigerian Crude Tet ~1% Th
Residues 10-20% Th

Nigerian Zircon Sand storage - 55 gal drums (909 lbs) and cloth bags ^(5-6%)
45 lbs in fenced area north of Carbide Bldg

Old Mix storage 6-7% 55 gal drums ~700 lbs - fenced area near
SW corner of Carbide Bldg

Crude Tet - ~1% 55 gal drums ~379 lbs SE of Chlorination
Bldg

A36

3

Chlorinator Residue 10-20th Th 55 gal drums south of Chlor Bldg

NZS in Storage after First Carbide 583 drums } 1,053,747 lbs
11,640 bags }

NOM " " " 252 drums 176,400 lbs

NCT stored 96 36,365

NCT shipped 389 124,715

Chlor Res Stored 32 barrels 23,000

NZS in Second Run at time of insp 276,582 lbs

11-15-61 Insp Rpt STB 440 ^{issued 10-2-61} (40-5001) mined 10-2-61 as continuation
of STA-9 and C4922

C4960 exp 10-31-60 replaced by STA-9

Labeling & cont
exempt lic cond
8e

Aug 60 - Nov 60 purchased 1,724,506 lbs

No waste disposal to date

8/60	9/60	10/60	11/60	A36
744,838	89,100	285,131	605,437	= ? 1,724,506

last ore processed 10/60



No proc since 1/64

Interimtent 4/62 - 1/64

3-18-64

Insp Rpt STB 440

Nov 61 - Mar 64 4,611,023 lbs purchased 5-6% Th

3,045,445 processed

1,565,578 NZS on hand

No Th disposed of -

Field notes Carbide 163,516 (9.4%) Scrubben Residue (oxide) 163,717 (10.40%)

Old Mix 143,130 (1%) " " (Spent salt) 105,458 (1%)

Carbide Chloride Residue 300,000 (1.7%)

Fined Sand (5-6%) 150,000

1-28-65

Insp Rpt STB 440

Th remains in storage

No transfer or receipts since last insp

On hand NZS 540,110 lbs ~6% Th

145,422,000 lbs scrubber acid 20-40% Th
(348 drums)

Outside fenced end - ~500,000 "Th Slug" 3-5% Th

No proc since 1/64

Comprise entire inventory of source material

Field notes

1,565,578 lbs of NZS ~ 6% = 205,930 lbs Th

4% Th Scrubben residue 5,569,681 NZS @ 6% = 334,180 lbs Th

540,110 lbs Th total

384 drums 384 lbs = 145,422 lbs of scrubber oxide 20-40% Th

Waste slug 3-5% Th ~ .5 x 10⁶ lbs

Young

2-25-65 Memo to files

This (disposal) could present a major problem

H. Young

A36

7-14-66

Insp Rpt STB 440 renewed 10-1-64

Plant now owned jointly by American Metals Climax and Carbon.
No ops involving licensed materials since last insp 1-28-65

All licensed material has been maintained in storage since that time

add

NES 6%	1,541,415
Old mix 5%	479,655
One Carbide 4.5%	317,313
Scrubber Oxide Acid 5%	163,391
Carbide Chlor Residue 7%	53,678
Spent Salt 1.5% Th	105,450 ⁸

stored outside
 fenced en-losure →

10-20-66

LTR Carbide Metals Climax to Kern State

Vaporizer Residue at Plant 163,391 lbs ThO₂ 35.85% UO₂ 5.9%

Salt Residue 105,458 lbs Th 2.5%

Still Bottoms

ThO₂ 1.55%

5-2-67

Insp Rpt STB 440

No ops with RM since 1/64 -

All licensed material maintained in storage

No receipt or transfer since last insp

Some drums deteriorating - greatest number among carbide
> chlorinated residue outside main plant enclosure (south side)
~150 drums 20-25% bad

5-18-67

INQUIRY

In 1959-1960 licensee purchased 1,707,660 lbs N2S 4-6% Th

Licensee now has following inventory

✓ N2S	1.54×10^6	4-6%
✓ Old mix	4.4×10^5	4-5%
✓ Carb Chlor Res	5.37×10^4	7
✓ Sulfuric Acid Oxide Res	1.63×10^5	36-58
Chloride Salt Res	✓ 1.05×10^5	1.5-2.5
Carbide belt Pickings	✓ 5.98×10^4	4-6
Carbide	✓ 2.51×10^5	4-6

1750 drums @ 700 lbs ea

← 5-2-67 Ellis at Plant

Plt Mgr did not want expense of continued storage or
commercial burial - Was considering license appl for own burial
ground - similar to NPS where he had worked

A36

(7)

4-20-67 - Ritchey request help

5-18-67 Memo to files Ellis

5-17-67 Joe Hoff called and said plant now under AMAX
& he had resp to dispose of materials in storage
would (1) transfer to NECO Morehead Kentucky
(2) " " NFS West Valley, NY
(3) Secure license to bury at site

8-1-68 INSP RPT STB 440 Amend 1 11-14-67

No receipt of transfers since last insp in 5/2/67
Indicates Dump Area contact readings: 7m/hr on contact 4m/hr at 1'
(also says no release of effluents outside restricted area - rad level in unresd area < 0.6 m/hr.

Tentative plans to dispose Xfr to NECO or inter origin.
to Climax Uranium Co, Grand Junction Colo.

6-13-69 Ltr AMAX to AEC all material removed. Requests inspection
10-24-69 Ltr AEC(OML) to AMAX - Requests closeout survey report.

5-28-70 INSP RPT STB 440

Transfer of materials to NECO since last insp
→ Records of transfers maintained made between 10-68/5-69

Inventory - none "(nil)"

~ 2,000,000 lbs xfrd 30,000 lbs/truck ~ 70 trucks
\$ 50,000 +

NECO did all loading & transporting - used payloader

spent salts & scrub oxides	271,400
chlorinator residue	480,000
Nigerian ore oxide	1,540,000
Old mix Carbide	480,000
Carbide mix	388,000

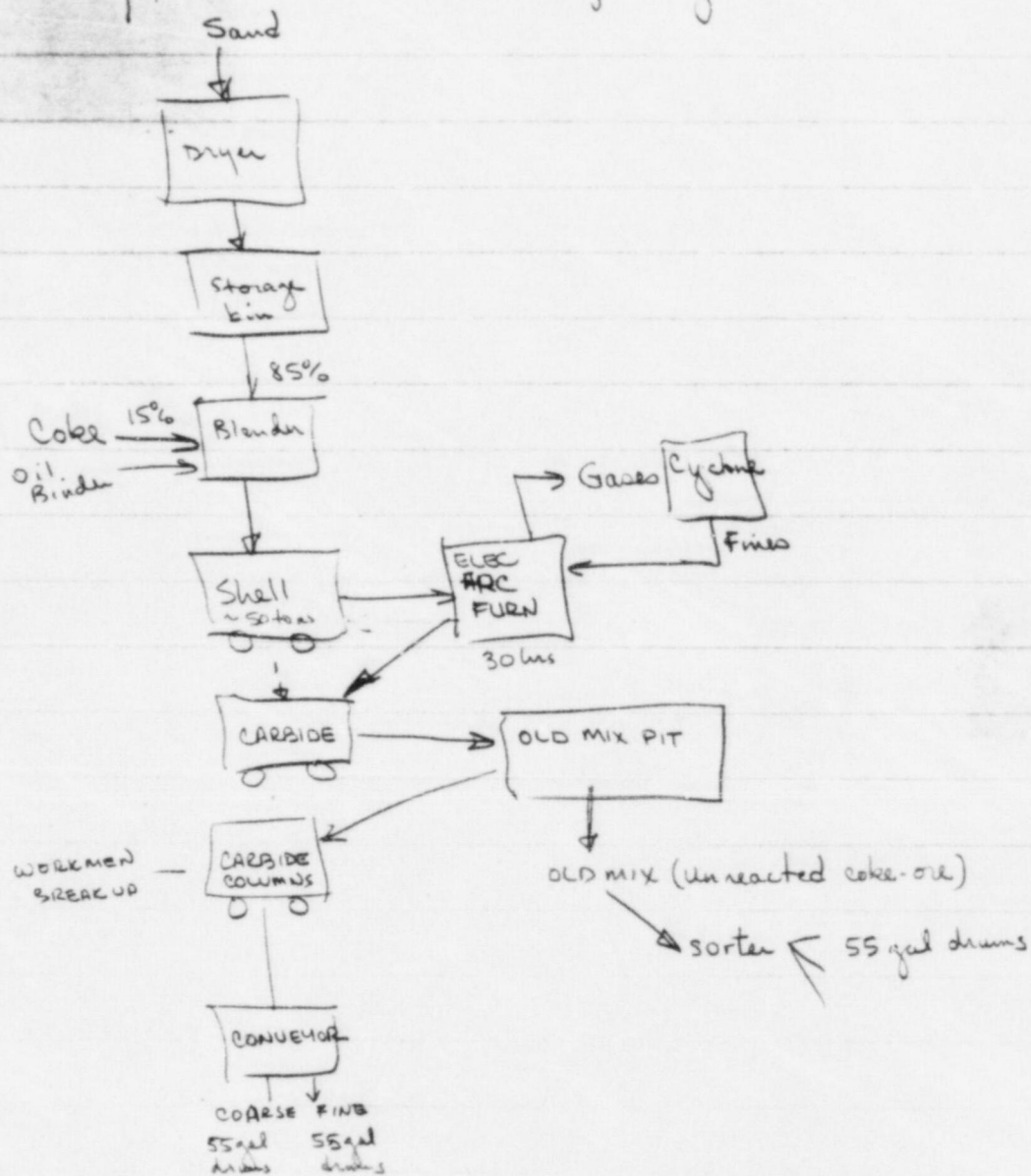
(OVER)

2,059,400

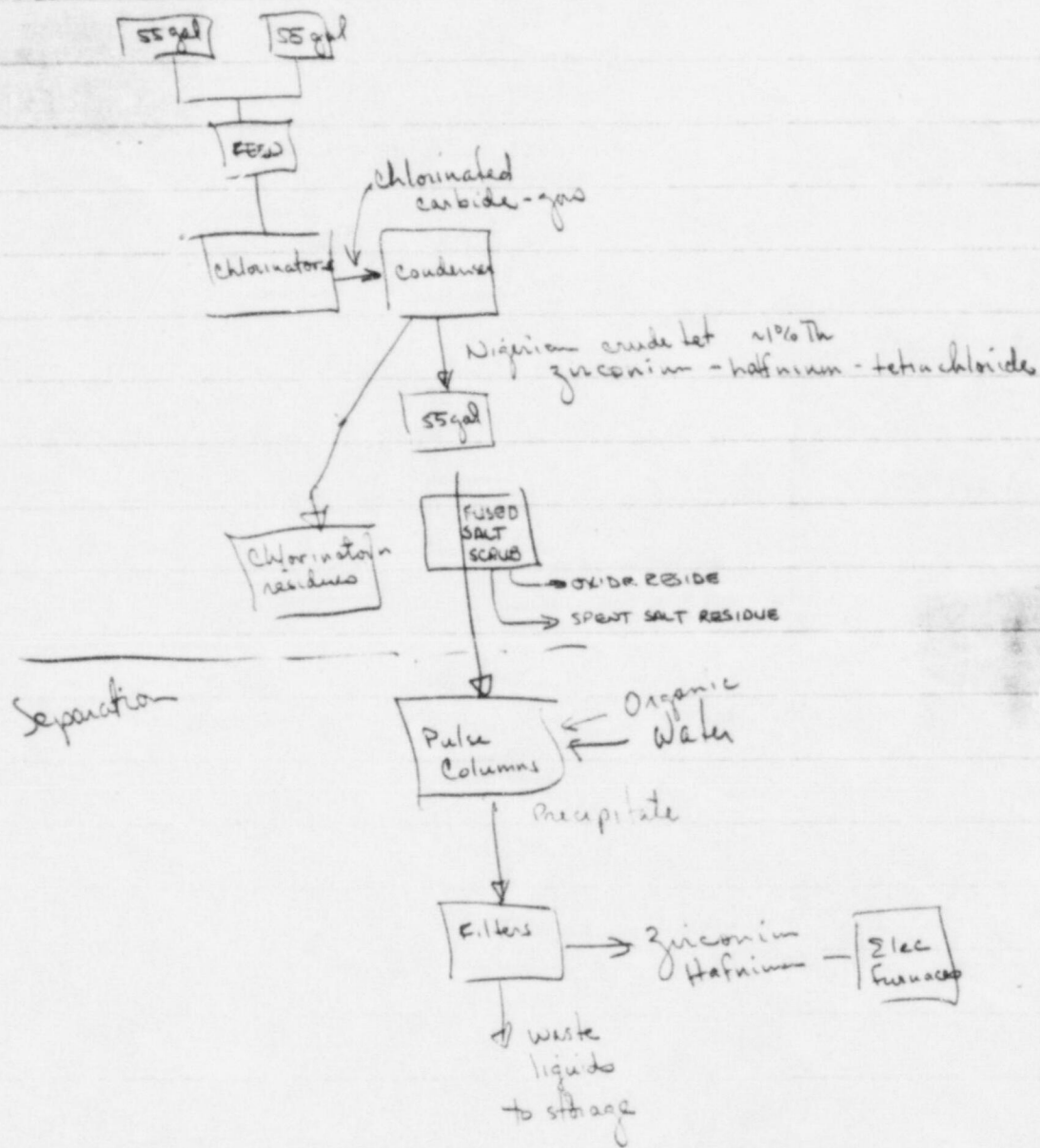
A36

Carbiding, Chlorination and crystallization

Carbiding



Chlorination



7-5-60

1,707,660 lbs (5.6% Th)

85,383 - 102,460

Sand stored 1,053,747 (5.6%) 52,687 - 63,225

Old mix 176,400 (6.7%) 10,584 - 12,348

Crude Tet 161,080 (1%) 1611

Chlorinator Res 23,000 (10-20%) 2300 - 4600

In Process Sand 276,582 (5.6%) 13,829 - 15,595

81,011 - 97,379

Assume error in Residue and compute %Th

6672 lbs - 9681 Th

29 - 42.1 % Th

11-15-61

+ 1,724,506 (5.6%)

Total ore purchased 3,432,166 (5.6%)

171,608 - 205,930 lbs Th

3-18-64

+ 4,611,023 (5.6%)

Total ore purchased 8,043,189 (5.6%)

402,159 - 482,591 lbs Th

*

1-28-65

Sand stored 1,565,578 (5.6%) 78,279 - 93,935

Th slug (sludge?) 500,000 (3.5%) 15,000 - 25,000

*

Can't make any sense of numbers

OFFICIAL USE ONLY

SUMMARY OF INVESTIGATION-RELATED CONVERSATION

CASE NO. II-C27	DATE 8/26/79	TIME INITIATED 1845	TIME COMPLETED 1855
TYPE ☐ MEETING ☐ INTERVIEW ☒ TELEPHONE CALL COLLECT ☒ YES ☐ NO ☐ OTHER		PARTICIPANTS Alderson/Delms Smith Smithville, West Virginia	
		CALLED NO. [REDACTED]	CALLING NO. 992/1860/Chg. To 221-5507

SUMMARY:

I called Mr. Smith to determine if he could provide any information regarding the burial of radioactive material at the Parkersburg, West Virginia, site. Mr. Smith stated that he worked at the site from April 1957 thru November 1974. He stated that he had been a member of the Safety Committee and that he had complained about the burial of Nigerian ore and Nigerian wastes to the Safety Committee "which included Jack Walters, Harvey Hite. Smith stated that he had dumped material himself including barrels which had been damaged and contained Nigerian ore and residue from the filter presses. Smith also indicated that ore and other materials would be buried by utility crews and that Bob Evans of Elizabeth, West Virginia, would know about that.

Smith indicated that he had filed a complaint with OSHA and with an organization he called NAOSH in Pittsburgh, Pennsylvania, but he believed that they had not wanted to get involved in the matter.

REVIEWED BY <i>Chafe Alderson</i>	DATE 8/27/79	PAGE OF
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2
Sect. Excavating.

Rt. 2 - go left

6 miles -

Rosemar Rd

Honda Dealer.

Go right. 5 mi to end
turn left
on right hand.

Mr. Morey - [REDACTED]

cat worked there in 1972

Dozer working for AHAX. I recall
because the D-6 cat. -

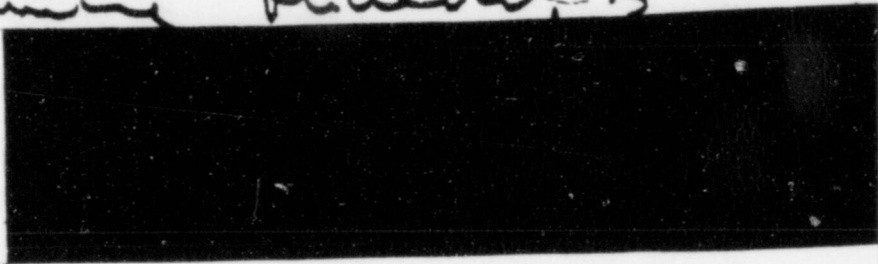
Bill Grant. [REDACTED]

J. D. Walters -

Dr. Sprue - Ritchie is working in
Florida.

~~call~~
~~1 p.m.~~ J. D. Walters - Titanium Metals
corp. Henderson, Nev.
(702) 564-2544
FTS 598-6011

John Ritchie -
Wyoming Minerals



Jo
Dave Clark

[REDACTED]
John Ragon - next to him

mini film - Dr. T.S. Bear

[REDACTED]

→ paper copies at 606
→ Bruce Reich

✓ Marie Woods - (304) 485-1891 - work
Punishment W. VA - News. [REDACTED]

✓ Charles Fuchs - Retired Carbonator
[REDACTED] - Marietta, Ohio.

George Wulfer - Union Carbide Corp
[REDACTED] Sistersville

✓ Harrison Kemp - retired carbonator
Across the street from Fuchs.

✓ George Fox -

— knows about Odis Westfall, Fox

Odis Westfall - Perry Machine Co.

Jim Duckworth Snelling & Snelling

Walt Parbo - L.B. FOSTER
Mary Ann Williams
[REDACTED]

① Camden Ave Exit.
GO RIGHT

② Take 95 So. to Pt. Pleasant

③ Intersection of Rt. 2
Four lane Hwy. on right
Make left at light.
Will turn into two-lane.

2 MILES FROM light.

Pass fire station -

9/10 mile - sign Dupont Circle
Go right - second lane on right

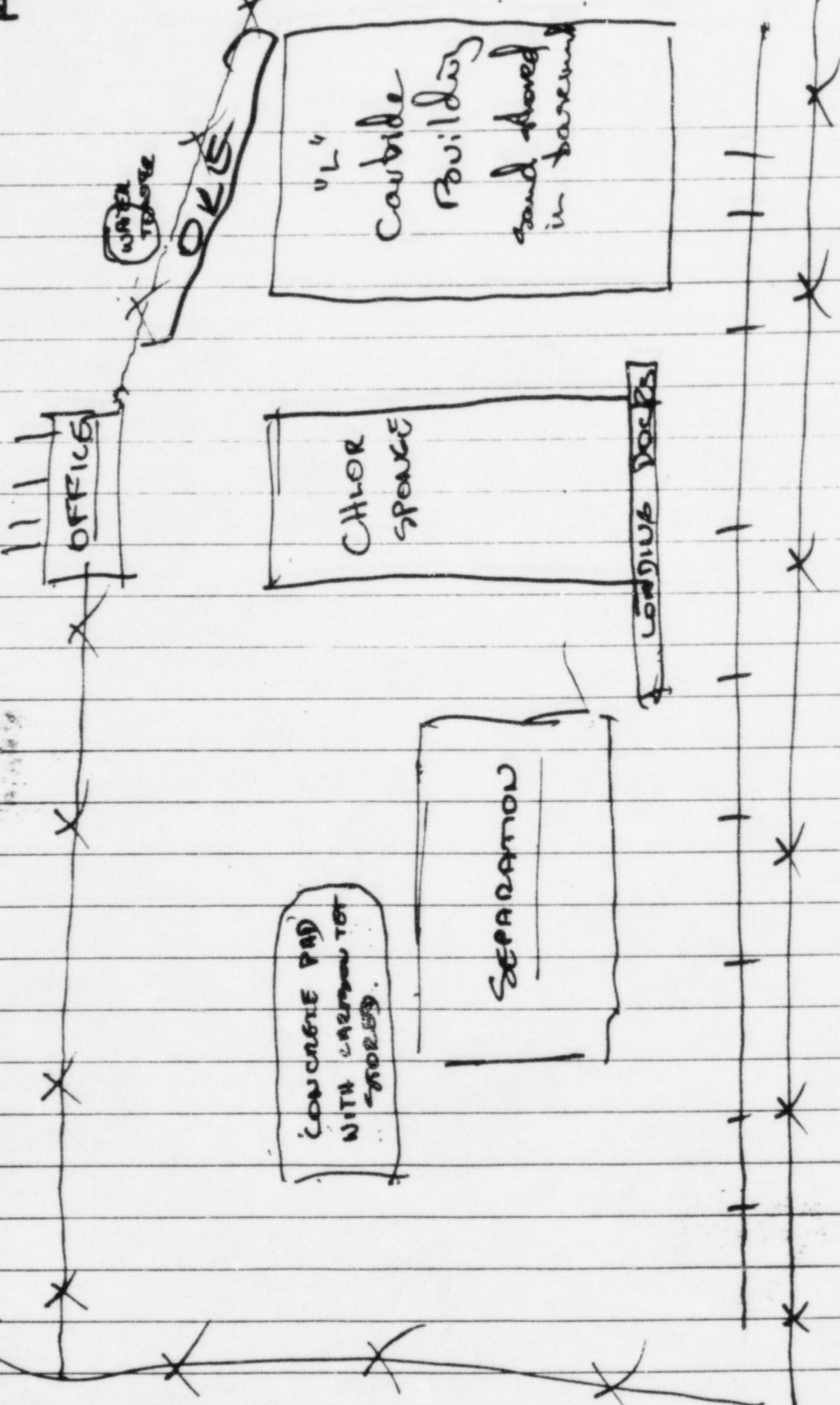
Sheriff L. W. "Lee" Bechtold
422-3559
422-3555 - Jail
Wood County Courthouse

① AMAX

- a. Records of transfer of ore in receipts etc. (previous uranium content)
- b. Any assay data on this ore as to %
- c. What % is residue?
- d. How many drums of residue
- e. Volume of residue generated in processing each ton of ore.
- f. Dry residue or liquid? (for)
- g. Slipunit of receipts from Maxie Flats & Chem Nuclear.

MAPS - show location.
Drum contractors -

Locate pyrophoric locations.



DUMP

OFFICIAL USE ONLY

SUMMARY OF INVESTIGATION-RELATED CONVERSATION

CASE NO. II-C27	DATE 8/14/79	TIME INITIATED 14:30	TIME COMPLETED 15:00
TYPE () MEETING () INTERVIEW (x) TELEPHONE CALL COLLECT () YES (x) NO () OTHER		PARTICIPANTS Alderson/McGuire/Ross Eberle	
		CALLED NO. [REDACTED]	CALLING NO. 221-5507

SUMMARY:

We contacted Mr. Eberle and informed that we were conducting an investigation regarding the Carborundum facility at Parkersburg, West Virginia. Mr. Eberle advised that his address was [REDACTED] and he is currently employed as a Production Engineer at G.E. Wilmington.

Mr. Eberle stated that he was employed by Carborundum and AMAX at the Parkersburg facility during the period 1957-1966 in positions of General Forman, Manager and Plant Manager. In September 1962, he was the Production Manager. I described the memorandum prepared by Barber, Baum, and Whipple of the University of Michigan dated September 17, 1962, and then asked Mr. Eberle if he could recall the circumstances surrounding the memorandum. He replied that waste residues were accumulated and were kept separated as to types, material was stored in drums "out back" and many of the drums deteriorated. He said that in some cases the material was just left in piles on the ground. We discussed the memorandum regarding waste generation rates and Eberle was unable to correlate waste generation rates with ore thruput rates and consumption rates. He did state that they normally processed approximately three loads of ore per week, each involving approximately 30,000 pounds of new ore.

He stated that they used Australian ore without radioactive materials until about 1962 and then went to the Nigerian ore because they had found it had a higher hafnium content. They eventually quit using the Nigerian ore because of the Columbium in the ore prevented proper operation of the plant. He stated that during the time he processed Nigerian ore, the plant operated at reduced capacity. Normal capacity was about one million pounds of zirconium output per year whereas with the Nigerian ore, about three hundred pounds of zirconium were produced per year. Mr. Eberle indicated that he had quite a few personal records that he had retained from his employment at Carborundum and provided the following information:

In 1960, 600,000 lbs. of Nigerian carbide was produced at an ore consumption rate of 3.5 lbs. of sand per pound of carbide.

In 1962, ^{877,000}~~800,077~~ lbs. of carbide was produced at a consumption rate of 1.9 lbs. of Nigerian sand per pound of carbide.

In 1963, 872,000 lbs. of carbide was produced at the same ore consumption rate as 1962.

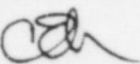
REVIEWED BY <i>[Signature]</i>	DATE 8-17-79	PAGE 1 OF 2
OFFICIAL USE ONLY 3 INFORMATION CONTAINED MAY BE EXEMPTED FROM DISCLOSURE BY FOIA (5 USC 552(b)(2)) AND/OR PRIVACY ACT (5 USC 552a(k)(2))		B3

SUMMARY OF INVESTIGATION-RELATED CONVERSATION (CONTINUATION SHEET)

Eberle stated that to the best of his knowledge none of the radioactive residues or ore were buried on site; however, he felt that some of the material from the deteriorated drums may have been buried unknowingly.

I asked Mr. Eberle if he knew the whereabouts of Mr. George Chapman, a previous Plant Manager, and was informed that Mr. Chapman had been dead for approximately five years.

I asked Mr. Eberle if he had been contacted by anyone from Carborundum, AMAX or L. B. Foster Company regarding this investigation or the problems at the Parkersburg site and was informed that he had been contacted by Dr. Kall approximately a year ago who asked him to provide a statement regarding his experiences and recollections. He stated that he provided two or three pages of material to the Dr. Kall.

Eberle stated that he was going on vacation starting 8/15/79 for approximately two weeks. I told him if I needed additional information, I would call him when he returned. 

PAGE 2 OF 2

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B3

INVESTIGATION CHRONOLOGY

CASE NUMBER II - C.27

DATE/TIME

ACTION TAKEN

6/28/78

8:40 p - Anonymous phone call
"Quit nosing around. People
want to keep their job.
Stop scaring the feds!
Leave us alone."

INVESTIGATION CHRONOLOGY

CASE NUMBER

DATE/TIME

ACTION TAKEN

DATE/TIME
6/3/21 5:1

Harry Johnson - Chief Engineer
Contractors - open to
business angles soon.

3. Bill Grant. Also taking
Oliver Younger - with
research records.

(1) Wm. (Buck) Talbot - co.
owner SET EXCAVATING
contract 1142 floor
on upper section.
about 1000 sq ft
work 1142

1907

... ..

34.

INVESTIGATION CHRONOLOGY

CASE NUMBER

DATE/TIME

ACTION TAKEN

6/08/18 (cont)

will furnish records.

- (2) Jennie Hammond - Mary Conrad
(3) Martin Eddy - Owner, Set. Engine
Saw pyrophoric reactions
Had to tell bulldozer
flaking - "eaten up"
(4) Darrel DRAIN - operator
(5) Ron FRYE - operator

Don't let my reminder
forget your brother, John and
determined words —
may 11. 1895. The paper
section may like.

The above is a list of the
 names of the persons who
 were present at the meeting
 held at the residence of
 Mr. J. H. Smith on the
 10th day of January 1881.
 The names are written in
 the order in which they
 were present.

9

II - 627

ACTION TAKEN

11:30a - Redwood Stan Thicke's call.
NIECO will furnish all appropriate
equipment and dorsal records
to AMAX. We will get copies
as soon as AMAX receives them.

1:00p. Meeting in JPO's office
with AMAX (Thielke, attorney
ATCOR) L.B. Foster (Bledsoe -
Reid/Douglas - Alan Ackerman, attorney
Curran - attorney. Surgery
proposed in excruciating detail
to be made to most
suspicious.

Wm. - Plow - and to Marie - 100.

[illegible]

The first of these is the fact that the
 system is not a simple one. It is a
 complex one, and it is not possible to
 describe it in a few words. It is a
 system of many parts, and it is not
 possible to describe it in a few words.

CASE NUMBER

ACTION TAKEN

3rd. - Placed in the ...
but ...
... of ...
... ..

5445p: run 12000. From 12000, 12000
of 12000. Hygiene. 12000
monte Carlo for my 12000
records. 12000 to 12000.
12000.

1115. - J. P. ... but ...
... content ...
... about ...
... to ...
... response ...
...
... P. ...

(4)

INVESTIGATION CHRONOLOGY

CASE NUMBER C-27

DATE/TIME

ACTION TAKEN

5/15/78

1:00 p - Meeting with Potter, Alderson, J.P.O'R and E.C. Foster people: Mr. Ford - Eastern Aven Manager, Mr. Bledsoe, Atlanta manager and Mr. Reed - attorney. Ford expressed disappointment with our perceived nonresponsiveness. He wanted a written report.

J.P.O'R responded and explained the NRC position:

- ① NRC did not permit any burial.
- ② AMAX must be responsible for any cleanup.
- ③ AMAX will submit survey proposal to NRC - no time limit.

Foster attorney thought that Carbonadium was also responsible. Explained that this was a joint venture and AMAX inherited the operation. Foster requested sample of all 5 wells. Site is safe, provided restrictions of 10 CFR 20 are observed.

(4)

INVESTIGATION CHRONOLOGY

CASE NUMBER C-27

DATE/TIME

ACTION TAKEN

5/15/78

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INVESTIGATION CHRONOLOGY

CASE NUMBER

II - C 27

DATE/TIME

ACTION TAKEN

5/10/78

3:30p - Received additional statement from John Douglas, attorney for E. B. Foster Co. He said that he would cooperate with me in any possible way.

5/11-12/78

— Investigation on site. Contacted the following:

Marie Woods - (304) 485-1891 - work
Newspaper person

Charles Fuchs -
retired - Carborundum

Harrison Kemp - retired utility foreman

George Wolfert - Union Carbide Lab
Sistersville, OH

Tom Smith - deputy sheriff.
former summer worker.

Bob Patton -

Former worker. Pt. Pleasant, Depue

Jim Duckworth - (304) 428-8221 - work
SNEELING & SNEELING

(3)

INVESTIGATION CHRONOLOGY

CASE NUMBER IT-C27

DATE/TIME

ACTION TAKEN

5/12/78

Interviews cont.

Douglas Shively - [REDACTED]
[REDACTED]

Brother - Donald Cunningham
same address & phone.

Hatzell Kendall - truck driver

Bob Evans - shifty employee

Now resides at [REDACTED]

Walt Paulo - Plant Manager

FTS 923-1511 [REDACTED]

Summary: It appears that an unknown number of drums, previously brought for commercial disposal, were buried on site. (confirm - Patton and Shively) Cunningham!

5/15/78

11:30a - Briefed Alderson and J.P. OR. Going back is not necessary at this time. Will write memo to files.

INVESTIGATION CHRONOLOGY

CASE NUMBER II - C 27

DATE/TIME

ACTION TAKEN

5/9/78

8:30a - Talked to Dick Woodruff re the AMAX case. Also examined the docket. It appears that approximately 1750 drums of zirconium tetrachloride waste were involved and identified by compliance inspectors from Atlanta. A letter to AEC (David Low) by J. W. Walters, AMAX project Manager of June 13, 1969 states that all radioactive material was shipped to Nuclear Engineering Co. Inc. Morehead, Ky for burial.

1:30p - Contacted Mr. Bruce Reichle, NECO and requested information re above. Please log.

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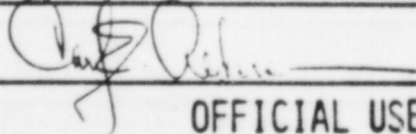
SUMMARY OF INVESTIGATION-RELATED CONVERSATION

CASE NO. II-C27	DATE 8/26/79	TIME INITIATED 1805	TIME COMPLETED 1815
TYPE ☐ MEETING ☐ INTERVIEW ☒ TELEPHONE CALL COLLECT ☒ YES ☐ NO ☐ OTHER		PARTICIPANTS Alderson/James Cunningham 	
		CALLED NO. 	CALLING NO. 992-1860/Chg. To 221-5507

SUMMARY:

I contacted Mr. Cunningham to confirm information provided by attorneys for L. B. Foster Company regarding an interview with Mr. Cunningham on May 31, 1978. In the memorandum to file prepared by the attorney he stated that Cunningham had said that many of the drums ^{that} contained radioactive Nigerian zirconium were set out in a field. The time came when AMAX took over and these drums were hauled away, but he is also aware that some of the material got buried in the dump area. Cunningham told me that the material was setting out in a field as he had stated, That he remembered chemists or persons from the lab surveying the drums and not getting anything on their "counter". He said that part of it was hauled away and he doesn't really know what happened to it. He feels that some of the drums may have broken and the material washed out into the field.

Cunningham suggested that I call James Duckworth who was the chemist in charge at the time and stated that he believed that Duckworth lived in

REVIEWED BY 	DATE 8/27/79	PAGE / OF /
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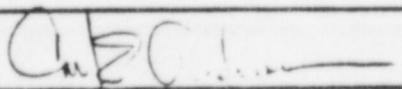
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SUMMARY OF INVESTIGATION-RELATED CONVERSATION

CASE NO. II-C27	DATE 8/26/79	TIME INITIATED 1750	TIME COMPLETED 1757
TYPE ☐ MEETING ☐ INTERVIEW ☒ TELEPHONE CALL COLLECT ☒ YES ☐ NO ☐ OTHER		PARTICIPANTS Alderson/Wayne B. Cayton, Sr. 	
		CALLED NO. 	CALLING NO. 992/1860/Chg. To 221-5507

SUMMARY:

I contacted Mr. Cayton to confirm information that he had provided to attorneys for L. B. Foster Company in June 1978. The documents provided by the attorneys indicated that Cayton had stated that whenever anything was yielded in the operation . . . that looked like scrap or trash . . . went into the dump . . . this was true for both the radioactive residues . . . Cayton stated that this was true, that waste from the Nigerian ore was taken to the dump just like waste from other ores that was processed. Cayton indicated that his concern was that these wastes would get into the drinking water table and he indicated that he had discussed this with George Chapman who at the time was plant manager. Cayton could not remember specifically when these materials were buried, but he believed that it was after AMAX had bought into the venture. I also asked Cayton about the statement attributed to him; that is, "That AMAX buried some of the Nigerian residues . . . many of these residues were put into drums and buried along with other trash". Cayton acknowledged ^{the} validity of that statement. Cayton suggested that I contact Delmis Smith of stating that he had a lot of the information documented.

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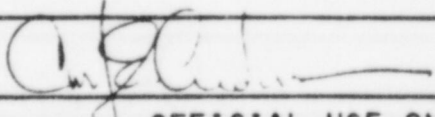
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SUMMARY OF INVESTIGATION-RELATED CONVERSATION

CASE NO. II-C27	DATE 8/26/79	TIME INITIATED 1705	TIME COMPLETED 1715
TYPE ☐ MEETING ☐ INTERVIEW ☒ TELEPHONE CALL COLLECT ☒ YES ☐ NO ☐ OTHER		PARTICIPANTS Alderson/Harrison C. Kemp	
		CALLED NO. [REDACTED]	CALLING NO. 992-1860/Chg. To 221-5507

SUMMARY:

I contacted Mr. Kemp to verify information provided by the attorneys for the L. B. Foster Company. Their memorandum to file indicated that Kemp had said that residues would be stored in drums and some material was sold while some was also placed in the dump. Kemp told me that he could not say positively that any of the material placed in the dump was radioactive. He said that that conclusion was based on statements made by other people. The attorney's memo also stated that Kemp believed much of the ore was placed in drums and buried. Kemp informed me that they did bury Nigerian ore. In response to my question as to "How you knew that it was Nigerian ore," he said that "The bags were marked Nigerian ore". He also stated that every Monday morning his crew would cleanup the various parts of the plant and the residues were taken to the dump or were sold. He stated that the lab didn't tell him which materials were radioactive and which weren't. He also stated that all residues were buried as far as he knew including residues from the processing of Nigerian ore. Kemp left employment at the site approximately nine years ago. He was unable to recall the timeframe that the Nigerian ores or residues were buried.

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PHONE CALL RECORD

DATE: 8/9/78 TIME: 9:10a CALL: in ☐ out ☒

INDIVIDUAL CALLED: STAN THIELKE
Phone No. 215 644-9350
INDIVIDUAL CALLING: ANNAST
Phone No. (404) 221-5611
A MAX

SUBJECT OF CALL: RETURN OF MR. THIELKE'S CALL

M.F.R. OF CALL: He wanted to confirm our receipt of the shipment info from NIECO. I confirmed that we had copies of the information.

II-C27