THE CARBORUNDUM COMPANY DOCKET NO. 40-5001
Policy.

THE CARBORUNDUM METALS COMPANY DIVISION
P. O. BOX 33 · AKRON, NEW YORK

May 15, 1961

U. S. Atomic Energy Commission
Washington 25, D. C.

Attention: Mr. J. C. Delaney
Chief, Nuclear Materials Branch
Division of Licensing and Regulation

DOCKETED
MAY 22 1961
Licensing Division of Licensing and Regulation Docket Office

Reference: 40-5001
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Gentlemen:

In your memorandum dated January 10, 1961, which accompanied our Source Material License (License No. STA-9), additional information was requested with regard to our organization, our radiation safety program and surveys, and other pertinent areas related to the processing of a thorium-containing ore. We have attempted to answer each of the ten points in order and to the best of our ability.

1. Source Material License STA-9 authorizes the Carborundum Metals Company to process ore containing thorium for an additional period of six months.

   The information below sets forth the organizational relationships, including authority and responsibility of each level of management and/or supervision in regard to development, approval and adherence to operating procedures.

   To insure adequate and satisfactory radiation protection, the service of Dr. Whipple, Consultant, and/or his associates are retained to carry out certain parts of the radiation safety program and to advise on radiation safety programs. The responsibility and authority of Dr. Whipple and/or his associates in prescribing procedures, operational and equipment modifications are set forth herein.

   a. General Responsibility

      Development and Approval of Operating Procedures - General responsibility for the development and approval of operating procedures rests with the Technical Branch of the Carborundum Metals Company under its manager, Mr. William W. Stephens with subordinate authority and responsibilities vested in the Assistant to the Manager, Dr. Donald R. Spink.

      In a consulting capacity, the services of Dr. Whipple and/or his associates will be used as deemed necessary or advisable.

      Execution and Adherence to Operating Procedures - The general responsibility for the execution and adherence to operating procedure will rest with the Plant Manager, Parkersburg Plant, Mr. George L. Chapman. Under the general responsibility of the Plant Manager, specific subordinate

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authority and responsibilities rests with supervisory personnel as outlined below according to the sequential phases of the production process.

In a consulting capacity, the services of Dr. Whipple and/or his associates will be used on problems involving the execution and adherence to operating procedure.

b. Specific Responsibilities (Sequential phases of the Production Process)

Phase I - Receiving, Material Handling and Storage of Raw Material - The responsibility and authority for the receiving, material handling and the storage of raw material rests with the Plant Engineer, Mr. Arthur Tuttle with subordinate supervisory responsibility and authority vested with the Utility Group Foreman, Mr. Leland Brooker.

Phase II - Bin Storage, Mixing, Carbide Furnacing and Storage of Zirconium Carbonitride - The authority and responsibility for the bin storage and mixing of zirconium, carbide furnacing and storage of zirconium carbonitride rests with the General Foreman of the Furnace Section, Mr. Ross Eberle with subordinate supervisory responsibility and authority vested in the two Assistant General Foremen, Furnace Group, John Bell and Frank Debo and the four Foremen, Messrs. Clark, Kellar, Stebbins and Stone.

Phase III - Receiving of Zirconium Carbonitride, the Chlorination Process and the Separation Process - The authority and responsibility for the receiving of zirconium carbonitride, the chlorination process and the separation process rests with the General Foreman of the Chemical Section, Mr. Harold Young with subordinate supervisory authority and responsibility vested in the Assistant General Foreman, Mr. Durward Snider and the four Foremen, Messrs. Gaston, Haller, Lewis and Ott.

Phase IV - Raw Material and In-Process Material Analysis - The raw material and in-process material analysis authority and responsibility rests with the Laboratory Manager, Mr. George Wulfert.

Phase V - Supply and Outfitting of Protective Gear for Personnel, Warning Signs and Plant Security - The authority and responsibility for the supply and outfitting of protective gear for personnel, warning signs and plant security rests with the Personnel Manager, Mr. Robert L. Hoye with subordinate authority and responsibility vested in Mr. Virgil Reeder, Supervisor Plant Protection and Safety.

Graphic Presentation of the Organization Relationships Expressed Above

Attached hereto is Figure 1, which is an organization chart indicating the line and staff relationships involving the development and approval, and the execution and adherence to operating procedures for the processing of zirconium ore containing thorium.

2. When Carborundum Metals first ventured into the processing of thorium-containing ores, we were without experience or knowledge of the problems to be faced. For these reasons, we secured the services of environmental health physics experts who were well acquainted with the AEC regulations and the organization of an adequate radiation safety program. These consultants, Dr. G. Hoyt Whipple et al, have developed the existing program and have provided requested surveillance

of the program. Their services have included training of people to conduct the necessary surveys on a routine schedule. As experience is gained within the organization, all of these operations will become routine and we will be able to reduce our reliance on our consultants to the point where they will only audit our practices, similar to the role of the AEC inspection teams. It will be the prime duty of our consultants to survey our operations and radiation safety program to make certain that we comply with pertinent governmental regulations. The administration of the radiation safety program rests with the Plant Manager, Parkersburg.

3. The Parkersburg plant is completely enclosed by a high wire fence (with barbed wire superstructure). A guard is on duty 24 hours each day and no unauthorized entries are allowed.

4. In view of the new MPC's for soluble and insoluble thorium, liquid effluent contamination is not expected to be a problem; consequently, the routine collection of one 100 ml. sample each week is thought to be adequate and probably unnecessary. Routine methods of processing the liquid samples have not yet been suggested but two possibilities exist.

   a. The total 100 ml. may be boiled down to dryness in a planchet and activity of both solubles and insolubles determined.

   b. The insoluble material may be filtered off and filtrate and residue counted separately.

   Method a. is the simpler of the two and is now the method of choice. After the sample is thoroughly dry its alpha activity should be determined 100 hours post collection in the proportional counter described under item 6 and the concentration of the effluent calculated from the formula provided in paragraph 6 of the memo dated July 25, 1960 after appropriate correction to comply with the new 10CFR20, that is:

$$\mu c/_{ml} = 2.3 \times 10^{-6} \times \frac{(\text{net 100 hr. c.p.m.})}{(\text{vol. in ml.})}$$

   Each liquid effluent sample should be taken at a point down stream of the junction of the surface drainage, process drainage, and sanitary sewers to the common sewer which ultimately discharges into the river.

5. The flow of materials through carbide production and carbide chlorination is indicated on drawing L-903. This drawing also includes points of dust generation from the related equipment. The details of the fume system, including locations, capacities and stack heights are given on drawings L-302, L-303, L-308, and D-307.

   The operation of the fume system for each of the two departments is described as follows:

   a. <u>Carbide</u>

   There are three individual fume systems which can be combined into one system with the capability of exhausting 40,000 CFM of air at the carbide

furnace. The carbide furnace operates only when peak-power is available. At this time, all the available exhausting capacity is used at the carbide furnace and all other operations are normally shut down.

During the period when the carbide furnace is shut down, a 20,000 CFM exhaust systems remains connected to the carbide furnace and the two remaining 10,000 CFM exhaust systems are diverted to individual operations as indicated on drawing L-302 and L-303.

However, when the carbide is dumped from the carbide cars into the dumping pit, the two 10,000 CFM exhaust systems are combined to give an exhausting capacity of 20,000 CFM at the dumping pit. This operation takes place approximately once every <u>two days</u>.

b. <u>Carbide Chlorination</u>

In general, the apparatus in carbide chlorination does not release fumes to the atmosphere during normal operating conditions. However, an adequate fume system is provided for the following intermittent operations during which fumes are evolved.

(1) Each chlorinator is fed with carbide every eight hours. At this point, there is a feed chute equipped with a fume hood having a capacity of 1800 CFM.

(2) Individual chlorinators are shut down and residues are removed on the average of once every five weeks. At this point, there is a flexhaust and portable hood capable of exhausting 750 CFM.

(3) It is expected that residues of ZrO_2, ThO_2, and $ThCl_4$ will be removed from the vaporizer approximately once every four hours. At this point, there is an exhaust capacity of 750 CFM.

6. The method of air sample collection and analysis was described in paragraph 3 of the Whipple et al memorandum dated March 10, 1960 and paragraphs 6 and 7F of the memo dated July 25, 1960. Copies of both of these memoranda have been sent to the Division of Licensing and Regulation.

Samples of airborne dust are taken with high volume air samplers manufactured by General Metal Works, Cleves, Ohio. Air is drawn through 4-inch diameter Whatman No. 41 filter paper disks at a maximum rate of 25 cfm. until the flow rate falls to 18 cfm. or for a period not to exceed 10 minutes. The filter paper is then removed from the sampler, folded in half, placed in a small envelope and labelled with identifying information. The envelope containing the filter paper is taken to the counting room where 25 percent of the total filter area is removed by cutting a circular disk from the filter to fit inside a 2 -inch, stainless steel planchet. The alpha activity of the sample is then determined, 100 hours post collection, in a Nuclear Measurements Corporation, Model PC-3, gas (P-10) flow proportional counter. Concentrations in the sampled air are calculated from the formula provided by paragraph 6 of the July 25, 1960 memorandum, and corrected to reflected changes in 10CFR20, that is:

$$\mu c/_{ml} \text{ (air)} = 1.1 \times 10^{-10} \times \frac{\text{(net 100 hr. c.p.m.)}}{\text{(Vol. in cu. ft.)}}$$

Performance of the proportional counter should be checked at least once each day with the calibrated alpha standard and the background should be counted at least twice a day. The background should be maintained at 1 c.p.m. or less.

7. A proposed routine air sampling schedule was provided in the memo dated July 25, 1960 and is repeated below. The schedule provides the number of sampling locations in each area as well as the sampling frequency. Sampling locations have been picked at the points where operators work and which we have found to contain the highest levels of air-borne contamination. Occupancy factors are included. Each of these areas is indicated on drawing L-903.

Routine Air Sampling Schedule With Occupancy Factors

Area		Location	Frequency	Occupancy Factor
Carbide	1.	ore and coke hole - outside	1 per week during loading	0.20
	2.	locker room - main floor	1 per week	1.0
	3.	control room - 2nd floor	1 per week	1.0
	4.	main floor	1 per week	1.0
	5.	catwalk - 2nd floor	1 per week	1.0
	6.	car pulling - main floor	1 per car	0.20
	7.	carbide sorting - main floor	1 per car	0.20
	8.	drumming operations - main floor	1 per car	0.20
Chlorination	9.	feeding carbide - 3rd floor	1 per week	0.02
	10.	bed residue pull - main floor	1 per residue pull	0.07
	11.	fused-salt scrubber - 2nd floor	2 per week	1.0
	12.	general area - main floor	1 per week	1.0
	13.	change room	1 per week	1.0
	14.	lunch room - 2nd floor	1 per week	1.0
Off-site		four directions from plant at nearest neighbor	continuous	

8. Program for use of respiratory protective equipment.

   a. Only Mine Safety Appliance Company "Comfo" filter respirators with M. S. A. type H Ultra Filter cartridges are to be used in the carbide and chlorination

areas during processing of Nigerian ore. (According to the M. S. A. catalogue, the type H Ultra Filter is intended for use in atmospheres containing "highly toxic radioactive dusts."

b. A necessary routine for respiratory protection consists of daily cleaning, fitting, and testing each respirator.

   (1) Fitting consists of proper wearing of the respirator according to the manufacturer's recommendations and juggling of respirator parts until a reasonably comfortable fit is achieved without leakage of air about the face piece and without crimping of nasal passages.

   (2) Testing includes inspection of all parts of the respirator and a leakage check with the respirator on the wearer.

   (3) Cleaning and disinfection of each respirator on a routine schedule is very important. A respirator is a very personal device and the extent to which it is used by an individual will depend upon how well it is maintained. The filter cartridge should be removed and inspected daily. With the filter cartridge removed, the respirator is to be scrubbed with soap and water each day before use. In no case are respirators to be used by more than one employee unless it is completely disinfected with materials, which will be supplied, and a new filter cartridge installed.

c. Enforcement of the respiratory protection program is vested with the Plant Manager. The importance of a routine respirator maintenance program will be stressed and frequent cleaning, testing and fitting demonstrations will be incorporated into our existing safety program.

d. Operating areas are swept down daily and sometimes each shift. Some of these areas are hosed down at frequent intervals.

9. The attached drawings (L-302, L-303, L-307 and L-308) adequately describe the various fume collection systems, including the discharge stacks. The effluent discharged from the fume collection systems consists primarily of a very fine ($<5\mu$) dust. Those fume systems located in the carbide building contain high efficiency cyclones to remove larger ($>5\mu$) particles. The concentration of radioactive materials in the final effluent on a weight basis is less than that of the raw materials being used. Many precautions have been incorporated when processing thorium-containing ores, which greatly reduce the amount of fine dust produced during the routine operation. Fortunately, the crude zircon, which contains thorium, averages plus 60 mesh whereas the normal zircon used (without thorium) is minus 80 mesh. Consequently, considerable less dust is produced with the thorium-containing zircon.

   Gelman Instrument Company, catalogue No. NA-7, air sampling units are used to continuously collect air samples at off-site locations. The units sample at a rate of 2 cubic feet per minute. The sampling rate is controlled by a built-in limiting orifice. The amount of air sampled is recorded by a dry gas meter, while the sampling time is shown by a time meter. Two-inch diameter AM-4 membrane filter disks obtained from the Gelman Instrument Company were used in these units.

Filter membranes are changed at 24-hour intervals. The activity is determined 100 hours post collection in the above described proportional counter and air concentrations determined according to the formula:

$$\mu c/ml. \text{ (air)} = 1.4 \times 10^{-11} \times \frac{\text{(net 100 hr. c.p.m.)}}{\text{(vol. in cu. ft.)}}$$

10. We have not written radiological safety operating instructions and note that, although the revised regulations require instruction of employees, there is no formal requirement in the regulations that these instructions be written. We feel that written instructions would be of questionable value at CMC, but if absolutely necessary, we shall prepare a set of instructions as soon as a full-stream operation is routine and firmly established.

A brief resume' of our progress on the processing of the thorium-containing ore may be pertinent. We have processed no thorium-containing ore since September 1960. At that time, difficulties were encountered because of the presence of some 1% columbium in the ore, which prevented subsequent separation of hafnium from zirconium in our liquid-liquid extraction system. To date, we have not completely resolved this problem so do not know when processing of the thorium-containing ore at Parkersburg will commence. We presently have 625 tons of thorium-containing ore in inventory at Parkersburg, which may go as high as 5000 tons; thus, we request that future source material licenses allow us to possess up to 5000 tons of thorium-containing ore.

Since we are uncertain as to when we will recommence our operations on ore containing thorium, we would appreciate an extension of the present license, which expires on June 30, 1961, to at least the end of 1961 and preferably to June 30, 1962.

If any further clarification of the information presented herein can be provided, you will find us most cooperative.

Very truly yours,

THE CARBORUNDUM METALS COMPANY

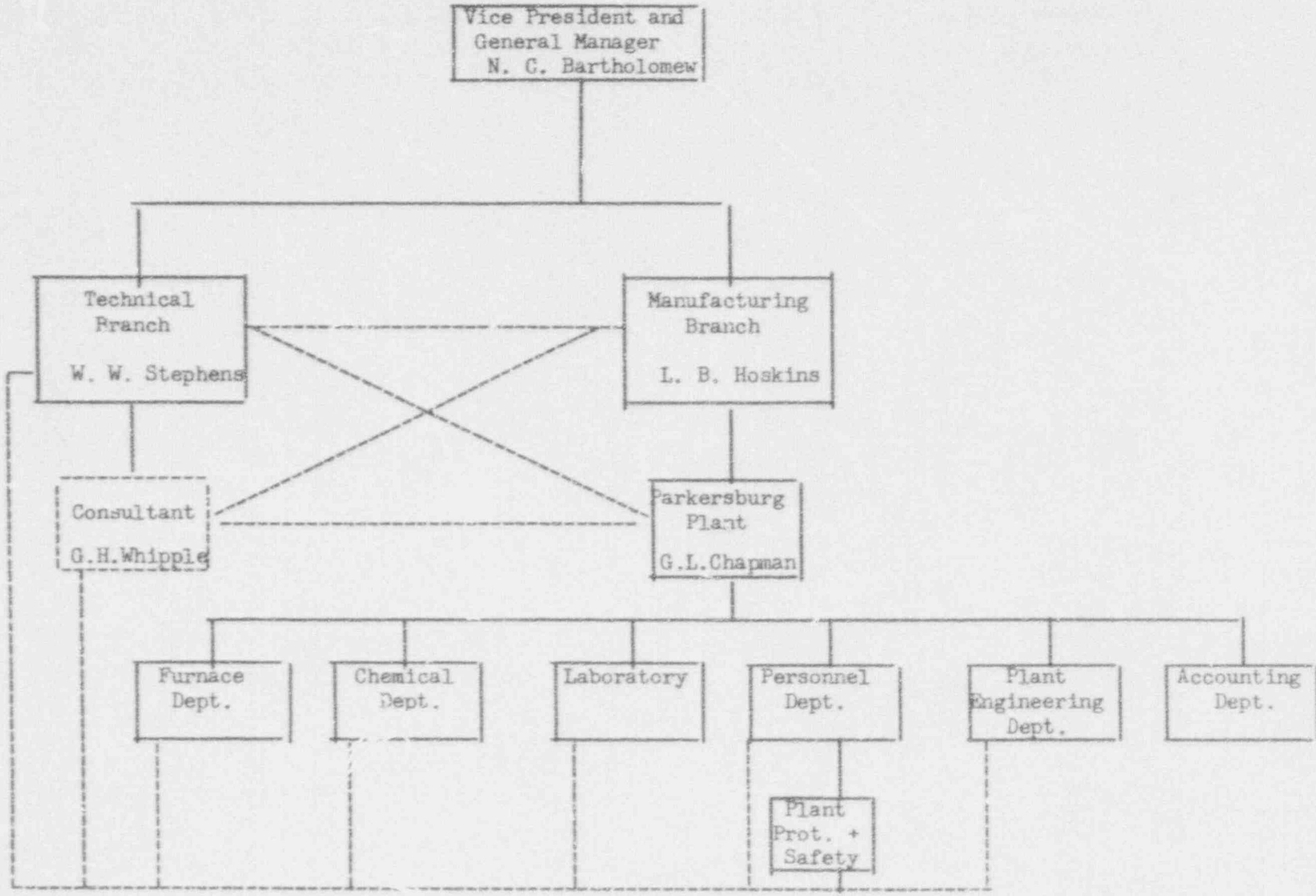
Donald R. Spink

Donald R. Spink, Assistant to Manager
Technical Branch

DRS:mc

Attachments

Figure 1



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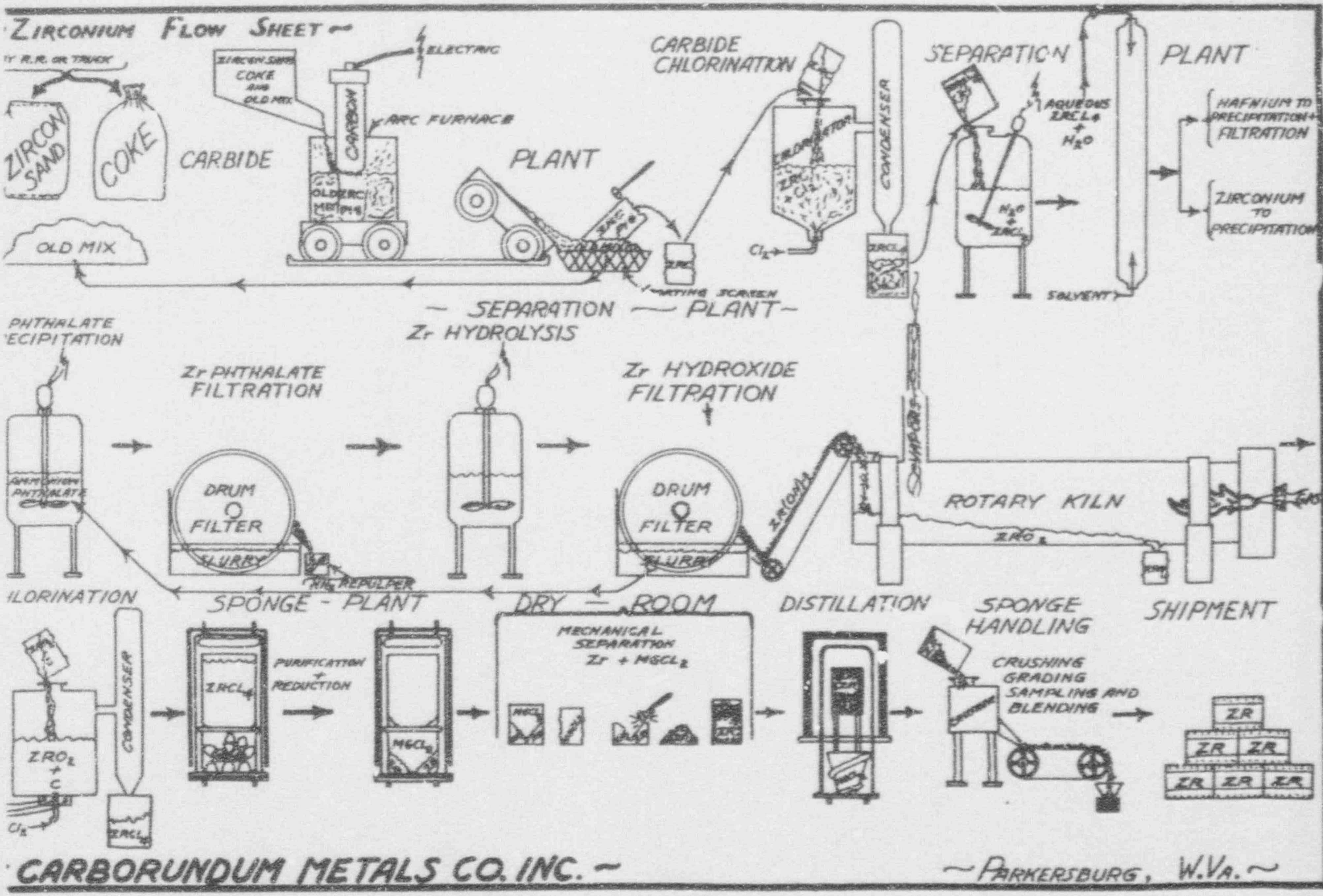
ZIRCONIUM FLOW SHEET
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CARBON
ARC FURNACE
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CARBIDE CHLORINATION
CONDENSER
Cl_2
$ZrCl_4$
SEPARATION
AQUEOUS $ZrCl_4$ + H_2O
H_2O + $ZrCl_4$
SOLVENT
PLANT
HAFNIUM TO PRECIPITATION + FILTRATION
ZIRCONIUM TO PRECIPITATION
— SEPARATION — PLANT —
PHTHALATE PRECIPITATION
AMMONIUM PHTHALATE
Zr PHTHALATE FILTRATION
DRUM FILTER
SLURRY
REPULPER
Zr HYDROLYSIS
Zr HYDROXIDE FILTRATION
DRUM FILTER
SLURRY
$Zr(OH)_4$
VAPORS
ROTARY KILN
ZrO_2
GAS
CHLORINATION
ZrO_2 + C
Cl_2
CONDENSER
$ZrCl_4$
SPONGE - PLANT
$ZrCl_4$
PURIFICATION + REDUCTION
$MgCl_2$
DRY — ROOM
MECHANICAL SEPARATION Zr + $MgCl_2$
DISTILLATION
SPONGE HANDLING
CRUSHING GRADING SAMPLING AND BLENDING
SHIPMENT
ZR
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