TO: FILE MAY 5, 1988

FROM: DON HULL

RE: OWENS-ILLINOIS GLASS PLANT IN PORTLAND, OREGON

On May 2nd, 1988, we visited the bottle glass plant operated by Owens-Illinois at 5850 N.E. 92nd Drive, Portland, Oregon 97220. The tour was led by Carol Rissell (purchasing agent), Bob Dolphin (ceramic engineer), and Roger Hansen.

The Owens-Illinois plant manufactures clear, green and amber bottle glass products from mixtures of recycled bottles (cullet) and sand. The natural sand sources are Lane Mountain Silica in Valley, Washington, dune sand from Coos Bay, Oregon, and a white ael oian (?) sand from Ehmett, Idaho. Limestone is supplied from Texada Island, British Columbia, by Ashgrove West and another supplier. Soda ash is obtained from Green River, Wyoming.

The cullet comes from curbside recycling programs in Portland and elsewhere and totalled 44,000 tons in 1987. The plant processes 12-15 tons per hour of recycled glass. The clear glass product contains 35-40% cullet, and the amber glass as much as 78% cullet. A quirk in technology prevents cullet from being used in excess of 80% in the mix. It has the advantage of melting at a slightly lower temperature than natural silica sand, thus prolonging furnace life.

The Owens-Illinois plant in Portland employs approximately 425 and uses approximately 500,000 therms of natural gas per month at a current price of approximately 28-30 cents per therm. All furnaces are now fired with natural gas, although electric furnaces were used in earlier years. Colorants used to provide the desired color include pyrite for amber glass and iron chromate (?) for green glass.

Additional details of the operation are provided on the attached handout.

DH:ch
hull1/fil5-52

Attachment
f5-05-88/1105

WELCOME TO OWENS-ILLINOIS GLASS CONTAINER INC.

Portland Glass Container Plant

You will be visiting Portland's glass container manufacturing plant, so perhaps a brief history and description of the manufacturing process will make your plant tour more interesting.

The Portland plant was constructed in the Parkrose area in 1956 on a site of 78 acres. There were two furnaces and six automatic bottle machines. Today there are three furnaces feeding six higher productivity machines making 1,000,000 bottles per day. We employ approximately 350 people to operate the plant around the clock, nearly 350 days per year. Two or three shut-downs per year are scheduled for maintenance and/or inventory control.

The Portland plant produces containers for the entire Northwest area, including Oregon, Washington, British Columbia, Idaho, Montana, Utah, and California. The types of ware manufactured here include food and juice containers, pharmaceutical ware, and beverage, liquor and beer bottles. Sizes range from 5 oz. to 130 oz. gallon jugs.

The major ingredients of making glass are silica sand, soda ash, limestone, and cullet or recycled glass. The raw materials when mixed together in proper proportions are known in glasshouse language as "batch". In the Portland plant the raw "batch" is transported by continuous conveyors from the batch storage and mixing house and automatically fed into the melting furnaces where it is melted to a liquid state at approximately 2700 degrees Fahrenheit. When the glass is thoroughly melted it sinks to the bottom of the tank, flows through an opening called a "throat", and up into a refining chamber to be purified. It then flows in to an automatic feeder and is partially forced through a small hole. Then it is cut by automatic mechanical shears into small pieces of precise weight "gobs". From the feeder, "gobs" fall into an automatic bottle blowing machine, which is probably the most fascinating part of the glass manufacturing process. These machines "form" the finished bottle to the exact dimension and specification when compressed air is blown into the neck of the bottle to force the molten glass to conform to the shape of the mold. The finished bottle then must be "annealed" or gradually cooled. This is accomplished in annealing ovens known as lehrs. In the lehr the containers move through gradually diminishing temperatures until the "cold end" is reached. Bottles and jars are inspected and examined thoroughly at this point. Once the containers have been judged to be Owens-Illinois quality they are placed in corrugated cartons or bulk loads, loaded on pallets and transported to the warehouse area to await shipment to customers.

Plant visitors are required to wear solid low-healed shoes as a safety precaution (open-toed sandals or tennis shoes are not permitted). Pants are advised for the women. Cameras are not allowed. Please be advised that there are several flights of stairs involved on the tour, both up and down.

Roger Hanson
Carol Rechelt

5/2/86

WELCOME TO OWENS-ILLINOIS. INC.

Glass Redemption Center

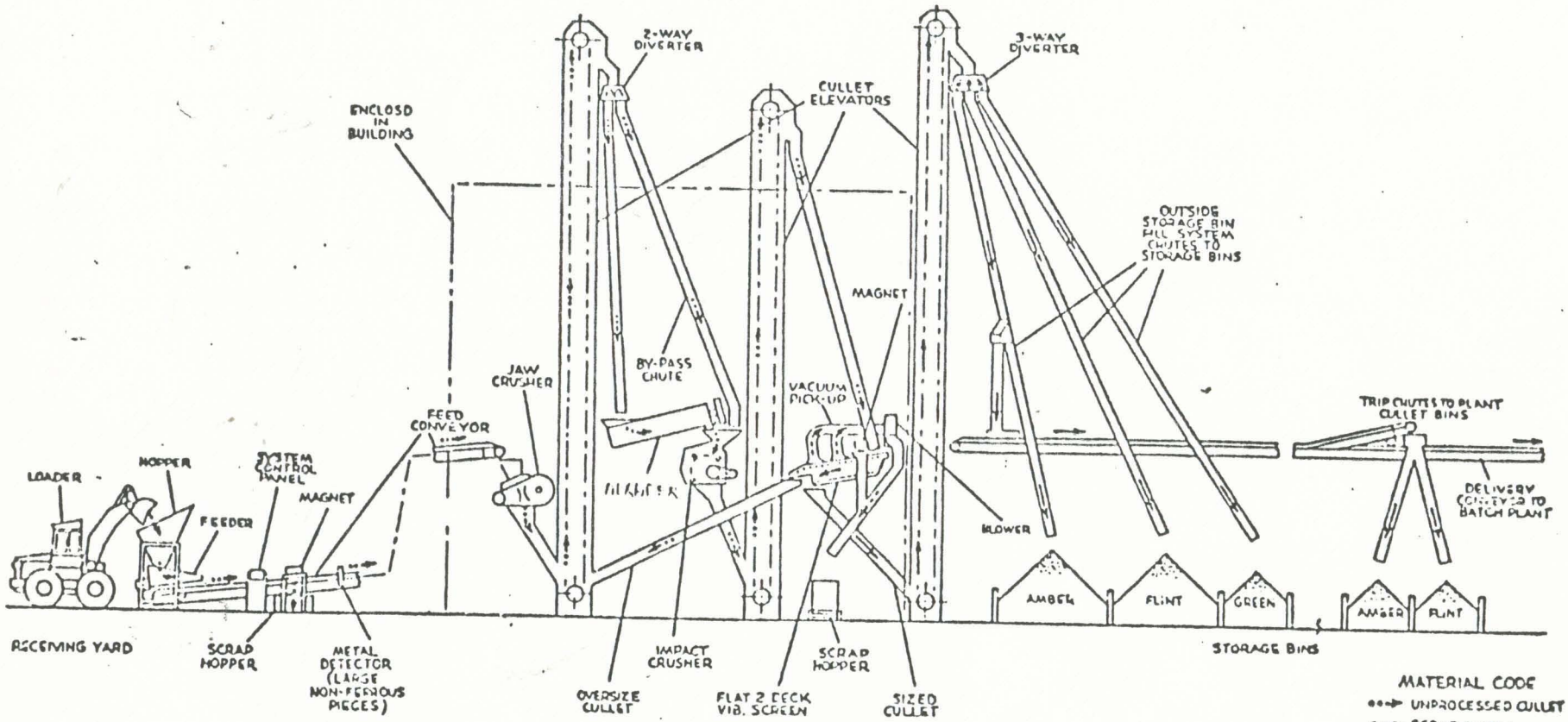
The Owens-Illinois Redemption Center located at 5850 N.E. 92nd Drive, Portland, Oregon (Phone 254-7331), was built in 1979 to process the rapidly increasing volume of ecology cullet we purchase. While we could handle the 8400 tons we purchased in 1974, a sophisticated system was required to satisfactorily process the 20,190 tons bought in 1982. The system chosen represents the most up-to-date development in cullet recycling, combining the best of many systems currently in use. Actual on-site construction by a local construction firm began in mid-1979 and the system was completed and processing cullet in early 1980. While the cost of the center itself was approximately $350,000, additional paving, weighing and storage facilities, mobile equipment costs, and building modifications increased the total investment in our cullet processing facilities to nearly $500,000.

The system processes 30 tons per hour and recovers 100% of all cullet entering the system. It works on a dry-screening, air-separation basis. Cullet is passed by two separate magnets for metal removal, two crushers for bottle breaking and sizing, an abrader to remove and tear paper labels, a vacuum to remove all light scrap, and a vibrating screen to separate properly sized cullet (3/4") from oversized. These capabilities enable us to accept redemption glass containing more paper and metal than we could previously accept, most of which would have been taken to landfills instead. Recycling glass contributes to litter reduction, helps support local recycling centers, help our over-crowded landfills and provides a payback for your used glass bottles and jars Recycling provides our glass container plant with a clean material to be mixed with raw materials, reducing melting energy requirements and improving our overall plant operation.

The Redemption Center is open Tuesdays and Saturdays from 8 a.m. to 2 p.m. and Thursdays from 3 p.m. to 7 p.m. with additional hours for commercial recyclers. We accept all jar and bottle container glass (light bulbs, ceramics, and other glass types have a different composition and cannot be used in our operation). Glass should be reasonably clean and must be separated by color -- green, clear (flint), or brown (amber). The bottles may be crushed or left whole, and any paper labels may be left on. We pay $40.00 per ton or .02 per pound for green, amber, and flint cullet. In 1986 the Owens-Illinois Portland plant paid $1,766,480 for 35,952 tons of cullet and since 1970 the O-I Portland plant has purchased 327,698 tons of recycled glass In 1987 the cullet increased by 19% to 44,431 tons and paid out to the public and recyclers $2,474,226.

FOR GLASS RECYCLING INFORMATION CALL: 251-9481

Owens-Illinois, Inc.
Glass Redemption Center
5850 N.E. 92nd Drive
Portland, Oregon 97220
503-254-7331



PORTLAND CULLET PROCESSING SYSTEM
(FLOW DIAGRAM)

OWENS-ILLINOIS, INC.
PORTLAND PLANT HISTORY

The Owens-Illinois, Inc. Portland Plant was constructed in 1956 on a 78-acre site just outside the Portland city limits to meet the demand of glass container growth in the great Northwest. It is the only glass container manufacturing facility in the State of Oregon, with direct competitors located in Seattle, Washington and Canada.

The original plant was constructed with two gas-fired furnaces feeding six bottle forming machines. In 1961-62 the plant was expanded with the addition of a third gas-fired furnace and two additional glass forming machines. A further expansion took place in 1970 with the construction of an all-electric glass furnace and two forming machines which provided a total production capacity of four furnaces and ten forming machines.

During its peak level of production in late 1971 the plant employed 533 personnel to operate ten production lines. Our historical annual increase in production ended in 1972 when the Oregon Bottle Bill went into effect and our production has steadily declined since that time. Currently we are operating three furnaces with six machines and employ approximately 400 people.

The plant produces containers for the northwest area including Oregon, Washington, Idaho, Montana, and California. We are a general line factory producing ware varying in size from a 4 oz. juice bottle to gallon jugs. In 1986 the plant manufactured 3,000,000 gross with net sales of 50,000,000. Our product mix was 30% beer, 20% beverage, 40% food and juice, and 5% pharmaceutical IV ware. Our major customers include:

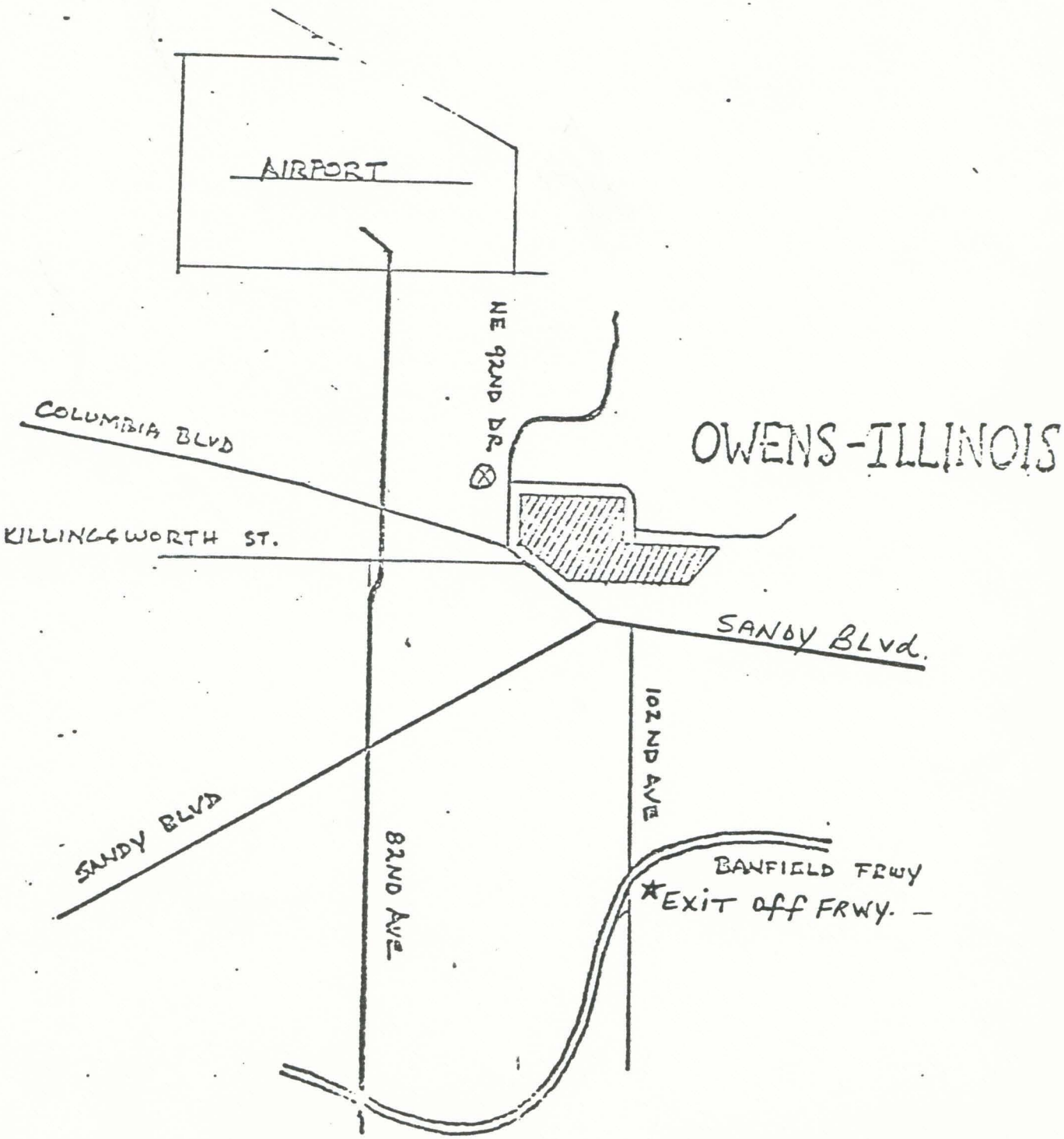
Customer	Type of Ware	Location
Pabst Brewing Company	Beer	Washington
Blitz Weinhard	Beer	Portland
Original N.Y. Seltzer	Seltzer Water	Washington
Welch Foods	Food	Washington
Ocean Spray	Juice	Washington
Hood River Distillers	Liquor	Oregon
Olshen	General	Various
Olympia	Beer	Washington
Potter Distillers	Liquor	Oregon
McGaw Laboratories	IV	California
Nalleys Fine Foods	Food	Washington

The Portland plant established a glass recycling program in 1970, two years prior to the enactment of the Oregon Bottle Bill, and this program has proven to be extremely successful. In order to process a growing volume of purchased cullet we installed a half million dollar cullet recycling facility in early 1980. The system works on a dry screening, air separation basis and processes approximately 25 tons per hour, recovering 100% of all cullet entering the system. Cullet is conveyed past two separate magnets for metal removal, two crushers for bottle breaking and sizing, an abrader to remove and tear paper and aluminum labels, a vacuum to remove light scrap, and a vibrating screen to separate properly sized cullet from oversized. Currently we utilize between 30% and 70% cullet in our batch mixes.

In 1986 the Portland Plant purchased 35,952 tons of recycled glass for $1,766,480. Since 1970 we have purchased 327,698 tons of recycled glass.

OWENS-ILLINOIS, INC.
5850 N.E. 92nd Drive
Portland, Oregon 97220
(503) 254-7331

DIRECTIONS: Go to the intersection of N.E. Columbia Blvd. and N.E. 92nd Drive. Proceed north on N.E. 92nd Drive for approximately two blocks and follow the directional signs to factory entrance and parking area.



8/1/87

GLASS REDEMPTION CENTER

Owens-Illinois Glass Container Inc.
5850 N.E. 92nd Drive
Portland, OR 97220
(503) 251-9481

Thank you for you interest in the reclamation of glass containers, BOTTLES and JARS only.

To understand our procedures for acceptance and to facilitate your delivery, please read the following:

1. Our acceptance hours are Tuesdays and Saturdays from 8 a.m. to 2 p.m. and Thursdays from 3 p.m. to 7 p.m.

2. Glass must be sorted by color (clear, green, and brown). To ensure future usage of green glass (wine bottles), the lead cap or wrap must be removed.

3. We urge all recyclers to accumulate as much glass as possible in order to reduce the number of trips and save gasoline. This practice will also reduce the number of cars to be weighed and allow us to serve you more efficiently with less delay.

4. Disposal of containers used to bring glass will be the responsibility of each individual. NOTE: Containers must be clean and free of any contaminates, especially if delivered by truck or barrels.

5. Children are to remain in cars at all times.

6. Ecology groups and individuals will be paid the equivalent of 2 cents per pound, or $40 per ton on clear, brown and green glass.

7. Any deliveries in excess of $75 will be paid by check, in some cases a cullet dealer application may be necessary before payment will be made. Any accumulated ticket in a week's period in excess of $75 will also fall in the above classification. Checks will be mailed the following Monday.

8. Proper footwear must be worn at all times throughout the recycling area. Tennis shoes, sandals or other soft or open footwear is not accepted. Safety glasses and gloves will be furnished while dumping, but PLEASE RETURN them.

9. You and your vehicle will be weighed as you arrive, the per cent of each color determined, scale ticket signed, and reweighed after dumping your glass. No outside weight certificates will be accepted.

10. It is the recycler's responsibility to ensure the glass and the glass hauling or handling equipment (boxes, barrels, dump truck, etc.) is free of foreign materials such as rock, excessive cardboard, ceramic materials, metal ores, clay, refractory and grinding materials. Any of these items can cause serious upsets to our production of new containers.

ep Procedure for Weighing:

1. Stop; wait for attendant to direct you to scales.
2. Weigh in and dump as directed.
3. Weigh out after dumping.
4. Receive cash receipt or check receipt.
5. Stop at Guard Office if under minimum ($75) and receive money.
   NOTE; IF ORIGINAL IS NOT TURNED INTO GUARD YOU CAN NOT BE PAID.
   CHECK CUSTOMERS MUST PUT ORIGINAL INTO BOX AT SCALE HOUSE.

---OI Purchasing Department

Many types of silica minerals in Oregon

By JOHN ELIOT ALLEN

Time travel

The thunderegg, Oregon's state rock, contains only a few of the many varieties of silica minerals found in abundance throughout the state. Agate and chalcedony can be found on many of our beaches and in the basaltic rocks of Oregon. Anyone can see agate-filled cavities in the fractured basalt of the road cut just east of Shellrock Mountain, nine miles east of Cascade Locks.

Besides the banded agate, moss agate and picture agate found in the thundereggs, petrified, silicified or opalized wood is extremely abundant, mostly in the mid-Tertiary Clarno Formation of Central Oregon, the Eagle Creek Formation in the Columbia River Gorge and in rocks of similar age along the east side of the Willamette Valley. Collectors on the Oregon beaches occasionally find a beautiful honey-colored silcified colony coral.

Chalcedony is the general name for the massive, semitransparent to translucent, cryptocrystalline form of quartz that also appears in a number of different colors and patterns. It is given many other names, depending usually upon the kind, amount and arrangement of the impurities it contains. Impurities of iron are responsible for red, yellow and green colors, nickel for apple-green, and manganese for pink, red and black.

When the bands are in pale colors, it is called agate. If the layers are of different colors, it is called onyx. Jasper, possibly the most common of all, usually is opaque red and yellow chalcedony, but it may be blue, green, brown or even black.

Plasma is dark green to leek green chalcedony. Heliotrope or bloodstone is green plasma with red spots of jasper. Chert is opaque black chalcedony. "Morrisonite" is a local name for a jasper, usually patterned in pale cream or yellow and brown, but also sometimes showing a wide variety of colors. All of these are found in Oregon.

Other forms of chalcedony found abundantly in the state are sard (yellow orange to brownish red to brown) and carnelian (deeper and brighter reds). Much rarer is sardonyx, which consists of layers of sard or carnelian in agate; prase, which is translucent or dull leek-green; and chrysoprase, which is apple green due to its nickel content. Non-gem varieties that are not found in Oregon include flint, hornstone and touchstone.

Innumerable descriptive adjectives are used in the names for the various kinds of agate. Some of these are plume, moss, fortification, enhydro (including a small water-bubble), dendritic, angel-wing, amethystine polka-dot, sunset, iris, rainbow, turtle-back, milk, snakeskin, grape, eye, tube, pipe and flower.

Types of jasper have nearly as many names, including jasponyx, wascoite, orbicular, brecciated, and picture, chicken-track, picture-window, etc. Jasper also is named for localities, such as Ochoco, Biggs, Owyhee, McDermitt.

Opal is an amorphous (non-crystalline, colloidal) form of silica. When water-clear, it is known as hyalite. Wood is frequently replaced by impure brown opal in Oregon, as seen in the wall beneath the Multnomah Falls coffee shop.

Besides being occasionally found in thundereggs, precious opal was mined near Unity on the Burnt River many years ago from a volcanic ash deposit. Some fire opal has been found in thundereggs from Opal Butte south of Heppner. Fire opal also has been found as small spheres (less than ⅛th inch in diameter) filling gas bubbles in basalts on the Powder River six miles south of Baker and from near the top of Hart Mountain, north of Plush.

There are almost as many varieties of coarsely crystalline quartz as of the cryptocrystalline kind. Specimens I have seen from Oregon localities include rock crystal, which is transparent and found in many mines; amethyst, which is purple or bluish violet; rose, yellow and smoky cairngorm, and milky quartz. This last is the most common of all, since it makes up much of the mineral veins in most mines, where it is called "bull quartz."

Much sagenitic quartz and agate, which contains clusters of fine needles, usually of the mineral rutile, has been found along the coast from Newport south for 30 miles. Aventurine quartz, which is spangled with small scales of mica or hematite, has been found as pebbles in bars along the Columbia, where it may be white, yellow or reddish in color.

A colorful yet inexpensive 60-page pocket guide to the quartz family minerals in Oregon is titled "Oregon Underfoot," by D.E. McMullen. It is sold at the Oregon Museum of Science and Industry.

"Quartz Family Minerals" is the title of a book that describes all these and more, written by Henry C. Dake (with F.L. Fleener and Ben Hur Williams) more than 45 years ago. Dake was one of those little-known but prolific amateur geologists who has added so much to our knowledge of the state.

John Eliot Allen is emeritus professor of geology at Portland State University. Letters to Allen should be sent to the PSU Geology Department, P.O. Box 751, Portland 97207.

SOURCE: THE (PORTLAND) OREGONIAN

DATE: JUNE 7, 1984

COMMODITY SECTION: INDUSTRIAL

STATE ARTICLE CONCERNS: OREGON

6/8

Silica

Seaside, OR
Signal
(Cir. W. 4,209)

OCT 4 1984

Jerry B

Allen's P. C. B Est. 1888

Silicon found in Clatsop sands

5018

The Oregon Department of Geology and Mineral Industries (DOGAMI) has released the results of a study in which samples from Clkatsop and Morrow Counties were collected and analyzed for thier potential as silica sand rescources.

Three deposits from which a silica sand product can be produced were identified in Clatsop County.

A study on Silica sand was conducted by DOGAMI geologist J. J. Gray, in cooperation with the Port of Morrow, the Mineral Resource Institute of the University of Alabama, and a private indistrial firm. I has been released as DOGAMI Open File Report 0-84-5.

The areas from which the samples were collected are both along the course of the Columbia River, dunes, and silt and sand of a glacial lake.

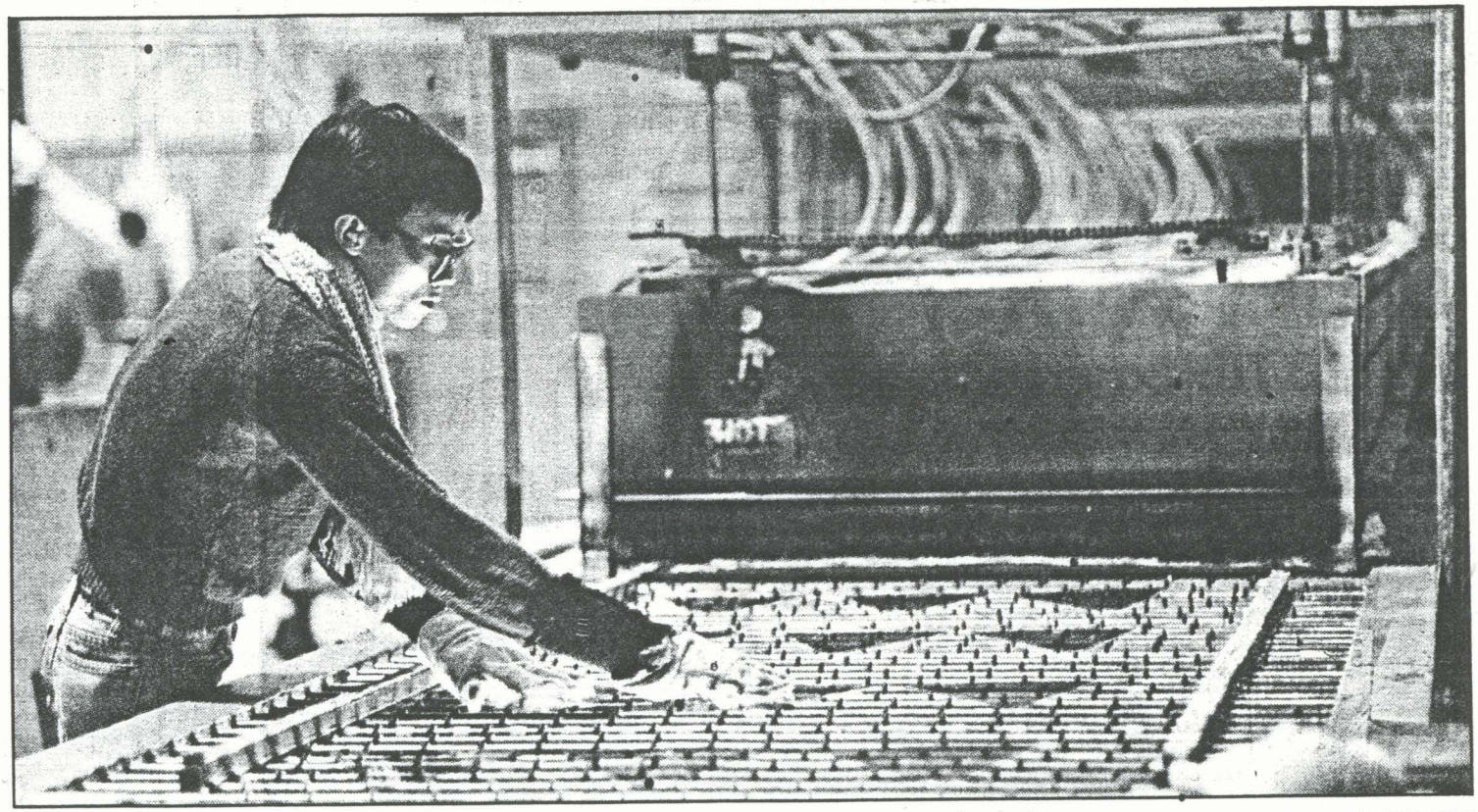
The testing for silica sand potential was based on standards for the most stringent silica sand markets. Each sameple was assayed, sized, subjectd to magnatic and gravity separation, and reassayed. The results are published in the report.

1/3/88 Oregonian

Oregon Glass Co. wipes away pain of restructuring

☐ Expansion almost leads to failure, until the company re-examines its markets and reduces costs

By JIM KADERA
of The Oregonian staff



The Oregonian/MICHAEL LLOYD

Nuoc Nguyen Tran adjusts glass panels on a conveyer carrying them through a continuous horizontal tempering oven at Oregon Glass Co. The manufacturing process strengthens the panels, making them harder to break.

WILSONVILLE — An Oregon producer of tempered window glass is setting profit records after undergoing losses and a major restructuring less than three years ago.

The results of the restructuring are profits for Gerald Clancy Jr. of Wilsonville, owner of Oregon Glass Co., and pay bonuses for the company's 130 employees.

"We went from record profits in 1984 to record losses in 1985. The next year was break-even. Now we're doing very, very well again," said Jorgen Iversen, the vice president and general manager. Iversen was a certified public accountant hired in 1985 by Clancy to correct inefficiencies blamed for the unprofitable period.

Sales totaled $11.9 million in fiscal 1984, $11.3 million in 1985, $8.7 million in 1986, $10.1 million in 1987, and the projection is for $11 million in the year that began last June. The privately held company did not disclose the amount of its profits or its 1985 loss.

But with demand expanding for tempered (safety) glass, which is not dependent on the new housing market, the future is bright, Iversen said. Tempered glass is expected to make up 21 percent of all U.S. glass sales by 1992, up from 5 percent in 1987.

"Our strength is in our people," Iversen said. "We have a mission of giving dependable service to our customers. We can't be all things to all people, but what we do we do very well."

Attempting to "be all things" sapped the company of its profits temporarily, he indicated. Oregon Glass was a Portland wholesale business that built a plant in Wilsonville in 1980 to begin tempering window glass for sale to industrial customers, primarily door manufacturers.

The problems began after Clancy bought out Taiwanese partners in Pacific Tempered Glass, located on property adjacent to Oregon Glass, and merged the two operations.

The company was competing in two glass markets, producing high-volume standard sizes for the industrial customers and custom orders to fit large building windows and serve other architectual uses. Custom orders provided a higher price markup, but Iversen noted they also caused headaches for Oregon Glass management.

The custom business required the company to inventory glass in pieces up to 10 feet by 20 feet, sometimes for months before it

Please turn to GLASS, Page D2

Glass: Custom glass meant high costs

■ Continued from Page D1

was used. Then, when it finally was cut to fill orders, there was excessive waste from the unused trimmings.

"You can lose a lot of money in your scrap. When I got here we were hauling glass to the dump. One year we hauled over $1 million of glass to the garbage," Iversen pointed out.

Another problem was in expanding sales into Southern California and Alaska. "Our delivery and fuel costs were out of this world," he continued.

"We had to be a market-driven company. We decided to get out of architectual custom glass. And we reduced our market area. We did surgery with a chain saw," Iversen said of the 1985 restructuring.

The glass tempering that began with a small crew of 15 in 1980 peaked at 200 employees in 1984, but 70 workers were laid off the next year. Laying off both production and sales people "was a wrenching experience," he said.

"Now our service territory is Seattle-Tacoma, Portland-Vancouver and south to Weed (in Northern California). It's mostly the I-5 corridor; that eliminates a lot of small stops. We have one big customer east of the Cascades in Bend."

The company buys raw glass from a number of U.S. and foreign manufacturers. Batches of the glass are put through furnaces for two minutes at a temperature of 1,300 degrees Fahrenheit. The process of tempering forms a plyable surface that resists breakage. The glass can be broken, but it does not shatter, as does untempered glass.

"You can throw it in the air and see it bounce like a dinner plate when it hits the ground," Iversen explained. Most of the Oregon Glass products are one-eighth inch thick.

Iversen said the company is dedicated to improving the life of its employees through financial incentives and other means. About 20 workers are immigrants from Asia. A survey of employees in 1986 revealed that a number of the immigrants did not communicate well in English.

"You can lose a lot of money in your scrap. . . . One year we hauled over $1 million of glass to the garbage."

Jorgen Iversen,
vice president,
Oregon Glass Co.

The company arranged through Clackamas Community College to provide English and math classes for employees and spouses who wanted the education, Iversen said.

Also, an employee stock-ownership plan was formed, he said, and now 44 percent of Oregon Glass shares are held in the trust.

Profits in fiscal 1987, which ended in May, provided for a bonus for hourly workers. The board of directors agreed to pay a bonus amounting to 20 percent of pretax profits from earnings in the current year. Iversen said hourly workers would receive the same bonus as himself and other salaried employees.

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MINERAL RESOURCES INSTITUTE

SCHOOL OF MINES AND ENERGY DEVELOPMENT
THE UNIVERSITY OF ALABAMA
P.O. DRAWER AY
UNIVERSITY, ALABAMA 35486

August 9, 1984

Mr. Jerry Gray
Department of Geology and Mineral Resources
1005 State Office Building
Portland, Oregon 97201

Dear Mr. Gray:

This letter will serve as notice of completion of the contract (MRI Project #31584 - Oregon Department Geology 3684) between the Mineral Resources Institute, University of Alabama and the Department of Geology and Mineral Industries, State of Oregon.

The attached tables summarize the chemical analysis of the oxides of the various elements. The determinations completed at your laboratories were reported in your letter of August 1.

The calculated waste products consist of the combined plus 20 mesh fraction, the minus 150 mesh fraction, the 20/150 mesh magnetics and the 20/150 mesh sink specific gravity 2.70 fractions. Because of rounding off of the analytical data obtained by x-ray analysis some of the numbers may be off by 0.1 - .2 percent. However, considering the quality of the products this increase will not materially change the results. The analysis of the waste products was calculated from head sample data in your letter of March 6, 1984.

The following is a summary of the data in tables 1-6.

1. None of the products meet glass sand specificiations.

2. None of the products in the D01 series (117A, B & C) meet cement sand specifications.

3. The non-magnetic sink 2.60, float 2.70 (20/150 mesh) fractions of R01 series (117 D, E & F) meet cement-sand specifications for silica and total alkalies. However, it might be difficult to isolate this fraction by commercially available gravity separation equipment. It might be possible to produce a product of similar, or even better analysis by flotation. This would require a rather extensive research program.

4. The potash (K_2O) analyses of the 20/150 mesh non-magnetic float specific gravity 2.60 fractions indicate the possibility of the presence of potash feldspars which may be of economic interest. Studies to determine the source of the K_2O values may be warranted. The production of cement sand meeting specifications would require the removal of the bulk of the K_2O. If present as potash feldspar this material might be recovered as an added value product.

Jerry, we have enjoyed working with you on this project. Billing for the contract settlement will be directed to you under separate cover. If we can be of service in the future do not hesitate to contact us.

Sincerely,

W. E. Lamont
J.R.

W. E. Lamont

cc: Pablo Vasquez
Bruce Tippin
Carl Rampacek
John Hanna
SOMED

MINERAL RESOURCES INSTITUTE
SCHOOL OF MINES & ENERGY DEVELOPMENT
THE UNIVERSITY OF ALABAMA

Table 1. Metallurgical balance, Ore 117A (PO 310 D01)

Size, Mesh	Product	Weight, percent	Analysis, percent							Distribution, percent						
			Na_2O	MgO	Al_2O_3	SiO_2	K_2O	CaO	Fe_2O_3	Na_2O	MgO	Al_2O_3	SiO_2	K_2O	CaO	Fe_2O_3
20/150	Non-Magnetic float 2.60	12.5	1.72	.65	21.06	73.31	6.25	1.93	1.13	14.7	6.9	20.3	13.0	39.4	7.8	2.5
20/150	Non-Magnetic sink 2.60 float 2.70	39.8	1.11	.42	11.39	85.42	.75	1.77	.73	29.3	14.7	34.9	48.5	15.1	22.8	5.2
Composite 20/150	Non-Magnetic float 2.70	52.3	1.26	.48	13.69	82.52	2.07	1.80	.82	44.0	21.6	55.2	61.5	54.5	30.6	7.7
---*	Waste**	47.7	1.76	1.91	12.18	56.58	1.89	4.47	10.80	56.0	78.4	44.8	38.5	45.5	69.4	92.3
Composite (head analysis)		100.0	1.50	1.16	12.97	70.15	1.98	3.07	5.58	100.0	100.0	100.0	100.0	100.0	100.0	100.0

*N.A.-Not Applicable
**Waste - All products not analyzed, calculated from head analysis

MINERAL RESOURCES INSTITUTE
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THE UNIVERSITY OF ALABAMA

Table 2. Metallurgical Balance, Ore 117 B (PO 311 D01)

Size, Mesh	Product	Weight, percent	Analysis, percent							Distribution, percent						
			Na_2O	MgO	Al_2O_3	SiO_2	K_2O	CaO	Fe_2O_3	Na_2O	MgO	Al_2O_3	SiO_2	K_2O	CaO	Fe_2O_3
20/150	Non-Magnetic float 2.60	7.2	1.62	.59	17.92	77.09	4.18	2.65	1.31	7.2	2.3	9.3	8.3	16.1	5.4	1.4
20/150	Non-Magnetic sink 2.60 float 2.70	13.4	1.11	.42	11.39	85.42	.75	1.77	.73	9.0	3.4	11.0	17.1	5.4	6.8	1.5
Composite 20/150	Non-Magnetic float 2.70	20.6	1.31	.49	13.69	82.52	1.94	2.09	.92	16.2	5.7	20.3	25.4	21.5	12.2	2.9
-- *	Waste**	79.4	1.73	1.34	13.94	63.06	1.84	3.09	8.13	83.8	94.3	79.7	74.6	78.5	87.8	7.1
Composite (head analysis)		100.0	1.50	1.16	13.89	67.07	1.86	3.53	6.65	100.0	100.0	100.0	100.0	100.0	100.0	100.0

* N.A. - Not applicable
**Waste- All products not analyzed, calculated from head analysis

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SCHOOL OF MINES & ENERGY DEVELOPMENT
THE UNIVERSITY OF ALABAMA

Table 3. Metallurgical Balance Ore 117C (PO 312 D01)

Size, Mesh	Product	Weight, percent	Analysis, percent							Distribution, percent						
			Na_2O	MgO	Al_2O_3	SiO_2	K_2O	CaO	Fe_2O_3	Na_2O_3	MgO	Al_2O_3	SiO_2	K_2O	CaO	Fe_2O_3
20/150	Non-Magnetic float 2.60	10.2	1.62	.59	17.92	77.09	4.18	2.65	1.31	9.0	4.4	14.3	11.2	21.9	8.0	2.2
20/150	Non-Magnetic sink 2.60 float 2.70	29.9	.93	.43	10.70	86.22	.87	1.54	.78	14.7	9.6	25.1	36.8	13.2	13.6	3.9
Composite 20/150	Non-Magnetic float 2.70	40.1	1.12	.47	12.54	83.89	1.72	1.82	.90	23.7	14.0	39.4	48.0	35.0	21.6	6.1
-- *	Waste**	59.9	2.42	1.95	12.90	60.80	2.14	4.44	9.17	76.3	86.0	60.6	52.0	65.0	78.4	93.9
Composite (head analysis)		100.0	1.90	1.36	12.76	70.06	1.97	3.39	5.85	100.0	100.0	100.0	100.0	100.0	100.0	100.0

* N.A.-Not applicable
**Waste-all products not analyzed, calculated from head analysis

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Table 4. Metallurgical Balance, Ore 117D (PO 314 R01)

Size, Mesh	Product	Weight, percent	Analysis, percent							Distribution, percent						
			Na_2O	MgO	Al_2O_3	SiO_2	K_2O	CaO	Fe_2O_3	Na_2O	MgO	Al_2O_3	SiO_2	K_2O	CaO	Fe_2O_3
20/150	Non-Magnetic float 2.60	15.8	1.27	.82	23.31	72.89	9.67	2.54	1.58	46.5	21.7	24.8	14.7	65.4	33.3	7.5
20/150	Non-Magnetic, sink 2.60 float 2.70	46.3	0	.27	3.17	96.71	.28	.73	.44	--	21.7	9.9	57.1	5.6	28.3	6.0
Composite 20/150	Non-Magnetic float 2.70	62.1	.32	.42	8.29	90.66	2.67	1.19	.72	46.5	43.4	34.7	71.8	71.0	61.6	13.5
-- *	Waste**	37.9	.61	.90	25.51	58.47	1.79	1.21	7.57	53.5	56.6	65.3	28.2	29.0	38.4	86.5
Composite (head analysis)		100.0	.43	.60	14.82	78.46	2.34	1.20	3.32	100.0	100.0	100.0	100.0	100.0	100.0	100.0

*N.A. -Not Applicable
**Waste-All products not analyzed, calculated from head analysis.

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Table 5. Metallurgical Balance, Ore 117E (PO 315 R01)

Size, Mesh	Product	Weight, percent	Analysis, percent							Distribution, percent						
			Na_2O	MgO	Al_2O_3	SiO_2	K_2O	CaO	Fe_2O_3	Na_2O	MgO	Al_2O_3	SiO_2	K_2O	CaO	Fe_2O_3
20/150	Non-Magnetic float 2.60	21.6	1.45	.82	22.62	73.77	7.87	1.80	1.83	28.2	30.0	36.5	19.8	73.6	30.7	17.5
20/150	Non-Magnetic sink 2.60 float 2.70	49.7	.04	.29	4.51	94.86	.37	.77	.45	1.8	23.3	16.7	58.5	7.8	29.9	9.6
Composite 20/150	Non-Magnetic float 2.70	71.3	.46	.45	10.00	88.47	2.64	1.08	.87	30.0	53.3	53.2	78.3	81.1	60.6	27.1
--*	Waste	28.7	2.68	.98	21.78	61.15	1.50	1.74	5.78	70.0	46.7	46.8	21.7	18.9	39.4	72.1
Composite (head analysis)		100.0	1.10	.60	13.38	80.63	2.31	1.27	2.28	100.0	100.0	100.0	100.0	100.0	100.0	100.0

* N.A. Not applicable
**Waste - All products not analyzed, calculated from head analysis

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Table 6. Metallurgical balance Ore 117F (PO 316 R01)

Size, Mesh	Product	Weight, percent	Analysis, percent							Distribution, percent						
			Na_2O	MgO	Al_2O_3	SiO_2	K_2O	CaO	Fe_2O_3	Na_2O	MgO	Al_2O_3	SiO_2	K_2O	CaO	Fe_2O_3
20/150	Non-Magnetic float 2.60	17.8	1.35	.78	22.94	73.16	7.77	1.89	1.65	21.4	20.9	38.2	16.2	65.4	21.7	9.2
20/150	Non-Magnetic sink 2.60 float 2.70	45.9	.37	.29	5.15	94.03	.40	.74	.44	15.2	19.4	22.1	53.9	8.5	21.7	6.4
Composite 20/150	Non-Magnetic float 2.70	63.7	.64	.42	10.11	88.19	2.45	1.07	.77	36.6	40.3	60.3	70.1	73.9	43.4	15.6
----*	Waste**	36.3	1.96	1.10	11.65	65.95	1.52	2.45	7.30	63.4	59.7	39.7	29.9	26.1	56.6	84.4
Composite (head analysis)		100.0	1.12	.67	10.67	80.12	2.11	1.57	3.14	100.0	100.0	100.0	100.0	100.0	100.0	100.0

* N.A. - Not Applicable
**Waste - All products not analyzed, calculated from head analysis

MINERAL RESOURCES INSTITUTE
AND
STATE MINE EXPERIMENT STATION
THE UNIVERSITY OF ALABAMA
UNIVERSITY, ALABAMA 35486

P. O. DRAWER AY

TELEPHONE: 205/348-6577

November 8, 1983

Mr. Jerry Gray
Department of Geology and Mineral Industries
1005 State Office Building
Portland, Oregon 97201

Dear Jerry:

As discussed on the phone last week, I'll delay my plans for a visit to your office until things are better defined by your group. However, as promised, I am attaching a brief outline of a general research study for glass sands. This may provide you with information that may be helpful. If we may be of further service, please let me know.

Sincerely,

R. Bruce Tippin
Director

RBT:sw

cc: Hanna
Rampacek

EVALUATION OF GLASS SAND DEPOSITS

Objectives

The major objectives of the proposed research program are:

1. To evaluate one or more silica deposits as raw materials for glass making.

2. To develop a beneficiation technique to economically produce quality silica sand products for selected markets.

3. To investigate the possibility of co-producing other valuable mineral by-products from the silica deposits.

Introduction

Silica sand low in iron is much in demand for glass, glass wool, ceramic and pottery use, and for many of these applications clean, white sand is desired. Impurities such as clay slime, iron stain, and heavy minerals including iron oxides, garnet, chromite, zircon, and other accessory minerals must not be present. Chromium, for example, must not be present, even in extremely small amounts, in order for the sand to be acceptable to certain markets. Feldspars and mica are also objectionable in some applications but in others may be desirable as source of alumnia. Generally, iron content must be reduced to 0.030% Fe_2O_3 or less for all specialty silica applications.

The more common glass sand deposits are either consolidated sandstone or loose sand pit deposits (wet or dry). By far the major tonnage of glass sand produed in the United States is taken from friable, readily-reduced sandstones and unconsolidated sands; the widespread nature of such prospect-types, renders dependence on the more indurated rocks of secondary importance.

Acceptable glass sands are, invariably, those which most nearly fit the glass-producer's economic needs and any method used to evaluate a raw material's potential must finally prove equatable with such needs. Of principal concern to the investigator are those properties of the orebody which include (1) chemistry of the silica-bearing body, (2) the mineralogy, nature and complexity of the component grains and (3) the grain-size distribution.

Of particular concern is the nature of the iron contamination. Iron-bearing species appear as 1) accessory mineral grains, either detrital or authigenic, 2) cements, 3) grain coatings, and 4) quartz-grain inclusions. Selection of the cheapest form of beneficiation requires precise information on the iron species in the particular deposit.

A PROPOSED RESEARCH PROGRAM

The proposed research program will embrace three major tasks.

1. Characterization of the silica deposit(s)
2. Beneficiation studies
3. Product evaluation and process development

All samples for the above investigations will be collected by others and shipped to the Mineral Resources Institue (MRI).

Most of the chemical, mineralogic analysis for the proposed program will be conducted at commercial laboratories to insure rapid turn-around of the results.

Task I. Characterization Studies

This will include the following investigations

1. Screen analysis at 20, 30, 40, 50, 60, 70, 80, 100, and 140 mesh to determine the size distribution of the head samples.
2. Heavy liquid separation of the size fractions between 20 and 140 mesh at 2.8 specific gravity to determine the percentage of all heavy minerals.
3. Chemical analysis of selected samples and test products.
4. Trace element analysis of the head sample and selected products.
5. Mineralogic and x-ray examination to determine the principal mineral impurities with particular reference to the iron-bearing minerals and undesirable refractory accessory minerals.

Task II. Beneficiation Studies

Based on the results obtained from the characterization studies mentioned under Task I, a number of beneficiation procedure(s) will be investigated to determine the simplest processing route to produce glass sand grade silica. The proposed investigations under this task may include but not limited to the following tests:

1. Attrition Scrubbing and Classification

   In these tests the -20 + 140 mesh sand fraction will be intensely agitated at high pulp density (60 - 75% solids) in a rubber lined attrition scrubber for removal of surface stain from the sand grains and to desentigrate the soft clay particles. The degree of surface filming and iron oxde stain will determine the scrubbing time required.

The scrubbed sand is diluted with water to 25-30% solids for removal of slimes released in the scrubber. In some cases the sand meets the required iron oxide specifications by scrubbing only. In this case, the sand product becomes final product.

However, the more difficult to treat sand may require two stage attrition scrubbing with classification and slime removal between stages. Other sands may require additional beneficiation techniques as indicated below.

2. Conditioning and Flotation

Deslimed sand containing mica, feldspar, and iron bearing heavy minerals often can be successfully cleaned to specifications by flotation. Generally this is done in an acid pulp circuit. Conditioning with H_2SO_4 and iron promoting reagents is most effective at high density, 70-75% solids. In the flotation step the impurity minerals are floated off in a froth product which is rejected as waste.

3. Magnetic separation

In case considerable amounts of magnetic impurities escape removal in the scrubbing and/or flotation steps, high intensity magnetic separation of the sand products may remove the last traces of iron impurities.

4. By Products

Should rejected tailing products from attritioning, flotation or magnetic separation contain considerable amounts of trace and accessory minerals, their recovery will be considered.

Task III. Product Evaluation and Process Development

Based on the beneficiation test results, a specific process flowsheet will be established. Further, laboratory investigations, pilot plant testing, and product evaluation may be needed and would be recommended in the final report.

Timber and Wood Products Group

P.O. Box 50
Boise, Idaho 83728
208/384-7158

Boise Cascade

November 2, 1983

Mr. Jerry Gray
Department of Geology
and Mineral Resources
1005 State Office Building
Portland, OR 97201

Dear Jerry:

In response to our recent discussions, Boise Cascade would be very interested in talking with responsible companies for the purpose of discussing possible joint ventures to explore for and produce minerals. The Mineral Resources Department requests, however, that the interested party contact us directly and that discussions take place only between them and Boise Cascade. We would further request that any contact and/or discussions be held confidential.

Even though Boise Cascade is involved in the exploration for various metallic and nonmetallic minerals on corporate lands, you specifically mentioned glass quality silica sand and kaolin.

In regard to silica sand, we do have a good understanding of location and quality of sands on our lands. For example, half or more of the Lane Mountain silica production in Stevens County, Washington, comes from Boise's land. Lane Mountain has 60 acres leased of the several thousand Boise owns which contain the addy quartzite sand formation.

The addy quartzite in this area produces a superior sand, typically having the chemical and physical characteristics shown below. The chemical analyses is a composite of six samples. Lab tests show that most of the iron present can be removed by scrubbing.

Jerry D. Lewis
Senior Geologist

Mineral Resources
One Jefferson Square
Boise, Idaho 83728
208/384-6196

Boise Cascade Corporation

Laboratory Report -- Sharp Schurtz Company

$S:O_2$	Silicon dioxide	99.23 %
Al_2O_3	Aluminum oxide	0.34
Fe_2O_3	Iron oxide	0.082
TiO_2	Titanium dioxide	0.074
Cr_2O_3	Chromic oxide	0.0012
CaO	Calcium oxide	0.009
MgO	Magnesium oxide	0.012
Na_2O	Sodium oxide	0.008
K_2O	Potassium oxide	0.062
	Loss on ignition	0.17
		99.9882%

A 25 pound sample submitted to the Colorado School of Mines Research Institute was subjected to an upgrading test. This test consisted of three-stage washing and magnetic separation. The submitted sample contained 99.4% silicon dioxide and 0.03% iron oxide.

Screen Product (Tyler) Mesh		Weight %
Head		100.0
	+ 10	0.7
- 10	+ 14	1.4
- 14	+ 28	7.5
- 28	+ 35	10.8
- 35	+ 48	20.6
- 48	+ 65	19.8
- 65	+100	18.3
-100	+150	15.5
-150		5.5

Much of the addy quartzite on Boise land is on or near major highway or rail line systems. The problem we face today is the current lack of new or guaranteed markets which have, up to now, discouraged us from performing detailed explorations to evaluate these sands.

In terms of raw exploration prospects, we have been doing a preliminary assessment of the sand potential on land in northwest Oregon and southwest Washington. The results to date are mixed. Geologically, I believe some sands do exist on our lands in those areas, but it will take a considerable exploration effort to determine if economic quantities of the desired quality are present. I have heard that good silica sand can be found on our land in northeast Oregon, but have not yet had the opportunity to verify this rumor.

Boise Cascade is interested in paper quality kaolin. We know of no commercial deposits on company lands at this time. We would be interested in talking with a company which has commercial reserves. We have several interesting coal and lignite prospects which may contain small amounts of over or under clay, which some companies may find useful. None of these deposits have been evaluated yet and the quantity and quality of the material is unknown.

I hope the above discussion meets your needs regarding what we are doing, and would like to do, with these commodities. You may show this letter to prospective companies who may be interested in working with us. Again, I emphasize that we prefer to deal with them directly rather than through a middleman.

Sincerely yours,

Jerry D. Lewis

Jerry D. Lewis
Senior Geologist

JDL/A9.13

MERIDIAN LAND & MINERAL COMPANY

Norwest Center
Post Office Box 1779
Billings, MT 59103-1779
406 256-4500

October 27, 1983

Mr. Jerry Gray
Geologist for the Department of
Geology and Mineral Industries
State of Oregon
Labor & Industry Building
Salem, OR 97310

Dear Mr. Gray:

Our silica sand project manager, William A. Bratney, is in the field and will not return until next week. I had wanted him to talk with you personally about our project. In the interim, I am sending you the speech Bill gave at the American Ceramic Society in San Diego. Bill is very high on the project and has done construction, technical and marketing groundwork over the past year.

We will have Bill give you a call when he returns next week.

Sincerely,

Peter Donald/sj

Peter G. Donald
Director, Minerals

PGD/lsj630j

enc.

The Pend Oreille Silica Sand Prospect
A New High Purity Source for the Northwest

by
Meridian Land & Mineral Company
Billings, Montana

William A. Bratney
Project Manager

Presented October 3, 1983
to the Glass Division
of the American Ceramic Society
36th Pacific Coast Regional Meeting
San Diego, California

The Pend Oreille Silica Sand Prospect

A New High Purity Source for the Northwest

Introduction

The Pend Oreille silica sand prospect, located in northern Idaho on the southeastern side of Lake Pend Oreille, is being investigated as a potential major new source for consumers in the Pacific Northwest and western Canada. This part of Idaho was first explored by Canadian trapper and geographer David Thompson in 1807 who recognized the strategic location of the lake in relation to the Hudson Bay Company's trapping empire. He built a trading post at its north end. Today modern highways and two major railroads traverse the panhandle country of Idaho providing important transportation links to the population centers of Spokane, Portland, Seattle, and Vancouver, British Columbia.

The prospect itself is situated about two miles northeast of the small town of Lakeview in Bonner County, while a proposed mill site has been optioned in the town of Athol, located in northern Kootenai County.

This afternoon I would like to give you a glimpse of how Meridian Land & Mineral Company has conducted its evaluation of this prospect. By doing so, it is hoped that you in the glass and ceramics manufacturing industries may gain some insight into the activities of the mineral exploration industry that is ultimately responsible for supplying you with the high quality raw materials you need day by day year after year.

Project Background

Meridian Land & Mineral Company first became interested in what came to be known as the Pend Oreille prospect in the Spring of 1980. Company staff geologists at this time were engaged in the exploration for commercially exploitable deposits of silica rock to supply the region's ferrosilicon and silicon carbide industries.

Geologic literature search and fruitful discussions with regional geology professors identified the Cambrian Gold Creek Quartzite as a potential target for a field exploration program. Other lower Paleozoic formations examined at this time included the Addy, Gypsy, and Flathead Quartzites also of Cambrian age. All of these units are found variously in northeastern Washington, northern Idaho, western Montana, and southern British Columbia.

The early geologic field reconnaissance led to the conclusion that of the many formations examined, the Gold Creek had the best potential for the discovery and ultimate development of high silica, low iron and alumina raw materials.

The major accessible bodies of Gold Creek Quartzite were subsequently covered with 20-acre placer mining claims in the mild winter months of early 1981. Three groups of claims were located using the firm of Salisbury and Dietz from nearby Spokane. The WGC or West Gold Creek block of 42 claims and the 36 claims of the Cent or Central Group have identified potential for silica rock

production. The GMP or Green Mountain-Packsaddle block of 114 claims has silica sand potential as well as abundant silica rock. The evaluation work that has been conducted on the GMP group has been broken into several segments for ease of discussion. These are Geology, Metallurgy or Process Design, Engineering, Environmental, and Marketing.

Geology

The geological evaluation of the GMP group began with surface sampling of outcrops and roadcuts. Reconnaissance level geologic maps were prepared for this claim block as well as the other two. Field crews working during the summer of 1981 completed this phase of the project and conducted a very limited 6-hole, 1200 foot core drilling program over a three mile strike length on the GMP group. This work was performed to test the thickness of a friable, or very easily broken down, body of rock located by surface work along the ridge in the central portion of the claims. An upper zone of highly fractured, very soft rock was loosely delineated as being between 100 and 150 feet in thickness. The friability was observed to gradually or abruptly gave way into the typically very tightly silica-cemented tough quartzites found throughout the rest of the project area.

On the basis of the success of early process testing, a more detailed drilling program was laid out for the following field season. It was approved following the completion of a survey of the Western silica industry which substantiated many of our early marketing assumptions.

The 1982 drilling resulted in the completion of 29 additional holes. A total of about 4200 feet of NC- and NX-sized diamond drill core samples were collected. Detailed textural and mineralogical analysis of these cores allowed us to differentiate between the rock types to the point where a provisional division into an upper and a lower member could be made.

The upper member of the Gold Creek is the portion of the deposit that has economic silica sand potential. It is characterized by massively bedded quartz-rich sandstones with an almost complete lack of feldspar and interstitial clays. It is also recognized by the absence of red, hematite-stained quartz grains, by the lack of significant amounts of interbedded claystones, and by the presence of a soft, pelletal iron-bearing mica. Thickness of the very friable glauconite to friable sandstone unit ranges from about 30 feet to in excess of 90 feet.

The lower member of the formation consists of at least three different lower quality lithologies. The transition vertically from the upper to the lower member can be recognized by the disappearance of the glauconite by an increase in the amount of tourmaline and zircon and by the appearance of iron flooded pink and red quartz grains. The transition is also marked by a dramatic increase in the number of shale partings and shale beds. All this should have a favorable effect on quality control in the mining operation by permitting rapid distinction between the good and the bad sandstone units.

Acting again upon the success of the bench scale testing program that followed this exploration phase, additional work was planned and carried out this last summer. It was designed as a combined exploration and pre-development program that was to provide us with, among other things, seismic field data to support laboratory seismic velocity studies that suggested low cost bulldozer ripping as a viable mining technique. Also, additional drilling was conducted and aerial photography was contracted. Lastly, a limited bulk sampling program was initiated. The field portion of this work has been completed, but the follow up activities are just now getting started.

Metallurgy/Process Design

The bench scale test work that has been conducted over the last two and a half years on surface and drill core samples has indicated that silica sand products of superior quality can be produced from the friable Gold Creek sandstones. Product recoveries are estimated to be in the 90% range.

The Denver Equipment test , performed in late 1981, showed that a combination of surface and drill core material could be beneficiated by means of laboratory roll crushing, rod milling, and two stages of attrition scrubbing followed by an acid flotation circuit. A very high silica, low alumina and iron product was obtained.

Results of the 1981 Denver Equipment Test

SiO_2	=	99.53%
Al_2O_3	=	0.13%
Fe_2O_3	=	0.042%
TiO_2	=	0.040%
CaO	=	0.021%
MgO	=	0.006%
Na_2O	=	0.18%
K_2O	=	0.027%
LOI	=	0.12%

Test work was also performed at Eriez Magnetics to determine the viability of wet high intensity magnetic separation techniques for cleaning up the ore. Results of this work demonstrate that an excellent low iron product is possible utilizing this method, but high titania values between .07% and .09% were found.

Ten drill holes from the 1982 exploration program were then tested representing about 600 feet of cored sandstone. The holes were spaced over a portion of the deposit roughly equal to 52 acres containing about 8.5 million tons of sandstone. At our projected production rate of 400,000 to 450,000 tons per year, once the markets are developed, this figure will equate roughly to about a 20 year mine life.

Metallurgical test results on these ten holes indicate that a very good grade of silica sand can be produced. The physical test work was performed by the Booth Co. of Salt Lake City, who sent the test products off to the Sharp-Shurtz glass laboratory for verifiable chemical analysis. The Booth Co.

work was very similar to the Denver Test in that a two staged attrition scrub followed by acid flotation was found to be the best way to beneficiate the sand. The results show excellent consistency from the top of the deposit through to the bottom of the upper member. The first 20-30 feet from each of these holes averaged 0.040% Fe_2O_3. The second 20-30 feet gave an average Fe_2O_3 value of 0.042%. The weighted average ($\bar{x}w$) for the eight major oxides and the loss on ignition (LOI) for these 10 holes are presented in Figure 2, with the standard deviation given from hole to hole.

Results of the Booth Company Study

		$\bar{x}w$	s
SiO_2	=	99.554%	.046
Al_2O_3	=	~~0.77%~~ 0.077%	.014
Fe_2O_3	=	0.041%	.009
TiO_2	=	0.041%	.006
CaO	=	0.019%	.002
MgO	=	0.005%	.001
Na_2O	=	0.25%	.004
K_2O	=	0.017%	.004
LOI	=	0.192%	.058

For the remainder of this year and into early 1984, we will conduct additional bench scale test work on the remaining drill cores from the 1982 field season and on the holes just drilled in 1983. This will provide a complete record over our deposit and should triple the probable reserve base.

At the same time, we plan to beneficiate a 50-60 ton sample of silica sandstone to use for detailed process design work and for test marketing purposes. Comments received from this first round of market testing will be incorporated into the final mill design.

Engineering

Very early in the project life it became apparent that selecting the best materials handling method would be the most crucial problem to be addressed. Most of our early attention was focused on the concept of utilizing a tug and barge to haul loads of raw or partially processed sands from the vicinity of Lakeview up the lake a distance of 35 to 50 miles to the town of Sandpoint or some other location on down the Pend Oreille River.

In this conceptual barging layout, one of the obvious major problems to overcome was the manner in which the sandstone was to be gotten from the mine site, situated at an elevation of 4800 feet down to the lake at an elevation of 2060 feet. Truck hauls, overland conveyors, aerial tramlines, and slurry pipelines were considered. An early study focusing on one alternative demonstrated that a barge and aerial tramline combination was possible and even marginally attractive from an economic feasibility sense. The study pointed out however, that operating and maintenance costs would be high.

No additional engineering was performed until March, 1983, when CH_2M Hill's Salt Lake City office began work on the project. One of the recommendations of the first study had been that a thorough transportation analysis be conducted. CH_2M Hill's subsequent study demonstrated that barging the sandstone up the lake was not likely to be the answer to our problem. Rather, a 16 mile slurry pipeline built from the mine all the way to the mill of Athol

was found to offer the greatest operational cost savings, the lowest maintenance costs, and the longest life of any of the alternatives examined. Safety factors and the slide aesthetic considerations of an almost completely buried slurry pipeline system were also important plus factors.

The mine plan as conceptually engineered calls for a large D9L Caterpillar or equivalent to rip mine the low seismic velocity friable sandstone. A loader, two 35 ton haul trucks, a back up intermediate sized bulldozer, and a road grader will complete the list of major mining equipment.

Mine run sandstone will be trucked less than a quarter of a mile initially to the primary crushing station where the material will be reduced to -10 mesh. This sand will then be mixed with water from a small pond on site and sent on its way to the mill down the slurry pipeline.

Environmental/Permitting

Because of the great scenic beauty of the Lake Pend Oreille region, Meridian has from the beginning of the project taken steps to ensure that its exploration work was performed according to State and federal requirements.

A fatal flaw environmental analysis of the prospect was performed early in 1982 by BEAK consultants of Portland, Oregon. Their work addressed our questions at the time and found nothing to seriously impair the viability of the prospect.

A total of 33 major and minor permits and approvals must be received, however before development can start. Field work has begun along the proposed transportation corridor and on the mine site to acquire baseline environmental data in the fields of wildlife, vegetation, aquatics, and soils. Good early meetings have been held with the Forest Service, the Idaho State Fish and Game Department and many of the other State and Federal agencies that will become involved during the permitting process. We believe that a 1985 or early 1986 startup is possible.

Marketing

All of the project work described earlier has been driven by several key marketing assumptions that have been substantiated by a great deal of internal and contracted work. The annual high purity silica sand consumption in the Pacific Northwest and western Canada in 1981 was between 600,000 and 700,000 tons. This figure is somewhat lower today than it was in 1981, because the prolonged economic downturn has affected all of the major sand markets. Glass sand markets have been adversely affected by the severe drop off in the number of new residential construction starts, and by a similar decline in commercial construction. Automotive glass production as well has been severely affected. Also container glass markets are competing with more and more aggressive plastic and aluminum packaging interests. An increased trend toward foundry sand reclamation to counteract the high delivery cost of new sand and the high disposal costs of discarded molds has adversely affected the

long-ailing foundry sand industry. Other industry segments are also down. All is not bleak, however. The contacts we have, suggest that all phases of the silica consuming industries are on the rebound toward a good second half of the decade.

Most of our metallurgical testing has been directed at the question of glass sand market acceptance. Our market work indicates that a 0.04% Fe_2O_3 sand product should be well received by the western glass industry. Our test work has shown however that iron values from the various drill holes on our proposed mine site vary from 0.023% Fe_2O_3 to 0.059% Fe_2O_3 in the final -40/+140 Mesh glass sand product. Recognizing that the spread of these values is possibly too wide to ensure our potential customers of the day to day shipment consistency that they require, steps have been taken during the conceptual engineering phase to mitigate this problem.

First, because we know what is in the ground through completion of detailed core drilling work, the mine design was changed to be able to provide crusher feed of reasonable uniformity. Mine run material after primary crushing will be fed to a large stockpile equipped with internal drawdown gates. Material going then to the secondary and tertiary crushers can be blended from within this stockpile by the manipulation of different gates. In the mill the sand will be monitored closely as it passes through the attrition scrub and flotation stages. If a quality variance is noted, a call up to the mine superintendent will serve to alter the feed accordingly. Similarly check screening will be performed at the mill to ensure that deleterious oversize

and undersize sand is not inadvertently finding its way into the final products.

The message to current suppliers or to potential suppliers of glass sands is very clear. Supply commitments in the future will go to the company that acts positively to ensure the highest degree of chemical and physical purity and consistency through an active quality control program.

Conclusions

As we go forward into the development phase on the Pend Oreille project, we will be doing so with the conviction that the Western silica consuming industries will have bounced back vigorously by 1985 and will be receptive to the appearance in the marketplace of a new high purity source of supply. Based upon our regional reconnaissance work, the detailed prospect exploration, the favorable bench scale test work and conceptual engineering, the positive permitting atmosphere, and the statements we are hearing about marketplace revivals, we believe that the Pend Oreille prospect has a good chance to successfully enter the marketplace in 1985. It is hoped that these comments have provided some insight on the efforts taken by one company to evaluate a new raw material deposit having the potential to sustain the silica sand consuming industries into the future.

591j

STATE OF OREGON

INTEROFFICE MEMO

TO: Don

DATE: October 18, 1983

FROM: Jerry Gray

SUBJECT: Telephone interview with Ed Miller, Oregon Portland Cement Portland, OR, 232-3116.

Ed will send us assays for Texada Is. and Durkee limestones and the Gnat CK. silica sand. The sand runs 70-72 percent SiO_2. The firm is not producing cement at its Lake Oswego plant but is still crushing Texada Is., limestone for agriculture usage.

	Tetada Chemical Grade Limerock	Gnat Creek Sandstone		
		1979	1980	1981
SiO_2	0.46	75.55	70.56	69.3
Fe_2O_3	0.07	4.05	4.03	6.2
Al_2O_3	0.19	12.67	15.85	15.1
CaO	55.06			
K_2O	0.02	1.84	1.82	2.0
Na_2O	0.02	0.66	0.64	0.77
MgO	0.35			
Loss	43.57			

Ed Miller
CPC Co.
10/15/83

STATE OF OREGON

INTEROFFICE MEMO

TO: Don

DATE: October 20, 1983

FROM: JJ Gray

SUBJECT: Telephone interview with Ken Rolland, General Manager, Unimin Corp., Emmett, Idaho (208) 365-4590

Unimin is an eastern U.S. producer of sand, that had 10 plants before it bought 6 more plants from Martin Marietta Corp. Mr. Rolland stated that their sand carried 0.088 to 0.100 percent iron. They have no problem with reserves. He will pass our data request on to headquarters and someone will get back to me. The company might put in extra equipment to get the iron down if they could get the contract for 200 tons of sand per day.

km

STATE OF OREGON

INTEROFFICE MEMO

TO: Don Hull

DATE: October 26, 1983

FROM: Jerry Gray

SUBJECT: Industrial Mineral Products

Industrial Minerals called me about doing the test work on silica sands. They have the equipment and use it for quality control for their own silica sand production. Their sand will not make clear glass. It runs 0.2 to 0.4 percent Fe_2O_3; 3 to 4 percent Al_2O_3; and 90 to 92 percent SiO_2. They will send us a letter about their testing program.

# # #

JG:bj

TABLE I ASSAY AND SIZING DATA FOR SAND SAMPLES TAKEN FROM CLATSOP AND MORROW COUNTIES

y	P031D01	P0311D01	P0312001	P0313D01	P0314R01	P0315R01	P0316R01
	70.15%	67.07%	70.06%	67.04%	78.46%	80.63%	80.12%
	12.97	13.89	12.76	12.99	14.82	13.38	10.67
	0.14	0.22	0.13	0.14	-	-	-
	5.58	6.65	5.85	5.86	3.32	2.28	3.14
	3.07	3.53	3.39	4.43	1.20	1.27	1.57
	1.16	1.74	1.36	1.69	.60	.60	.67
	1.50	1.67	1.90	1.75	.43	1.10	1.12
	1.98	1.86	1.97	2.05	2.34	2.31	2.11
	0.9	0.02	0.0	0.0	.24	.20	.19
	96.55%	96.65%	97.42%	95.95%	101.41%	101.71%	99.59%
	0.23%	0.12%	23.9%	2.5%	-	-	-
	37.9	2.8	57.2	43.1	-	-	-
	40.5	11.1	13.9	17.3	-	-	-
	15.4	33.6	3.2	15.2	-	-	-
	3.5	14.7	0.8	5.9	-	-	-
	2.3	38.8	1.1	16.0	-	-	-
	99.83%	100.62%	100.1%	100.0%	-	-	-

Sample Number	County	Sample Type	Township	Range	Section	¼ Section
P0310D01	Morrow	Dune Sand	4N	25E	20	SW
P0311D01	Morrow	Loess	3N	26E	29	NW
P0312D01	Morrow	Washed Sand	4N	25E	10	NE
P0313D01	Morrow	Dredge Spoils	4N	25E	3	SE
P0314R01	Clatsop	Sandstone	7N	6W	6	SE
P0315R01	Clatsop	Sandstone	8N	6W	19	NW
P0316R01	Clatsop	Sandstone	8N	7W	8	NE

P0310D01

87.0

10.9 12.5%

34.6 39.8%

DATE: 14-JUN-84 TIME: 09:17:47
SAMPLE NAME: 130S

NA	MG	AL	SI	S	CL	K	CA
1.721	0.646	21.059	73.314	0.312	0.000	6.252	1.931

TI	FE	
0.000	1.130	106.366

DATE: 14-JUN-84 TIME: 09:24:24
SAMPLE NAME: 140S

NA	MG	AL	SI	S	CL	K	CA
1.112	0.416	11.385	85.419	0.264	0.000	0.747	1.769

TI	FE	
0.000	0.726	101.837

P0311D01

46.3

3.3 7.2

6.2 13.4

DATE: 14-JUN-84 TIME: 09:30:53
SAMPLE NAME: 290S

NA	MG	AL	SI	S	CL	K	CA
1.623	0.587	17.920	77.094	0.333	0.000	4.175	2.652

TI	FE	
0.000	1.308	105.692

DATE: 14-JUN-84 TIME: 09:37:21
SAMPLE NAME: 300S

NA	MG	AL	SI	S	CL	K	CA
1.226	0.467	13.851	83.364	0.307	0.000	0.793	2.280

TI	FE	
0.000	0.723	103.010

P0312D01

62.0

6.3 10.2

18.5 29.9

DATE: 14-JUN-84 TIME: 09:43:51
SAMPLE NAME: 450S

NA	MG	AL	SI	S	CL	K	CA
1.800	0.630	19.334	74.922	0.324	0.000	5.076	2.362

TI	FE	
0.000	1.120	105.568

DATE: 14-JUN-84 TIME: 09:50:30
SAMPLE NAME: 460S

NA	MG	AL	SI	S	CL	K	CA
0.931	0.426	10.704	86.217	0.256	0.000	0.872	1.541

TI	FE	
0.000	0.778	101.724

P0314R01

66.8

10.6 15.8

30.9 46.3

DATE: 14-JUN-84 TIME: 09:57:48
SAMPLE NAME: 610S

NA	MG	AL	SI	S	CL	K	CA
1.270	0.818	23.313	72.886	0.474	0.001	9.669	2.544

TI	FE	
0.000	1.583	112.557

DATE: 14-JUN-84 TIME: 10:21:02
SAMPLE NAME: 620S

NA	MG	AL	SI	S	CL	K	CA
0.000	0.273	3.170	96.709	0.261	0.000	0.284	0.730

TI	FE	
0.000	0.439	101.867

P0315R01

78.2

16.9 21.6

38.9 49.7

DATE: 14-JUN-84 TIME: 10:28:07
SAMPLE NAME: 770S

NA	MG	AL	SI	S	CL	K	CA
1.445	0.850	22.262	73.773	0.401	0.000	7.868	1.804

TI	FE	
0.000	1.827	110.229

DATE: 14-JUN-84 TIME: 10:35:24
SAMPLE NAME: 780S

NA	MG	AL	SI	S	CL	K	CA
0.040	0.290	4.514	94.860	0.237	0.000	0.366	0.771

TI	FE	
0.000	0.454	101.531

69.2

DATE: 14-JUN-84 TIME: 10:44:06
SAMPLE NAME: 930S

NA	MG	AL	SI	S	CL	K	CA

STATE OF OREGON

INTEROFFICE MEMO

TO: Jerry

DATE: August 2, 1984

FROM: Bev

SUBJECT: Silica sand open-file report

This is a brief summary of our discussion this morning on your open-file report.

1. Title--Bench testing of silica sand from deposits in Clatsop and Morrow Counties, Oregon.
2. Series--Open-File Report O-84-5
3. Funding number--Home base
4. Contents--a. Disclaimer
   b. Text
      1) Cover
      2) 6-page summary
      3) Data tables
      4) Recommendation
      5) References
      6) Appendix
   c. Figures
      1) Map showing location of other two figures
      2) Map of area of Clatsop County showing Miocene sandstone outcrop and sample-location sites
      3) Map of Morrow County showing pluvial glacial deposits, older loess, sand dunes, and sample-location sites.
5. Schedule--Jerry is currently waiting for more material from Alabama. The report should be draft typed and into editing by August 20. It should be edited, retyped, printed, and released by the end of the month. Chuck will start on the artwork tomorrow.
6. Number to be printed--Jerry anticipates a very limited demand for this report. A distribution list is attached. At this time I suggest we print only 100 copies of the report. This will take care of our regular free distribution of 50 copies, Jerry's distribution, and about 35 left for sale.

BFV:ak
cc: John B.
Chuck S.
Klaus N.

Attachment

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Plant Chemist

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Senior Project Engineer

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+ 6 copies to Richard Schulberg, Economic Dep. 155 Cottage St NE, Salem 9731

+ 2 copies to Alabama - ~~(get address from Jerry)~~
a. W. E. Lamont, Research Assoc., Mineral Resources Institute, Univ of Alabama, University, Alabama ~~35486~~ 35486
b. R. Bruce Tippin, same address

STATE OF OREGON

DOGAMI

DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
1005 STATE OFFICE BUILDING, PORTLAND, OR 97201
(503) 229-5580

NEWS RELEASE

RELEASE DATE:

CONTACT: KLAUS NEUENDORF

TEST RESULTS RELEASED FOR SILICA SAND FROM CLATSOP AND MORROW COUNTIES

The Oregon Department of Geology and Mineral Industries (DOGAMI) has released the results of a study in which samples from Clatsop and Morrow Counties were collected and analyzed for their promise as silica sand resources. Three deposits were identified in Clatsop County from which a silica sand product can be produced.

The 12-page study, Bench Testing of Silica Sand from Deposits in Clatsop and Morrow Counties, Oregon, was conducted by DOGAMI geologist J.J. Gray, in cooperation with the Port of Morrow, the Mineral Resource Institute of the University of Alabama, and a private industrial firm. It has been released as DOGAMI Open-File Report O-84-5.

The areas from which the samples were collected are both along the course of the Columbia River and contain deposits of sandstone, fluvioglacial sand and gravel, dunes, and silt and sand of a glacial lake. ~~and the sample sites are located in an upper Miocene sandstone.~~ The testing for silica sand potential was based on standards for the most stringent silica sand markets. Each sample was assayed, sized, subjected to magnetic and gravity separation, and re-assayed. The results of the tests are presented in the report in tabular form.

The new report, DOGAMI Open-File Report O-84-5, is now available at the Oregon Department of Geology and Mineral Industries, 1005 State Office Building, 1400 SW Fifth Avenue, Portland, OR 97201. The purchase price is $__. Orders under $50 require prepayment.

# # # # # # # # # # # #

84-14

GENSTAR
Cement

Genstar Cement Limited
7777 Ross Road
Delta, British Columbia
Ph. (604) 946-0411

Mailing Address:
P.O. Box 950
Delta, British Columbia
V4K 3S6

1984 07 17

Mr. Gerry Gray
Oregon Department Geology &
Mineral Industries
1005 State Office Building
Portland, Oregon
U.S.A. 97201.

Dear Sir:

Enclosed is copy of analysis of samples received as per our telephone conversation of July 16, 1984. Do not hesitate to call if further information is needed.

Yours truly,

GENSTAR CEMENT LIMITED

R Kerton

for: L. Szafron
Plant Chemist

LS/rk
enclosure

VICTOR ATIYEH
GOVERNOR

Department of Geology and Mineral Industries
ADMINISTRATIVE OFFICE
1005 STATE OFFICE BLDG., PORTLAND, OREGON 97201 PHONE (503) 229-5580

August 1, 1984

Dr. W.E. Lamont
Mineral Resources Institute
The University of Alabama
P.O. Box Drawer A~~B~~
University, Alabama 35486

Dear Dr. Lamont:

Enclosed is a copy of the assay data for the two splits of the six sand samples; 3 Amp-N. Mag-F 2.60 and 3 Amp-N. Mag-S 2.60, F2.70.

The computer printout used NA for Na_2O; MG for MgO; SI for SiO_2; K for K_2O; CA for CaO; and FE for Fe_2O_3. The assaying was by x-ray used for industrial processing of cement. The first split was somewhat out of the firm's normal working range, so that the totals are more than a 100 percent.

Sincerely,

Jerry J. Gray
Economic Geologist

JJG:ak
Encl.

DATE: 14-JUN-84 TIME: 09:17:47
SAMPLE NAME: 13OS

NA	MG	AL	SI	S	CL	K	CA
1.721	0.646	21.059	73.314	0.312	0.000	6.252	1.931

TI	FE	
0.000	1.130	106.366

DATE: 14-JUN-84 TIME: 09:24:24
SAMPLE NAME: 14OS

NA	MG	AL	SI	S	CL	K	CA
1.112	0.416	11.385	85.419	0.264	0.000	0.747	1.769

TI	FE	
0.000	0.726	101.837

DATE: 14-JUN-84 TIME: 09:30:53
SAMPLE NAME: 29OS

NA	MG	AL	SI	S	CL	K	CA
1.623	0.587	17.920	77.094	0.333	0.000	4.175	2.652

TI	FE	
0.000	1.308	105.692

DATE: 14-JUN-84 TIME: 09:37:21
SAMPLE NAME: 30OS

NA	MG	AL	SI	S	CL	K	CA
1.226	0.467	13.851	83.364	0.307	0.000	0.793	2.280

TI	FE	
0.000	0.723	103.010

DATE: 14-JUN-84 TIME: 09:43:51
SAMPLE NAME: 45OS

NA	MG	AL	SI	S	CL	K	CA
1.800	0.630	19.334	74.922	0.324	0.000	5.076	2.362

TI	FE	
0.000	1.120	105.568

DATE: 14-JUN-84 TIME: 09:50:30
SAMPLE NAME: 46OS

NA	MG	AL	SI	S	CL	K	CA
0.931	0.426	10.704	86.217	0.256	0.000	0.872	1.541

TI	FE	
0.000	0.778	101.724

DATE: 14-JUN-84 TIME: 09:57:48
SAMPLE NAME: 61OS

NA	MG	AL	SI	S	CL	K	CA
1.290	0.818	23.313	72.886	0.474	0.001	9.669	2.544

TI	FE	
0.000	1.583	112.557

DATE: 14-JUN-84 TIME: 10:21:02
SAMPLE NAME: 62OS

NA	MG	AL	SI	S	CL	K	CA
0.000	0.273	3.170	96.709	0.261	0.000	0.284	0.730

TI	FE	
0.000	0.439	101.867

DATE: 14-JUN-84 TIME: 10:28:07
SAMPLE NAME: 77OS

NA	MG	AL	SI	S	CL	K	CA
1.445	0.850	22.262	73.773	0.401	0.000	7.868	1.804

TI	FE	
0.000	1.827	110.229

DATE: 14-JUN-84 TIME: 10:35:24
SAMPLE NAME: 78OS

NA	MG	AL	SI	S	CL	K	CA
0.040	0.290	4.514	94.860	0.237	0.000	0.366	0.771

TI	FE	
0.000	0.454	101.531

DATE: 14-JUN-84 TIME: 10:44:06
SAMPLE NAME: 93OS

NA	MG	AL	SI	S	CL	K	CA

VICTOR ATIYEH
GOVERNOR

Department of Geology and Mineral Industries
ADMINISTRATIVE OFFICE
1005 STATE OFFICE BLDG., PORTLAND, OREGON 97201 PHONE (503) 229-5580

June 7, 1984

Mr. Larry Szafron
Genstar Limited
7777 Ross Road
Delta, B.C.
CANADA

Dear Mr. Szafron:

We have been working with Doug Blender of your Edmonton office to see if a cheaper source of low-alkali silica sand could be found in Oregon. Enclosed are 12 beneficiated sand samples from Oregon sand deposits. We would like to have you run the samples for SiO_2, Al_2O_3, TiO_2, Fe_2O_3, CaO, MgO, Na_2O, K_2O, and SO_3.

The assay results should be sent to me at the above address. Also, could you, briefly, send along what method was used for the assaying. Doug supplied the information verbally, but being a "geologist" the information did not stay.

Thank you for your help.

Sincerely,

Jerry J. Gray
Economic Geologist

JJG:bj
Encl.

MINERAL RESOURCES INSTITUTE
AND
STATE MINE EXPERIMENT STATION
THE UNIVERSITY OF ALABAMA
UNIVERSITY, ALABAMA 35486

P. O. DRAWER AY

TELEPHONE: 205/348-6577

May 30, 1984

Mr. Jerry Gray
Department of Geology and Mineral Industries
1005 State Office Building
Portland, Oregon 97201

Dear Mr. Gray:

Enclosed you will find a copy of the final report concerning the evaluation of the six sand samples submitted to the Mineral Resources Institute under contract 3G84.

Should you have any questions regarding this information please do not hesitate to call.

Sincerely,

W. E. Lamont

W. E. Lamont
Research Associate

WEL:ph
cc: Bob Wells
Read Holland
Carl Rampacek
Annie Ballard

MINERAL RESOURCES INSTITUTE
AND
STATE MINE EXPERIMENT STATION
THE UNIVERSITY OF ALABAMA
UNIVERSITY, ALABAMA 35486

P. O. DRAWER AY

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Mr. Jerry Gray
Department of Geology and Mineral Industries
1005 State Office Building
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Sincerely,

W. E. Lamont

W. E. Lamont
Research Associate

WEL:ph
cc: Bob Wells
Read Holland
Carl Rampacek
Annie Ballard

MINERAL RESOURCES INSTITUTE
AND
STATE MINE EXPERIMENT STATION
THE UNIVERSITY OF ALABAMA
UNIVERSITY, ALABAMA 35486

P. O. DRAWER AY

TELEPHONE: 205/348-6577

May 17, 1984

Mr. Jerry Gray
Department of Geology and Mineral Industries
1005 State Office Building
Portland, Oregon 97201

Dear Mr. Gray:

Under separate cover I am sending to your attention 96 samples representing studies of the six sand samples you submitted to MRI for evaluation as potential glass and/or cement sand resources. A final report discussing the results of these studies is in progress and will be forwarded as soon as possible.

Should you be interested in initiating your analytical evaluation of the products prior to receipt of the final report I would suggest that you look first at samples 14, 30, 46, 62, 78, and 94 (circled on the attached list) as these samples represent the highest quality products produced in our evaluation. These products should contain the bulk of the quartz sand meeting the size specifications for cement sand shown in your letter of March 6; however, they also probably contain a limited quantity of feldspar due to an overlap of specific gravity between certain feldspars and quartz.

The methods used to isolate these fractions should yield maximum quartz sand weight recovery, under the conditions of trial. While it might be theroretically possible to improve the quality of the sand products by reducing the feldspar content by flotation techniques, the low weight recoveries (13 to 49 percent) represented would be further reduced, thus increasing the cost/ton of concentrate.

In the course of the heavy liquid separation studies all near gravity material was placed in either the float 2.60 or the sink 2.70 fractions to insure the highest quality quartz fractions possible. Consequently, some of the quartz, represented by locked particles, may have reported outside the specific gravity range of 2.60 - 2.70.

It is highly doubtful that any of the concentrates will meet any known glass sand specifications; however, if you wish to analyze the samples for potential glass sand usage you should remove the plus 28 mesh (30 U.S.) from the concentrates to meet glass sand size specifications.

We will appreciate hearing the results of your analyses of those products analyzed. It has been a pleasure working with you on this project. Dr. Tippin sends his regards.

Sincerely,

W. E. Lamont

W. E. Lamont
Research Associate

WEL:ph
Enclosures

Oregon Sand Samples

Sample #	Ore #	Test #	Product
1	(PO 310 D01) 117 A	2	+20 m
2	"	"	+28
3	"	"	28/35
4	"	"	35/48
5	"	"	48/65
6	"	"	65/100
7	"	"	100/150
8	"	"	150/200
9	"	"	-200
10	"	3	Ro. mag 3 amps
11	"	"	C1 mag 3 amps
12	"	"	C2 mag 3 amps
13	"	"	3 amp N.mag f 2.60
14	"	"	3 amp N.mag S 2.60, f 2.70
15	"	"	3 amp N.mag S 2.70
16	"	"	-150
17	(PO 311 D01) 117 B	2	+20
18	"	"	+28
19	"	"	28/35
20	"	"	35/48
21	"	"	48/65
22	"	"	65/100
23	"	"	100/150
24	"	"	150/200
25	"	"	-200
26	"	3	Ro mag 3 amps
27	"	"	C1 mag 3 amps
28	"	"	C2 mag 3 amps
29	"	"	3 amp N.mag f 2.60
30	"	"	3 amp N.mag S 2.60, f 2.70
31	117 B	3	3 amp N.mag S 2.70
32	"	"	-150
33	(PO 312 D01) 117 C	2	+20
34	"	"	+28
35	"	"	28/35
36	"	"	35/48
37	"	"	48/65
38	"	"	65/100
39	"	"	100/150
40	"	"	150/200
41	"	"	-200
42	"	3	0.2 amp mag
43	"	"	1.5 amp mag
44	"	"	3.0 amp mag
45	"	"	3 amp N.mag f 2.60
46	"	"	3 amp N.mag S 2.60, f 2.7
47	"	"	3 amp N.mag S 2.70
48	"	"	-150
49	(PO 314 R01) 117 D	2	+20
50	"	"	+28
51	"	"	28/35
52	"	"	35/48
53	"	"	48/65
54	"	"	65/100
55	"	"	100/150
56	"	"	150/200
57	"	"	-200
58	"	3	0.5 amp mag
59	"	"	1.5 amp mag
60	"	"	3.0 amp mag

Sample #	Ore #	Test #	Product
61	117 D	3	3 Amp Ni Mag f 2.60
62	"	"	3 Amp Ni Mag S 2.60, f 2.70
63	"	"	3 Amp Ni Mag S 2.70
64	"	"	−150
65	(PO 315 R01) 117 E	2	+ 20 m
66	"	"	+ 28
67	"	"	28/35
68	"	"	35/48
69	"	"	48/65
70	"	"	65/100
71	"	"	100/150
72	"	"	150/200
73	"	"	−200
74	"	3	0.5 Amp mag
75	"	"	1.5 Amp mag
76	"	"	3.0 Amp mag
77	"	"	3 Amp Ni Mag f 2.60
78	"	"	3 Amp Ni Mag S 2.60, f 2.70
79	"	"	3 Amp Ni Mag S 2.70
80	"	"	−150
81	(PO 316 R01) 117 F	2	+ 20
82	"	"	+ 28
83	"	"	28/35
84	"	"	35/48
85	"	"	48/65
86	"	"	65/100
87	"	"	100/150
88	"	"	150/200
89	"	"	−200
90	"	3	0.5 Amp mag

Sample #	Ore #	Test #	Product
91	117 F	3	1.5 Amp mag
92	"	"	3.0 Amp mag
93	"	"	3 Amp Ni Mag f 2.60
94	"	"	3 Amp Ni Mag S 2.60, f 2.70
95	"	"	3 Amp Ni Mag S 2.70
96	"	"	−150

MINERAL RESOURCES INSTITUTE
AND
STATE MINE EXPERIMENT STATION
THE UNIVERSITY OF ALABAMA
UNIVERSITY, ALABAMA 35486

P. O. DRAWER AY

TELEPHONE: 205/348-6577

May 17, 1984

Mr. Jerry Gray
Department of Geology and Mineral Industries
1005 State Office Building
Portland, Oregon 97201

Dear Mr. Gray:

Under separate cover I am sending to your attention 96 samples representing studies of the six sand samples you submitted to MRI for evaluation as potential glass and/or cement sand resources. A final report discussing the results of these studies is in progress and will be forwarded as soon as possible.

Should you be interested in initiating your analytical evaluation of the products prior to receipt of the final report I would suggest that you look first at samples 14, 30, 46, 62, 78, and 94 (circled on the attached list) as these samples represent the highest quality products produced in our evaluation. These products should contain the bulk of the quartz sand meeting the size specifications for cement sand shown in your letter of March 6; however, they also probably contain a limited quantity of feldspar due to an overlap of specific gravity between certain feldspars and quartz.

The methods used to isolate these fractions should yield maximum quartz sand weight recovery, under the conditions of trial. While it might be theroretically possible to improve the quality of the sand products by reducing the feldspar content by flotation techniques, the low weight recoveries (13 to 49 percent) represented would be further reduced, thus increasing the cost/ton of concentrate.

In the course of the heavy liquid separation studies all near gravity material was placed in either the float 2.60 or the sink 2.70 fractions to insure the highest quality quartz fractions possible. Consequently, some of the quartz, represented by locked particles, may have reported outside the specific gravity range of 2.60 - 2.70.

It is highly doubtful that any of the concentrates will meet any known glass sand specifications; however, if you wish to analyze the samples for potential glass sand usage you should remove the plus 28 mesh (30 U.S.) from the concentrates to meet glass sand size specifications.

We will appreciate hearing the results of your analyses of those products analyzed. It has been a pleasure working with you on this project. Dr. Tippin sends his regards.

Sincerely,

W. E. Lamont

W. E. Lamont
Research Associate

WEL:ph
Enclosures

Oregon Sand Samples

Sample #	Ore #	Test #	Product
1	(PO 310 D01) 117 A	2	+20 m
2	"	"	+28
3	"	"	28/35
4	"	"	35/48
5	"	"	48/65
6	"	"	65/100
7	"	"	100/150
8	"	"	150/200
9	"	"	-200
10	"	3	Ro. mag 3 amps
11	"	"	C1 mag 3 amps
12	"	"	C2 mag 3 amps
13	"	"	3 amp N. mag f 2.60
14	"	"	3 amp N. mag S 2.60, f 2.70
15	"	"	3 amp N. mag S 2.70
16	"	"	-150
17	(PO 311 D01) 117 B	2	+20
18	"	"	+28
19	"	"	28/35
20	"	"	35/48
21	"	"	48/65
22	"	"	65/100
23	"	"	100/150
24	"	"	150/200
25	"	"	-200
26	"	3	Ro mag 3 amps
27	"	"	C1 mag 3 amps
28	"	"	C2 mag 3 amps
29	"	"	3 amp N. mag f 2.60
30	"	"	3 amp N. mag S 2.60, f 2.70

Sample #	Ore #	Test #	Product
31	117 B	3	3 amp N. mag S 2.70
32	"	"	-150
33	(PO 312 D01) 117 C	2	+20
34	"	"	+28
35	"	"	28/35
36	"	"	35/48
37	"	"	48/65
38	"	"	65/100
39	"	"	100/150
40	"	"	150/200
41	"	"	-200
42	"	3	0.2 amp mag
43	"	"	1.5 amp mag
44	"	"	3.0 amp mag
45	"	"	3 amp N. mag f 2.60
46	"	"	3 amp N. mag S 2.60, f 2.7
47	"	"	3 amp N. mag S 2.70
48	"	"	-150
49	(PO 314 R01) 117 D	2	+20
50	"	"	+28
51	"	"	28/35
52	"	"	35/48
53	"	"	48/65
54	"	"	65/100
55	"	"	100/150
56	"	"	150/200
57	"	"	-200
58	"	3	0.5 amp mag
59	"	"	1.5 amp ma
60	"	"	3.0 amp ma

Sample #	Ore #	Test #	Product
61	117 D	3	3 Amp Ni Mag f 2.60
62	"	"	3 Amp Ni Mag S 2.60, f 2.70
63	"	"	3 Amp Ni Mag S 2.70
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65	(PO 315 R01) 117 E	2	+ 20 m
66	"	"	+ 28
67	"	"	28/35
68	"	"	35/48
69	"	"	48/65
70	"	"	65/100
71	"	"	100/150
72	"	"	150/200
73	"	"	−200
74	"	3	0.5 Amp mag
75	"	"	1.5 Amp mag
76	"	"	3.0 Amp mag
77	"	"	3 Amp Ni Mag f 2.60
78	"	"	3 Amp Ni Mag S 2.60, f 2.70
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84	"	"	35/48
85	"	"	48/65
86	"	"	65/100
87	"	"	100/150
88	"	"	150/200
89	"	"	−200
90	"	3	0.5 Amp mag
91	117 F	3	1.5 Amp mag
92	"	"	3.0 Amp mag
93	"	"	3 Amp Ni Mag f 2.60
94	"	"	3 Amp Ni Mag S 2.60, f 2.70
95	"	"	3 Amp Ni Mag S 2.70
96	"	"	−150

MINERAL RESOURCES INSTITUTE
AND
STATE MINE EXPERIMENT STATION
THE UNIVERSITY OF ALABAMA
UNIVERSITY, ALABAMA 35486

P. O. DRAWER AY

TELEPHONE: 205/348-6577

May 17, 1984

Mr. Jerry Gray
Department of Geology and Mineral Industries
1005 State Office Building
Portland, Oregon 97201

Dear Mr. Gray:

Under separate cover I am sending to your attention 96 samples representing studies of the six sand samples you submitted to MRI for evaluation as potential glass and/or cement sand resources. A final report discussing the results of these studies is in progress and will be forwarded as soon as possible.

Should you be interested in initiating your analytical evaluation of the products prior to receipt of the final report I would suggest that you look first at samples 14, 30, 46, 62, 78, and 94 (circled on the attached list) as these samples represent the highest quality products produced in our evaluation. These products should contain the bulk of the quartz sand meeting the size specifications for cement sand shown in your letter of March 6; however, they also probably contain a limited quantity of feldspar due to an overlap of specific gravity between certain feldspars and quartz.

The methods used to isolate these fractions should yield maximum quartz sand weight recovery, under the conditions of trial. While it might be theroretically possible to improve the quality of the sand products by reducing the feldspar content by flotation techniques, the low weight recoveries (13 to 49 percent) represented would be further reduced, thus increasing the cost/ton of concentrate.

In the course of the heavy liquid separation studies all near gravity material was placed in either the float 2.60 or the sink 2.70 fractions to insure the highest quality quartz fractions possible. Consequently, some of the quartz, represented by locked particles, may have reported outside the specific gravity range of 2.60 - 2.70.

It is highly doubtful that any of the concentrates will meet any known glass sand specifications; however, if you wish to analyze the samples for potential glass sand usage you should remove the plus 28 mesh (30 U.S.) from the concentrates to meet glass sand size specifications.

We will appreciate hearing the results of your analyses of those products analyzed. It has been a pleasure working with you on this project. Dr. Tippin sends his regards.

Sincerely,

W. E. Lamont

W. E. Lamont
Research Associate

WEL:ph
Enclosures

VICTOR ATIYEH
GOVERNOR

Department of Geology and Mineral Industries
ADMINISTRATIVE OFFICE
1005 STATE OFFICE BLDG., PORTLAND, OREGON 97201 PHONE (503) 229-5580

March 30, 1984

Wayne Schwandt, Manager
Port of Morrow
P.O. Box 200
Boardman, Oregon 97818

Dear Wayne:

Attached is the assay data for the sand samples. Please keep this data confidential until the cement firm can make a decision whether or not to set up a sand plant.

Sincerely,

Jerry J. Gray
Economic Geologist

JJG:ab

Attachment

VICTOR ATIYEH
GOVERNOR

Department of Geology and Mineral Industries
ADMINISTRATIVE OFFICE
1005 STATE OFFICE BLDG., PORTLAND, OREGON 97201 PHONE (503) 229-5580

March 26, 1984

CONFIDENTIAL

Mr. William Cooke
Technical Services
AFG Industries, Inc.
P.O. Box 929
Kingsport, Tennessee 37662

Dear Bill:

Since our last meeting on November 21, 1983, we have undertaken sampling in two areas in Oregon for silica sand deposits. We would like to design our testing procedures so that the results of laboratory work will be directly applicable to your search for the high silica sand needed to support a glass manufacturing plant.

Feldspathic sand samples have been taken near Boardman in Morrow County in northeastern Oregon and near the Columbia River northwest of Portland. Preliminary analytical data are enclosed. Several of the samples will be processed at the University of Alabama Mineral Resources Institute to ascertain the preliminary feasibility of upgrading to a high silica product.

We would appreciate your detailed advice on both physical and chemical testing procedures as soon as possible. We also need an updated statement of your tonnage, screen size and grade requirements so that our future work can proceed efficiently. It is our understanding that the Coos Bay sand is a technically and economically feasible source for your silica raw material requirements; however, if this conclusion proves to be incorrect, we are prepared to provide any geologic support that you need to locate alternative sources of supply.

We hope the new data will be helpful and look forward to providing assistance as you proceed. Please be assured that we will treat this matter in strict confidence.

Best regards.

Sincerely,

Donald A. Hull
State Geologist

DAH:jr
Encl.
bc John C. Anderson

MINERAL RESOURCES INSTITUTE
AND
STATE MINE EXPERIMENT STATION
THE UNIVERSITY OF ALABAMA
UNIVERSITY, ALABAMA 35486

P. O. DRAWER AY

TELEPHONE: 205/348-6577

March 20, 1984

Mr. Jerry J. Gray
Department of Geology and Mineral Industries
1005 State Office Building
Portland, Oregon 97201

Dear Jerry:

I was pleased to receive your letter for preliminary beneficiation evaluation of the Oregon sand samples. We will initiate testwork upon receipt of the samples. Thank you for your interest in the Mineral Resources Institute and looking forward to working with you on this project.

Sincerely,

R. Bruce Tippin
Director

RBT:scr

cc: Carl Rampacek
File

1 cc John B
1 cc Terry G

VICTOR ATIYEH
GOVERNOR

Economic Development Department

595 COTTAGE STREET NE., SALEM, OREGON 97310 PHONE (503) 373-1200

March 15, 1984

Mr. Donald A. Hull
State Geologist
Department of Geology and Mineral Industries
1005 State Office Building
Portland, Oregon 97201

Dear Don:

Thank you for your recent letter regarding your activities in support of a major investment case that is looking for sand as a source of raw product in Oregon. Your department has been instrumental in providing data and expertise for this business.

Rick Schulberg will continue to be your contact for this case, and will be discussing with you further arrangements as this case progresses.

Sincerely,

John

John C. Anderson
Director

JA:vw

RECEIVED-PTLD
MAR 19 1984
DEPT. OF GEOLOGY

VICTOR ATIYEH
GOVERNOR

Department of Geology and Mineral Industries
ADMINISTRATIVE OFFICE
1005 STATE OFFICE BLDG., PORTLAND, OREGON 97201 PHONE (503) 229-5580

March 13, 1984

Dr. R. Bruce Tippin, Director
Mineral Resources Institute
The University of Alabama
P.O. Drawer AY
University, Alabama 35486

Dear Dr. Tippin:

I forgot to put in my sample transmittal letter that your bench testing as, we agreed, would cost no more than $2,500.00.

Again, if you have any questions, please contact me.

Thank you.

Sincerely,

Jerry J. Gray

Jerry J. Gray
Economic Geologist

JJG:ab

VICTOR ATIYEH
GOVERNOR

Department of Geology and Mineral Industries
ADMINISTRATIVE OFFICE
1005 STATE OFFICE BLDG., PORTLAND, OREGON 97201 PHONE (503) 229-5580

March 8, 1984

John C. Anderson
Department of Economic Development
595 Cottage St. N.E.
Salem, Oregon 97310

Dear John:

We urgently need to communicate with technical representatives of the "glass company" about our recent work on potential sources of silica sand in Oregon. We have collected samples of sands that will require careful testing to evaluate beneficiation methods for upgrading quality. To date we have not received the information requested earlier regarding testing procedures that are acceptable to the company in order to assure that our resulting data will be useful to them. We also need a definitive statement of quality and tonnage required for the proposed plant. We cannot make further progress until this information is available. Could you please send the name, address and telephone number of the appropriate individuals in the glass company.

Best regards.

Sincerely,

Don

Donald A. Hull
State Geologist

DAH:ab

bcc: Jerry Gray

VICTOR ATIYEH
GOVERNOR

Department of Geology and Mineral Industries
ADMINISTRATIVE OFFICE
1005 STATE OFFICE BLDG., PORTLAND, OREGON 97201 PHONE (503) 229-5580

March 6, 1984

Dr. R. Bruce Tippin, Director
Mineral Resources Institute
The University of Alabama
P.O. Drawer AY
University, Alabama 35486

Dear Dr. Tippin:

Six sand samples have been sent to you for bench testing. We need to know if any of the sand samples will meet cement and/or glass specifications. A table giving assays for the samples is attached. The specification for cement sand is SiO_2-85 percent plus and less than 0.6 total alkalies. Total alkalies is defined to mean the percent of Na_2O plus 65.8 percent of the K_2O percent. The sizing needed is - 20 mesh + 140 mesh. For the glass sand the glass firm has not given us its specifications. We will assume that SiO_2 should be 98 percent and iron should be less than 0.04 percent. The iron specification is important. The firm may be able to use some of the feldspathic material. The sizing need + 20 mesh, 0 percent; + 30 mesh, 1 percent maximum; and - 140 mesh less than 5 percent.

If you have any questions please call me.

Thank you.

Sincerely,

Jerry J. Gray

Jerry J. Gray
Economic Geologist

JJG:ab

Attachment

ASSAY AND SIZING DATA FOR SAND SAMPLES TAKEN FROM CLATSOP AND MORROW COUNTIES

Chemistry	P031D01	P0311D01	P0312001	P0314R01	P0315R01	P0316R01
SiO_2	70.15%	67.07%	70.06%	78.46%	80.63%	80.12%
Al_2O_3	12.97	13.89	12.76	14.82	13.38	10.67
TiO_2	0.14	0.22	0.13	-	-	-
Fe_2O_3	5.58	6.65	5.85	3.32	2.28	3.14
CaO	3.07	3.53	3.39	1.20	1.27	1.57
MgO	1.16	1.74	1.36	.60	.60	.67
Na_2O	1.50	1.67	1.90	.43	1.10	1.12
K_2O	1.98	1.86	1.97	2.34	2.31	2.11
SO_3	0.9	0.02	0.0	.24	.20	.19
TOTAL	96.55%	96.65%	97.42%	101.41%	101.71%	99.59%
SIEVE SIZES						
+20	0.23%	0.12%	23.9%	-	-	-
-20	37.9	2.3	57.2	-	-	-
-60	40.5	11.1	13.9	-	-	-
-100	15.4	33.6	3.2	-	-	-
-140	3.5	14.7	0.8	-	-	-
-200	2.3	38.8	1.1	-	-	-
TOTAL	99.83%	100.62%	100.1%	-	-	-

STATE OF OREGON

INTEROFFICE MEMO

TO: Don H.

DATE: March 5, 1984

FROM: Jerry Gray

SUBJECT: Silica Sand - A Status Report

A one-line summary of our silica sand work would be that it is on low burner. Before we proceed much further, we need some formal technical answers. We need to know the glass company's raw materials specifications. We need to know what they would like and what they could use from the standpoint of transportation costs. These specifications are not the same. We need to know how much raw materials will be needed.

The Department has collected seven sand samples which have been assayed and funding for beneficiation testing of six of the samples has been arranged with the Port of Morrow. Along with sending the six samples to the Mineral Resources Institute at the University of Alabama, we need to send the glass company specifications in terms of assays and sizing. Guessing what is needed is not the way to go. We will do just that when the agreement for the test work funding arrives from the Port of Morrow. In looking for a source of silica sand for the glass plant, the Department has received help from a Canada cement manufacture. This firm is looking for a source of low alkali silica sand. The firm's specifications are 85% plus silica and less than 0.6 combined alkali. The sand source must be near barge transportation. This firm has agreed to assay all our raw samples and all the beneficiated sample splits. The attached table gives the raw sample assay data. If material from one of the sand source samples can be upgraded to meet both glass and cement needs, the cement firm might build a sand plant

to supply both markets. For those areas served by barge, Oregon may have a real cost advantage. Limestone for the Portland market comes from Canada. Those barges go back empty. Empty barges go up the Columbia and come back loaded with grain. A sand deposit on the lower Columbia could supply a cement plant in Canada and a glass plant at Boardman through barge backhaul rates.

A Departmental find is its unpublished data generated in the 1940's for foundry sands. Sand deposits from Grants Pass to Astoria were sampled and mapped. Test work included sizing, assaying, and some clay washing. One sample from the Eugene area, after the clays were washed out, ran 97.42% SiO_2 and only 1.22% Al_2O_3-Fe_2O_3. This data is contained in three folders entitled "Eugene Sand", "Sand Reconnaissance - Western Oregon" and "Miscellaneous Foundry Sand Data."

# # #

JG:bj

TABLE I ASSAY AND SIZING DATA FOR SAND SAMPLES TAKEN FROM CLATSOP AND MORROW COUNTIES

Chemistry	P031D01	P0311D01	P0312001	P0313D01	P0314R01	P0315R01	P0316R01	Cement Firm Sample
SiO_2	70.15%	67.07%	70.06%	67.04%	78.46%	80.63%	80.12%	82.83%
Al_2O_3	12.97	13.89	12.76	12.99	14.82	13.38	10.67	12.94
TiO_2	0.14	0.22	0.13	0.14	-	-	-	0.01
Fe_2O_3	5.58	6.65	5.85	5.86	3.32	2.28	3.14	1.63
CaO	3.07	3.53	3.39	4.43	1.20	1.27	1.57	1.01
MgO	1.16	1.74	1.36	1.69	.60	.60	.67	0.49
Na_2O	1.50	1.67	1.90	1.75	.43	1.10	1.12	0.52
K_2O	1.98	1.86	1.97	2.05	2.34	2.31	2.11	2.07
SO_3	0.9	0.02	0.0	0.0	.24	.20	.19	0.26
TOTAL	96.55%	96.65%	97.42%	95.95%	101.41%	101.71%	99.59%	101.76%
SIEVE SIZES								
+20	0.23%	0.12%	23.9%	2.5%	-	-	-	4.2%
-20	37.9	2.3	57.2	43.1	-	-	-	84.2
-60	40.5	11.1	13.9	17.3	-	-	-	5.3

-100	19.4	33.6	3.2	15.2	-	-	-	2.1
-140	3.5	14.7	0.8	5.9	-	-	-	.1
-200	2.3	38.8	1.1	16.0	-	-	-	3.6
TOTAL	99.83%	100.62%	100.1%	100.0%	-	-	-	99.5%

Sample Number	County	Sample Type	Township	Range	Section	¼ Section
P0310D01	Morrow	Dune Sand	4N	25E	20	SW
P0311D01	Morrow	Loess	3N	26E	29	NW
P0312D01	Morrow	Washed Sand	4N	25E	10	NE
P0313D01	Morrow	Dredge Spoils	4N	25E	3	SE
P0314R01	Clatsop	Sandstone	7N	6W	6	SE
P0315R01	Clatsop	Sandstone	8N	6W	19	NW
P0316R01	Clatsop	Sandstone	8N	7W	8	NE
Cement Firm Sample	Clatsop	Sandstone	near P0315R01			

STATE OF OREGON

INTEROFFICE MEMO

TO: John Beaulieu

DATE: February 23, 1984

FROM: Jerry Gray

SUBJECT: Glass Sand Assays

Doug Blender of Genstar called with the following assay data:

	SAMPLE NUMBER 1	2	3	4	5
SiO_2	70.15	67.07	70.06	67.04	82.83
Al_2O_3	12.97	13.89	12.76	12.99	12.94
TiO_2	0.14	0.22	0.13	0.14	0.01
Fe_2O_3	5.58	6.65	5.84	5.86	1.63
CaO	3.07	3.53	3.39	4.43	1.01
MgO	1.16	1.74	1.36	1.69	0.49
Na_2O	1.50	1.67	1.90	1.75	0.52
K_2O	1.98	1.86	1.97	2.05	2.07
SO_3	0.9	0.02	0.0	0.0	0.26
TOTAL	96.55	96.65	97.42	95.95	101.76

SIEVE SIZES					
+20	0.23	0.12	23.9	2.5	4.2
-20	37.9	2.3	57.2	43.1	84.2
-60	40.5	11.1	13.9	17.3	5.3
-100	15.4	33.6	3.2	15.2	2.1
-140	3.5	14.7	0.8	5.9	.1
-200	2.3	38.8	1.1	16.0	3.6
TOTAL	99.83	100.62	100.1	100.0	99.5

81-125-1387

Sample No. 1 is the dune sand - Department Sample No. PO 310D01.

Sample No. 2 is the older sand (Loess) - Department Sample No. PO 311D01.

Sample No. 3 is the washed sand from the Ready Mix plant - Department Sample No. PO 312D01.

Sample No. 4 is the dredge tailings - Department Sample No. PO 313D01. (This one is not to be sent to Alabama.)

Sample No. 5 was the sandstone at the creek level near Oregon Portland Cement's sand pit on Gnat Creek. The Department does not have a sample at this spot. The closest Department sample was taken within the nearby pit and was No. PO 315R01.

# # #

JG:bj

VICTOR ATIYEH
GOVERNOR

Department of Geology and Mineral Industries

ADMINISTRATIVE OFFICE

1005 STATE OFFICE BLDG., PORTLAND, OREGON 97201 PHONE (503) 229-5580

February 22, 1984

Wayne Schwandt, Manager
Port of Morrow
P.O. Box 200
Boardman, Oregon 97818

Dear Mr. Schwandt:

The Oregon Department of Geology and Mineral Industries collected six silica sand samples during the 14th and 15th of February. Three of the samples were from the Boardman area and three were from the Wauna area. The six samples will be assayed by a Canadian cement firm at no cost. The physical testing will be performed by the University of Alabama Mineral Resource Institute at a cost of $2,500.00. The Department has and will cover all collecting and handling costs. The Port of Morrow is to pay for the physical testing. The Port will be billed at the end of the project.

The Port must realize that results from the six samples taken from potential resources as large as the ones being sampled can not be the final word. The best that can be hoped for, is that the samples show enough promise that a potential user will be enticed to take their own samples.

Attached are copies of the Department's communications with the University of Alabama, Mineral Resources Institute.

Please sign one of the attached agreements and return it if you wish us to proceed.

Sincerely,

Jerry J. Gray
Economic Geologist

JJG:ab

Enclosures

AGREEMENT

The Oregon Department of Geology and Mineral Industries hereby agrees to collect six sand samples (three from the Boardman area and three from the Wauna area), split out a ten-pound portion of each sample, save and store the rest of each sample, and ship the ten-pound splits to the University of Alabama Mineral Resource Institute. After the Institute does their testing, each of the ten-pound samples will be separated into a high silica fraction and other fractions. These sample portions will be sent to the Department for transshipment to a cement plant in Canada for assaying. The Institute, after receiving the assays, will submit a final report to the Department. The Department will pay the Institute $2,500.00 for testing the six samples and for their final report.

The Port of Morrow agrees to reimburse the Department for the cost of the University of Alabama Resource Institute's test work and final report. The cost is to be $2,500.00. The $2,500.00 is to be paid when the Department submits the Port a copy of the Institute's final report.

Oregon Department of Geology and Mineral Industries

_____ _____

John D. Beaulieu
Deputy State Geologist

Date

Port of Morrow

_____ _____

Wayne L. Schwandt
Manager

Date

AGREEMENT

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Oregon Department of Geology and Mineral Industries

John D. Beaulieu
Deputy State Geologist

Date 2/22/84

Port of Morrow

Wayne L. Schwandt
Manager

Date 2-29-84

RECEIVED-PTI
MAR 5 1984
DEPT. OF GEOLOG

VICTOR ATIYEH
GOVERNOR

Department of Geology and Mineral Industries
ADMINISTRATIVE OFFICE
1005 STATE OFFICE BLDG., PORTLAND, OREGON 97201 PHONE (503) 229-5580

February 22, 1984

Mr. John C. Anderson, Director
Oregon Economic Development Department
595 Cottage Street, N.E.
Salem, Oregon 97310

Dear John:

As we discussed in Salem last week, it is very important for our geologists to meet with technical representatives of the glass company to review their testing results on samples of silica sand from various locations in Oregon and to share our latest information. We would like to confirm the earlier indication that the Coos Bay sand is adequate. If not, we should aggressively investigate alternative sources.

In recent weeks, we have not had feedback from the company regarding the questions raised earlier about testing procedures and results to date.

Best regards.

Sincerely,

Donald A. Hull
State Geologist

DAH:jr

VICTOR ATIYEH
GOVERNOR

Department of Geology and Mineral Industries

ADMINISTRATIVE OFFICE

1005 STATE OFFICE BLDG., PORTLAND, OREGON 97201 PHONE (503) 229-5580

February 21, 1984

Doug B. Blender
Genstar Cement Limited
College Plaza 8215 112 Street
P.O. Box 2555 Main PO
Edmonton, Alberta
CANADA T5J 2T1

Dear Doug:

Enclosed are the materials you needed copied. Another report that we don't have but you may wish to get would be "Economic Feasibility of Silica Sand Processing and Related Manufacturing in Chelan County, Washington", June, 1966, by Industrial Consultants, published by Economic Development Administration, U.S. Department of Commerce. The Contract number was C-107-65. The report can be ordered from the National Technical Information Service, U.S. Department of Commerce, Springfield, Virginia 22151.

I have the sand samples all boxed up ready to be sent out, but need to get the Port's okay.

If I have missed anything, please advise.

Sincerely,

Jerry J. Gray
Economic Geologist

JJG:ab

Enclosure

STATE OF OREGON

INTEROFFICE MEMO

TO: John B.

DATE: February 8, 1984

FROM: Don

SUBJECT: Silica Sand

It is likely that representatives of the glass manufacturing company will visit Oregon within one month and possibly by the end of February, 1984. It will be important to have written information summarizing the current status of our work on various sands available by February 25th. Please let me know if it will be desirable for Jerry or others to meet with company representatives.

km

Also - E13 letter

Contains Recycled Materials

STATE OF OREGON

INTEROFFICE MEMO

TO: John Beaulieu

DATE: February 1, 1984

FROM: Jerry Gray

SUBJECT: Clatsop County Silica Sand Assays

The following are assays from the four samples taken by Mr. Blender of Gemstar Cement Company, Alberta Canada, (403) 432-0231.

SAMPLE #	1	2	3	4
SiO_2	78.46%	72.89%	80.63%	80.12%
Al_2O_3	14.82	15.99	13.38	10.67
Fe_2O_3	3.32	5.24	2.28	3.14
CaO	1.20	1.14	1.27	1.57
MgO	.60	.84	.60	.67
Na_2O	.43	.55	1.10	1.12
K_2O	2.34	2.34	2.31	2.11
Total Alkalies as Na_2O*	1.97	2.09	2.53	2.51
Cl	0	0	0	0
SO_3	.24	.11	.20	.19
TOTAL	101.36%	99.17%	101.70%	99.59%

P0314R01 P0315R01 P0316R01

* Total alkalies are obtained by taking 65.8% of the K_2O figure and adding the Na_2O figure.

81-125-1387

Contains Recycled Materials

Sample 1 was taken on Nicolai Mountain where John Beaulieu is pictured in Bulletin 79. Sample 2 is a composite of Oregon Portland Cement's six stockpiles of dark colored sand in the Gnat Creek Quarry. Sample 3 was from the lighter colored part of the outcrop in the quarry and was taken over a vertical distance of 12 feet. Sample 4 was taken from the NE¼ of Section 8, T8N, R7W from a light colored outcrop next to a paved road near a private bird refuge.

Mr. Blender is looking for a silica source with total alkalies of .6% or less. The samples were screened and the fraction assayed. None of the sizes were upgraded.

Mr. Blender will fly to Portland to go with us to get the Morrow County samples. He will get them assayed for us with a turn-a-round time of about three days.

# # #

JG:bj

Jerry

STATE OF OREGON

INTEROFFICE MEMO

TO: Don Hull

DATE: January 6, 1984

FROM: Jerry Gray

SUBJECT: Meeting with Oregon Economic Development Department

The meeting was attended by Richard Schulberg, Norm Solomon, Paul Haugland, Peter Tryon and myself. A wide range of subjects were discussed. Regarding the glass plant, the firm's sales staff would like the plant in Medford; the producing staff would like it at Boardman. Because the chip truck comes back from Coos Bay empty, transportation of sand from Coos Bay would be cheap. The monies saved in transportation from not using Lane Mountain would be enough to up-grade the Coos Bay sands. The cement company's silica needs were pointed out to OEDD. It was pointed out that it is time to start sampling some of the sand deposits. OEDD may have some monies for this. I suggested that our Department might be willing to pick up the cost of taking a few samples, if the glass firm would run them and we would get the results which, in time, we could publish. They were told that I would be taking a sample of the Boardman sand when the cement company's man comes down in late January.

Over the long term, it was pointed out the need for a non-metal program because of the employment it could generate. They would back us in this effort. The need for a small report on each of the mineral-using industries was raised. These reports could become chapters for Bulletin 64.

As far as off-shore minerals go, their thinking is the same as ours. They were very disappointed over Bob Bailey's newspaper blast at MMS.

If Hobart Butte goes forward to a plant building stage, then for a 3 million dollar plant the State could put up $600,000 at 3% interest.

JJG:bj

Contain Recycle Material

MINERAL RESOURCES INSTITUTE
AND
STATE MINE EXPERIMENT STATION
THE UNIVERSITY OF ALABAMA
UNIVERSITY, ALABAMA 35486

P. O. DRAWER AY

TELEPHONE: 205/348-6577

January 27, 1984

Mr. Jerry Gray
Department of Geology and Mineral Industries
1005 State Office Building
Portland, Oregon 97201

Dear Jerry:

This is to confirm our telephone conversation of January 26, 1984 concerning testing Oregon sand deposits for producing glass grade silica (Reference letter of October 10, 1983).

The Mineral Resources Institute would be pleased to initiate the previously outlined tests when the ten pound samples are received (approximately March 1 - 15, 1984). The tests will be conducted by Mr. William E. Lamont, Research Associate. We estimate the exploratory study on six (6) samples can be completed in two to three weeks assuming no delays in chemical analysis. The products would be shipped to your facility for chemical assay and the results returned to MRI for evaluation. Chemical specification for the final product would be forwarded when the test samples are submitted to MRI. The lump sum cost of this exploratory study would be $2,500. After completion of the study a report would be submitted to your office which would summarize the test program, evaluate the results and make any recommendations that are appropriate.

If there are any questions concerning the proposed study, please feel free to contact either Mr. Lamont or myself. Thank you for your interest in the Mineral Resources Institute and looking forward to your response.

Sincerely,

R. Bruce Tippin
Director

RBT:ph
cc: Bob Wells
Read Holland
Ed Lamont
Carl Rampacek

VICTOR ATIYEH
GOVERNOR

Department of Geology and Mineral Industries
ADMINISTRATIVE OFFICE
1005 STATE OFFICE BLDG., PORTLAND, OREGON 97201 PHONE (503) 229-5580

November 28, 1983

Mr. Thomas E. Shufflebarger, Jr.
Geologist
106 Hageman Street
Berkeley Springs, West Virginia

Dear Mr. Shufflebarger:

In answer to your question about Oregon's glass and foundry sand producers, the State has only one.

The firm is Coos Sand Corporation, 4421 - 138th S.E. Bellevue, Washington 98006.

Sincerely,

Jerry Gray
Economic Geologist

JG:bj

Thomas E. Shufflebarger, Jr.
Geologist
106 Hageman Street
Berkeley Springs, WV 25411
Tel. (304)258-1584

November 19, 1983

Oregon Department of Geology & Mineral Industries
1005 State Office Building
1400 SW 5th Avenue
Portland, Oregon 97201

Gentlemen:

Could you furnish me with a listing of the glass sand and foundry sand producers now located in the State of Oregon ? Company names and mailing addresses would be quite helpful.

This I would appreciate very much.

Sincerely,

T. E. Shufflebarger, Jr.

T. E. Shufflebarger, Jr.

RECEIVED-PTLD
NOV 22 1983
DEPT. OF GEOLOGY & MINERAL INDUSTRIES

VICTOR ATIYEH
GOVERNOR

Department of Geology and Mineral Industries
ADMINISTRATIVE OFFICE
1005 STATE OFFICE BLDG., PORTLAND, OREGON 97201 PHONE (503) 229-5580

November 21, 1983

Mr. Doug Blender
Genstar Cement
P. O. Box 2555
Edmonton, Alberta
CANADA T5J 2T1

Dear Mr. Blender:

In answer to your request about Oregon's silica sands, a copy of a report about the resources needed for glass manufacture and part of Bulletin 79 are enclosed.

If you need more help, please call.

Sincerely,

Jerry J. Gray
Economic Geologist

JJG:bj
Encl.

VICTOR ATIYEH
GOVERNOR

Department of Geology and Mineral Industries
ADMINISTRATIVE OFFICE
1005 STATE OFFICE BLDG., PORTLAND, OREGON 97201 PHONE (503) 229-5580

November 21, 1983

William Cook
AFG Industries, Inc.
P.O. Box 929
Kingsport, Tennessee 37662

Dear Mr. Cook:

The enclosed materials on mineral raw materials are part of the information the Department has developed in support of your search for a float glass plant site. The materials include the following:

1. Our interoffice memo of October 20, 1983 outlining a test procedure for evaluating raw materials;

2. The Department's report "The Mineral Resource Base for Flat Glass Manufacturing in Oregon";

3. Mr. Tippin's letter of November 8, 1983 listing the steps in the evaluation of glass sand deposits;

4. Mr. Lewis' letter of November 2, 1983 describing Boise Cascade's silica sand deposits and the firm's current exploration program for silica sand;

5. Mr. Donald's letter of October 27, 1983 and attached report "The Pend Oreille Silica Sand Prospect a New High Purity Source for the Northwest", summarizing Meridian Land's work in northern Idaho;

6. Interoffice memo of October 18, 1983 giving assays for Texada Is., British Columbia limestone and Gnat Creek, Oregon silica sand;

7. Interoffice memo of October 20, 1983 giving assay data for Unimin's Emmett, Idaho silica sand deposit;

8. Interoffice memo of October 26, 1983 giving assays for Industrial Mineral Products' silica sand deposit.

Other contacts the Department made and that may be of further interest to you are as follows:

1. Mr. Truswell, owner, Wenatchee Silica Products, Inc., Wenatchee, Washington, phone (509)-663-3552. This silica sand runs 98% silica, 0.3% Fe_2O_3 and 1.0% Al_2O_3.

2. Gary Steele, Weyerhaeuser Company, Tacoma, Washington 98477, phone (206)-924-2567. Weyerhaeuser may have clear-glass sand deposits in east King County, Washington. Mr. Steele would like to talk with your firm.

3. Mr. DeVall, Coos Sand Corp., 4421 138th SE, Bellevue, Washington 98006, phone (206)-746-0381. This firm mines and processes silica sand and crushes limestone for glass usage.

If you have any questions or if we can be of further service please advise.

Sincerely,

Jerry J. Gray

Jerry J. Gray
Economic Geologist

JJG:ab

Enclosure

STATE OF OREGON

INTEROFFICE MEMO

TO: Jerry G. and John B.

DATE: November 21, 1983

FROM: Don

SUBJECT: Coordination with DED

On November 16, 1983 I talked candidly with Wayne Wolfe, Deputy Director with the Department of Economic Development, to express our continuing concern about the failure of DED to communicate with us with regard to raw material sources that could supply a float glass manufacturing plant in Oregon. As you know we have had an increasing level of frustration due to the unannounced cancellation of meetings, failure to return phone calls and lack of response to written communication between DOGAMI and DED. In the meantime the glass company appears to be approaching a decision regarding plant siting.

Wayne acknowledges the internal problems with respect to the individuals that have been working with the glass company and failing to communicate with us. I asked Wayne to simply write us and request that our involvement be terminated if that is their desire. Alternatively I made clear the need to meet directly with the technical representatives of the glass company so that we can transmit the substantial information already developed from a variety of private sources with respect to raw materials such as silica, dolimite and limestone. I also indicated that it will be necessary to meet with the glass company in order to determine DOGAMI's official contribution to this economic development project. Wayne promises to call back later today (11/16/83) and indicates that the glass company is now in Oregon reevaluating possible plant sites.

DAH:ab

Contains Recycled Materials

VICTOR ATIYEH
GOVERNOR

Department of Geology and Mineral Industries
ADMINISTRATIVE OFFICE
1005 STATE OFFICE BLDG., PORTLAND, OREGON 97201 PHONE (503) 229-5580

November 17, 1983

Mr. Wayne J. Wolfe
Deputy Director
Department of Economic Development
155 Cottage Street NE
Salem, Oregon

Dear Wayne:

During the past several weeks we have been working as previously requested on the compilation of private unpublished data on silica, dolomite and limestone resources of the Pacific Northwest in order to encourage the establishment of a float glass manufacturing plant in Oregon. We have become increasingly frustrated by the communications gap that has developed between DED and our staff. The net result has been an inability to transmit important technical information to AFG Industries, Inc. Meetings have been cancelled without prior notice, letters are unanswered and telephone calls have not been returned.

As noted in my letter and memo of October 20, 1983 and earlier letter of October 6, 1983 it is important for us to have a response from you and AFG Industries. I am baffled by DED's inability to schedule a meeting with the representatives of AFG and our staff.

Please write me your ideas on our role in the effort to encourage the location of this company in Oregon. If DED does not want involvement by our geologists in this effort I would appreciate a statement to that effect. Copies of my earlier letters and memo are enclosed.

Sincerely,

Donald A. Hull
State Geologist

km

bcc: John Beaulieu
Jerry Gray

MINERAL RESOURCES INSTITUTE
AND
STATE MINE EXPERIMENT STATION
THE UNIVERSITY OF ALABAMA
UNIVERSITY, ALABAMA 35486

P. O. DRAWER AY

TELEPHONE: 205/348-6577

November 8, 1983

Mr. Jerry Gray
Department of Geology and Mineral Industries
1005 State Office Building
Portland, Oregon 97201

Dear Jerry:

As discussed on the phone last week, I'll delay my plans for a visit to your office until things are better defined by your group. However, as promised, I am attaching a brief outline of a general research study for glass sands. This may provide you with information that may be helpful. If we may be of further service, please let me know.

Sincerely,

R. Bruce Tippin
Director

RBT:sw

cc: Hanna
Rampacek

EVALUATION OF GLASS SAND DEPOSITS

Objectives

The major objectives of the proposed research program are:

1. To evaluate one or more silica deposits as raw materials for glass making.

2. To develop a beneficiation technique to economically produce quality silica sand products for selected markets.

3. To investigate the possibility of co-producing other valuable mineral by-products from the silica deposits.

Introduction

Silica sand low in iron is much in demand for glass, glass wool, ceramic and pottery use, and for many of these applications clean, white sand is desired. Impurities such as clay slime, iron stain, and heavy minerals including iron oxides, garnet, chromite, zircon, and other accessory minerals must not be present. Chromium, for example, must not be present, even in extremely small amounts, in order for the sand to be acceptable to certain markets. Feldspars and mica are also objectionable in some applications but in others may be desirable as source of alumnia. Generally, iron content must be reduced to 0.030% Fe_2O_3 or less for all specialty silica applications.

The more common glass sand deposits are either consolidated sandstone or loose sand pit deposits (wet or dry). By far the major tonnage of glass sand produed in the United States is taken from friable, readily-reduced sandstones and unconsolidated sands; the widespread nature of such prospect-types, renders dependence on the more indurated rocks of secondary importance.

Acceptable glass sands are, invariably, those which most nearly fit the glass-producer's economic needs and any method used to evaluate a raw material's potential must finally prove equatable with such needs. Of principal concern to the investigator are those properties of the orebody which include (1) chemistry of the silica-bearing body, (2) the mineralogy, nature and complexity of the component grains and (3) the grain-size distribution.

Of particular concern is the nature of the iron contamination. Iron-bearing species appear as 1) accessory mineral grains, either detrital or authigenic, 2) cements, 3) grain coatings, and 4) quartz-grain inclusions. Selection of the cheapest form of beneficiation requires precise information on the iron species in the particular deposit.

A PROPOSED RESEARCH PROGRAM

The proposed research program will embrace three major tasks.

1. Characterization of the silica deposit(s)
2. Beneficiation studies
3. Product evaluation and process development

All samples for the above investigations will be collected by others and shipped to the Mineral Resources Institue (MRI).

Most of the chemical, mineralogic analysis for the proposed program will be conducted at commercial laboratories to insure rapid turn-around of the results.

Task I. Characterization Studies

This will include the following investigations

1. Screen analysis at 20, 30, 40, 50, 60, 70, 80, 100, and 140 mesh to determine the size distribution of the head samples.
2. Heavy liquid separation of the size fractions between 20 and 140 mesh at 2.8 specific gravity to determine the percentage of all heavy minerals.
3. Chemical analysis of selected samples and test products.
4. Trace element analysis of the head sample and selected products.
5. Mineralogic and x-ray examination to determine the principal mineral impurities with particular reference to the iron-bearing minerals and undesirable refractory accessory minerals.

Task II. Beneficiation Studies

Based on the results obtained from the characterization studies mentioned under Task I, a number of beneficiation procedure(s) will be investigated to determine the simplest processing route to produce glass sand grade silica. The proposed investigations under this task may include but not limited to the following tests:

1. Attrition Scrubbing and Classification

   In these tests the -20 + 140 mesh sand fraction will be intensely agitated at high pulp density (60 - 75% solids) in a rubber lined attrition scrubber for removal of surface stain from the sand grains and to desentigrate the soft clay particles. The degree of surface filming and iron oxde stain will determine the scrubbing time required.

The scrubbed sand is diluted with water to 25-30% solids for removal of slimes released in the scrubber. In some cases the sand meets the required iron oxide specifications by scrubbing only. In this case, the sand product becomes final product.

However, the more difficult to treat sand may require two stage attrition scrubbing with classification and slime removal between stages. Other sands may require additional beneficiation techniques as indicated below.

2. Conditioning and Flotation

Deslimed sand containing mica, feldspar, and iron bearing heavy minerals often can be successfully cleaned to specifications by flotation. Generally this is done in an acid pulp circuit. Conditioning with H_2SO_4 and iron promoting reagents is most effective at high density, 70-75% solids. In the flotation step the impurity minerals are floated off in a froth product which is rejected as waste.

3. Magnetic separation

In case considerable amounts of magnetic impurities escape removal in the scrubbing and/or flotation steps, high intensity magnetic separation of the sand products may remove the last traces of iron impurities.

4. By Products

Should rejected tailing products from attritioning, flotation or magnetic separation contain considerable amounts of trace and accessory minerals, their recovery will be considered.

Task III. Product Evaluation and Process Development

Based on the beneficiation test results, a specific process flowsheet will be established. Further, laboratory investigations, pilot plant testing, and product evaluation may be needed and would be recommended in the final report.

11/2

Jerry G.,

You should call Al Bartell in Portland on or before 11/7 to give him the tonnage requirements for silica, ls, & dolo for the glass plant

In turn, later in Nov. he will send us quality & quantity data on dolo & silica.

Al Bartels - 11/2

(1) Silica sand - Lane Mtn. only source in production
Wylie - Pacific Silica - new owner
@ capacity

Second silica deposit near Lane Mtn.

(2) Dolomite - Al has deposit @ Northport
Union Carbide former consumer
< 1% SiO_2 Fe - low

(3) Office @ Northport & Addy

(4) Second deposit of silica is
trying to sell.

(5) He will send us data.

(6) No phone @ Addy

(7) (509) - 732 - 4530 a cabin - Northport, Wa. 48 mi. N. of Addy

Box 32
Addy, Wa. 99101 } business address; no phone

11/7/83

Don:

I called A.O. Bartell, he would give us a tour of the silica and dolomite deposits before or after the NW Mining meeting. He would take the glass people too.

Jerry

VICTOR ATIYEH
GOVERNOR

Department of Geology and Mineral Industries
ADMINISTRATIVE OFFICE
1005 STATE OFFICE BLDG., PORTLAND, OREGON 97201 PHONE (503) 229-5580

November 1, 1983

Wayne J. Wolfe
Department of Economic
Development
155 Cottage Street NE
Salem, Oregon 97310

Dear Wayne:

We are continuing our efforts to locate sources of silica, limestone, and dolomite in order to encourage the location of a float glass manufacturing facility in Oregon. A substantial amount of additional data is being compiled.

I am concerned that we are duplicating the efforts of others and continue to feel that it is critical to discuss technical aspects of raw material requirements with the principal and your staff. An exchange of information and ideas is crucial to our progress.

Sincerely,

Donald A. Hull
State Geologist

km

cc: John D. Beaulieu
Jerry J. Gray
Richard J. Schulberg

10/31

Joe Jemmett, Simplot

(208) - 336 - 2110

(1) Overton is highest quality glass sand -

Simplot Silica

Overton

(2) Bovill -

(3) Overton - washing & sizing

Best contact -

(4) W.J. (Sandy) Sandoval, Gen. Mgr

Simplot Silica Products

Overton, Nevada 89040

P.O. 308

(702) - 397 - 2667

Jerry G -

CONSULTANTS IN EXPLORATION,
DEVELOPMENT & EVALUATION
OF MINERAL RECOURCES

WILLIAM M. REED & ASSOCIATES
MINING GEOLOGISTS
8338 S. BEACHVIEW DRIVE — CLINTON, WASHINGTON 98236
PHONE (206) 321-4994

RECEIVED-PTLD
OCT 31 1983
DEPT. OF GEOL...
& MINERAL ...

10/27/83

Dear Don:

I looked around but had no luck finding that report on silica deposits in the N.W. that Hank Reed put together. As I remember, it might not have been that useful to you. You might see Hank at the NWMA convention and ask about it.

This reference could possibly have some info you can use:

Carter, G.J., Industrial Silica Deposits of the Pacific Northwest, USBM IC 811E.

Sorry I couldn't be of more help.

Best regards
Bill

STATE OF OREGON

INTEROFFICE MEMO

TO: John B. and Jerry

DATE: October 27, 1983

FROM: Don

SUBJECT:

I have learned second-hand that initial testing of a sample of Coos Bay sand by a glass manufacturing company has revealed that this material may be suitable. A 50 pound sample has been forwarded as of October 19th for further testing by magnetic separation and floatation.

We have scheduled a meeting in our office at 9 a.m. on Tuesday, November 1st to meet with the principals and the DED staff to review progress and plan our future activities. You should plan to attend.

DAH:ab

Contain Recycle Material

STATE OF OREGON

INTEROFFICE MEMO

TO: Don Hull

DATE: October 26, 1983

FROM: Jerry Gray

SUBJECT: Industrial Mineral Products

Industrial Minerals called me about doing the test work on silica sands. They have the equipment and use it for quality control for their own silica sand production. Their sand will not make clear glass. It runs 0.2 to 0.4 percent Fe_2O_3; 3 to 4 percent Al_2O_3; and 90 to 92 percent SiO_2. They will send us a letter about their testing program.

# # #

JG:bj

Contains Recycled Materials

STATE OF OREGON

INTEROFFICE MEMO

TO: Don Hull

DATE: October 26, 1983

FROM: Jerry Gray

SUBJECT: Silica Testing

Dr. Whittmore, University of Washington, Phone (206) 543-2154, stated that we could not get any help from the University of Washington for a silica testing program. He did give the following laboratory as doing a lot of assay work for the glass industry:

Hartford Division
E.M. Hart Industries
P.O. Box 700
Windsor, Connecticut 06095

# # #

JG:bj

Contains Recycled Materials

STATE OF OREGON

INTEROFFICE MEMO

TO: John B.
Jerry G.

DATE: October 20, 1983

FROM: Don H.

SUBJECT: Glass manufacturing

We need to proceed quickly with the evaluation of silica, limestone and dolomite resources that would support a new float glass manufacturing operation located in Oregon. The following approach is suggested.

(1) Develop a priority list of silica sources and evaluate each for quality and reserves. The list should include present producers, dormant past producers and undeveloped deposits. Telephone and letter inquiries should be used initially to answer questions about quality and quantity at current producers. Extensive travel will be required. Analytical data should be standardized, e.g., use Fe_2O_3 throughout rather than Fe. Land use aspects of each site should be evaluated. Field work needs to be prioritized. A list of this type will frequently need to be revised but should always be current.

(2) For limestone and dolomite resources, similar priority lists are needed. These evaluations must be done together keeping in mind the magnesia content of the various limestone deposits. Magnesite or magnesian limestone deposits may offer an alternative to dolomite.

(3) A standardized analytical procedure for treatment of samples is needed before logical field work can proceed. The procedure should be planned on two scales - first a bench scale and later a pilot scale. The analytical procedure should be designed to mimic later plant requirements in terms of contaminants.

The analytical procedure needs to be an interactive combination of geological, physical and chemical testing including detailed mineralogy, field mapping, screening, washing and chemical analysis.

Selected samples will need to be evaluated with more specialized methods such as magnetic separation, attritution scrubbing, and/or flotation. Combinations of these procedures will have to be used on both bench and pilot scales.

(4) After the testing procedures are outlined and reviewed by the potential glass manufacturer, various testing facilities will need to be evaluated in depth for cost, speed, etc. Key facilities include Colorado Research Foundation, ceramic engineering laboratories at schools such as Cal-Berkeley and the Mineral Research Institute of the University of Alabama.

(5) In order to expedite the evaluation of raw material sources an in-depth discussion will be needed with the technical staff of the glass manufacturing firm. The procedures outlined above must be critiqued by this company. This discussion should be completed by mid-December, 1983.

(6) The cost of field work and laboratory evaluation will have to be budgeted in a careful manner and an Emergency Board appearance in January, 1984 may be desirable.

(7) The following deadlines are suggested.

November 30, 1983 - Complete the collection of available analytical and reserve data for established producers in California, Idaho, Oregon, Montana and Washington.

December 15, 1983 - Complete discussions with glass manufacturer regarding scope of our involvement in field sampling and mapping, lab testing and calculation of reserves for silica, limestone, and dolomite raw materials.

July 1, 1984 - Complete the initial field sampling and mapping of dormant and undeveloped deposits.

August 31, 1984 - Complete the initial mineralogical, physical and chemical analysis of dormant and undeveloped deposits. A detailed review of results with the manufacturing company should be held in September, 1984. Subsequent schedules cannot be predicted pending tentative decisions with regard to plant site locations and scope of pilot scale testing of promising deposits of silica, limestone and dolomite.

All of the work outlined above should be undertaken with the understanding that a comprehensive publication of results will be desirable at the appropriate time.

The project described above should be given highest priority and Jerry Gray should delay additional field work in central Oregon until the 1984 field season or beyond. All field sampling should include geologic mapping in order to allow later evaluation of lab results.

cc: Wayne J. Wolfe
Richard Schulberg

STATE OF OREGON

INTEROFFICE MEMO

TO: Don

DATE: October 20, 1983

FROM: JJ Gray

SUBJECT: Telephone interview with Ken Rolland, General Manager, Unimin Corp., Emmett, Idaho (208) 365-4590

Unimin is an eastern U.S. producer of sand, that had 10 plants before it bought 6 more plants from Martin Marietta Corp. Mr. Rolland stated that their sand carried 0.088 to 0.100 percent iron. They have no problem with reserves. He will pass our data request on to headquarters and someone will get back to me. The company might put in extra equipment to get the iron down if they could get the contract for 200 tons of sand per day.

km

Contains Recycled Materials

STATE OF OREGON

INTEROFFICE MEMO

TO: Don

DATE: October 18, 1983

FROM: Jerry Gray

SUBJECT: Telephone interview with Ed Miller, Oregon Portland Cement Portland, OR, 232-3116.

Ed will send us assays for Texada Is. and Durkee limestones and the Gnat CK. silica sand. The sand runs 70-72 percent SiO_2. The firm is not producing cement at its Lake Oswego plant but is still crushing Texada Is., limestone for agriculture usage.

	Tedada Chemical Grade Limerock	Gnat Creek Sandstone		
		1979	1980	198
SiO_2	0.46	75.55	70.56	69.
Fe_2O_3	0.09	4.05	4.03	6.
Al_2O_3	0.19	12.69	15.85	15,
CaO	55.06			
K_2O	0.02	1.89	1.90	2.0
Na_2O	0.02	0.66	0.64	0.7
MgO	0.35			
Loss	43.57			

E. J. Miller
OSC Co.
10/18/83

STATE OF OREGON

INTEROFFICE MEMO

TO: Don

DATE: October 18, 1983

FROM: Jerry Gray

SUBJECT: Telephone interview with Jerry Louise of Boise Cascade Corp. Boise, Idaho (208) 384-6161

Mr. Louise was called for information about silica resources in the Pacific Northwest.

Boise owns 50% of the land that is being mined at Lane Mt. Washington. The washed silica sand is 99.6 to 99.7 SiO_2. He is interested in the Clatsop County sands. He has looked at some of the same formation in S.W. Washington. He said that the statement can be made that within the land owned by Boise in Clatsop and Columbia Counties a supply of silica sand can and would be found to supply a flat glass plant. If a flat glass were to be located in Portland they would also be looking to produce silica sand for the Northern California market. The problem with the Lane Mt. area is the Burlington-Northern rates. They will not drop the rate in order to increase output.

For laboratory work he uses Bondar-Clegg & Co., Vancouver, B.C. for just SiO_2 analysis, for other needs he uses Sharp-Shurtz, Sandusky, Ohio, (614) 653-0532 and the Colorado School of Mines Research Institute, Metallurgy Research, Golden, CO, (303) 279-2581.

Mr. Louise stated that there are three flat glass plants (Flint & Amber) in the West. Northwest Glass, Seattle; Spectrum Glass Co., Inc., Seattle; and Owens-Illinois, Inc., Ione, California.

STATE OF OREGON

INTEROFFICE MEMO

TO: Jerry Gray

DATE: October 10, 1983

FROM: Don H.

SUBJECT: Silica Sand

One of the potential sources of float glass quality silica sand is an extensive deposit in the vicinity of Emmett, Idaho. Please make sure that you check out this potential in your evaluation.

DAH:ab

Contains Recycled Materials

MINERAL RESOURCES INSTITUTE
AND
STATE MINE EXPERIMENT STATION
THE UNIVERSITY OF ALABAMA
UNIVERSITY, ALABAMA 35486

P. O. DRAWER AY

TELEPHONE: 205/348-6577

October 10, 1983

Mr. Jerry Gray
Dept. of Geology and Mineral Industries
1005 State Office Building
Portland, Oregon 97201

Dear Jerry:

I appreciated the opportunity to talk to you yesterday about the Mineral Resources Institute, especially concerning testwork and evaluation of glass sand. I have enclosed some general information about MRI for reference. Our staff has considerable non-metallic research experience as shown in the project and presentation listing. MRI has specialized in two major areas of research--fossil fuels and non-metallics. I was personally involved with the design and evaluation of a privately owned feldspathic sand operation in North Carolina which produced glass quality material. This process included acid scrubbing, two stage flotation and dry magnetic separation.

If after reviewing the information about the Institute, I would be glad to discuss the project further. I will be at a conference in California in mid-November and can possibly stop for a short visit if it is appropriate. However, I would need to know fairly soon to make the needed travel arrangements.

As mentioned we would like to obtain a two pound sample of the material being considered. This would provide us the opportunity to conducting a cursory evaluation to determine if the sand is glass and quality before a more detail study would be considered. The evaluation would be without charge.

Thank you for your consideration and interest in the University of Alabama Mineral Resources Institute.

Sincerely,

R. Bruce Tippin
Director

RBT:scr
Enclosures

The University of Alabama
Mineral Resources Institute

DR. R. BRUCE TIPPIN
Director

University Drawer AY
Tuscaloosa, Alabama 35486
Office Phone (205) 348-6577

STATE OF OREGON

INTEROFFICE MEMO

TO: Don

DATE: October 6, 1983

FROM: Jerry G.

SUBJECT:

Charles Daellenbach of the BLM at Albany was called. No help. The Director of the Tuscaloosa Research Center was called. They are to work on strategic minerals. Informally they might be able to look at some of our samples and tell us what beneficiation system would work. He talked to the University of Alabama which can do the type of work that we need.

Bruce Tippin of the University of Alabama, (205) 348-6577, called. The cost for them to do work for us would be about $250/day. He is going to send us printed material about their program. If we send him a sample of the sand he can look at it and tell us if it would be worthwhile to try and upgrade the sand.

JJG:ab

Jerry

Contain Recycle Material

Jerry G - FYI

VICTOR ATIYEH
GOVERNOR

Department of Geology and Mineral Industries

312 S.E. "H" STREET, GRANTS PASS, OREGON 97526 PHONE (503) 476-2496
Mailing address: P.O. BOX 417, GRANTS PASS, OREGON 97526

October 5, 1983

Abner M. Ingebretson
S. 2619 Garfield Road
Spokane, Washington 99203

Dear Mr. Ingebretson:

Your letter to Don Hull was forwarded to me for answering.

I have inquired about the reported quartz deposit and at this point have concluded it must be the old Bristol Silica Mine. The property has been sold recently and the new owners are trying to put it back into operation.

The Bristol Silica Mine is located about 3 miles southwest of Gold Hill in Sec. 30, T. 36 S., R. 3 W., and the washing, screening plant is on the Southern Pacific Railroad about 3 miles west of Gold Hill.

If you need further information on the deposit feel free to contact us. Also, if I learn that this is possibly not the property reported, I will let you know.

Sincerely,

Len

Len Ramp
Resident Geologist

LR:rep

cc: Don Hull, State Geologist

RECEIVED-PTLD
OCT 13 1983
DEPT. OF GEOL.

STATE OF OREGON

INTEROFFICE MEMO

TO: Jerry Gray

DATE: October 4, 1983

FROM: Don Hull

SUBJECT: Silica resources

In order to evaluate potential sources of silica sand supply for the manufacture of high quality float glass, it will be necessary to develop an overview of resources throughout northern California, along coastal portions of southern California, throughout Idaho and northeastern Washington State where current operations at Lane Mountain north of Spokane represent the established supply.

By October 10 we will need a short written summary of these various alternative sources of supply with a view toward a silica raw material source that does not exceed 0.05 percent Fe_2O_3.

It is possible that we will want to undertake a sampling program for such resources later this year. We will need to establish sources of lab back-up for both physical and chemical testing of silica sand deposits in order to make such a sampling program effective.

On a confidential basis please pursue the possibility of obtaining lab support from the U.S. Bureau of Mines facilities.

John B., you and I should meet to review the situation on Monday, October 10. It is important to finish this work on silica before undertaking more sampling on the COMA project.

DAH:jr
cc John Beaulieu

Contains Recycled Materials

GENSTAR
Cement

Doug B. Blender, P. Eng.
Senior Project Engineer

Genstar Cement Limited
College Plaza, 8215 112 Street
Edmonton, Alberta
P O Box 2555, Main P O T5J 2T1
Ph (403) 432-0231 Telex 037-3304

Lee Stuart Lahti
Route 4, Box 504
astoria Oregon 97103
504, 6204

PORT OF MORROW

WAYNE L. SCHWANDT
MANAGER

(503) 481-2695
1 Marine Drive

P.O. Box 200
Boardman, OR 97818

READYMIX
SAND & GRAVEL, Inc.
"Rock Product Specialists"
Concrete
Rock
Asphalt
Block - Brick
Masonry Supplies

JOHN O'REILLY
Manager:
Boardman Division

P.O. Box 246 • Boardman, OR 97818 • (503) 481-9246

10/14/83

Jerry G.,

My detailed editorial comments are attached re the silica report.
Let's polish and have ready by 10/19.
Looking good

— update table w/ shared including 1980+ data

— expand table to address quality,
— quantity, "specs" for each deposit, mineralogy —
Also any new deposits
— develop a questionnaire & phone list
to get the data

For Silica
LS
Dolomite

1:30 Thu.

10/14/83

Jerry G. - re silica report

Table 1 - add Boardman deposit

note that the Emmett, Idaho deposit may have been sold to Unimin (sp ?) ?

Need to develop data on reserves later

Typos need correction

Report - p.1 - line 6 - export market is not involved as far as we now know diff re summary - p.7

p.2 - line 2 - without price quotes we should not reach conclusions re "cheapest source"

p.2 - line 9 - can we verify with reserve data that "Oregon has huge silica sand resources"

Question

1. How much resource are needed

Silica sand		200 t/d
Limestone	30%	60 T/d
Dolomite	20%	40 T/d
Lime		
Soda Ash		

2. Does the Firm want a tour of the silica and dolomite deposits of NW Washington. City Center Motel (509) 732-4530 A.D. Bartell

No

3. Can we get help from the firm if we take samples for them?

?

4. Can we use the Firm's name?

?

Hank Reed
Meridian Co.
(406) 256-4500

Bill Bratney
Project manager
(406) 256-4572

Meridian has an undeveloped ~~sand~~ silica sand deposit near Pend Oreille? Idaho ~~? Washington~~? ~~the~~ He will send us data on the deposit. The ~~iron~~ sand would run 0.04 Fe_2O_3 and 0.08 Al_2O_3. The deposit would be serviced by two rail lines. He thought the dolomite fines from the Northwest Alloys, Inc. magnesium operation. Industrial Minerals may have the sales contract for the fines.

Coos Sand — (206) 746-0381
Morey DeVall — crushes limestone for glass, could get sand down to ack as belender

Gary Steele, Weyerhauser (206) 924-2567
will call back

"Hank"
Henry E. Reed, Meridian Co.,
(406) 256-4500
call 10/24/83

~~Gary Wright~~, Union Pacific Railroad
(503) 249-2711 Carl Long, (415) 982-2100 x2
JRJ Over. None except Emmett.

~~U.S.G.S. P.P. 820 Silica Sand 1973.~~

O. J. Whittmore (206) 543-2154
University of Washington
Call 10/24/83

M. Herl

Hartford Division
E. M. Hart Industry
~~Hartfur Div~~
~~E. M. HART Industry~~
P.O. BOX 700
Windsor Com 06095

Silica
$50.00
$74.00

10/24/83

Gary Steel
Weyerhauser Co. (206) 924-2567
~~Tamaco~~ Tacoma, Washington 98477

Weyerhauser may have clear glass sand in east King County, Washington, in T21N, R7E. The rail distance is about 160 miles to Portland. They would like to talk to the glass company.

Bill Bratney
Meridian Land & Minerals
(406) 256-4572

Dolomite needs low Iron
less than 0.07 % Fe_2O_3

Dick Olson - 10/24/83

Suggests contacting -

(1) Pete Peterson

Dravo

Denver or Lakewood or Golden

Did silica work for Burlington

(2) Fay Bristol

(3) USBM - Silica commodity specialist

(4) Simplot has Nevada silica near Overton

(3) Tom Gay - Calif Division of Mines silica man

(6) Bill Osterling - Southern Pacific RR SF

Pete Peterson - Dravo 10/24/83

1. BN is developing sands in Idaho & N. Dakota

2. They will send brochures & silica rept.

3. Hank Reed is best B/N contact.

(303) 429-6820

6021 W. 75th Drive
Arvada, Colo. 80003

4.

Coos Sand — 746-0381

Gary Steele

206 / 924-2567

Boise Cascade 384-6161

~~963-3141~~ →

Bernard J. Guarnera

~~Berry~~ Guranera

Jerry Luise

99.5 silica

99.6 to 99.7

Don

Burington Northern

Billing or Seattle

Union Pacific

Consulter

~~Oregon Portland~~

~~Ed Miller~~

~~232-3118~~

Washind U. testing

Cal Berkly testing

Call Research Foundation

6/4

John B.,

Attached is the Alabama MRI report on sand samples.

How should we release this info to the public?

Return to JJG.

Jerry – Locations?
- How does hand written material relate
- What are the chemical results
- Let's briefly discuss Dan's question + define when it can best be answered.

John B

10/25/83

Truswell
Wenatchee Silica Products, Inc., Wenatchee Washington
(509) 663-3552 office (509) 663-1697 Mill

Wenatchee sand runs 98% silica 0.3% Fe_2O_3, and 1.0% Al_2O_3.

It will not make clear glass. The deposit has 100,000,000 tons.
For test work he recomended E.M. Hart Industries, Connecticut, University of Idaho, Joy Manufacturing, and Gallagher Salt Lake, Utah. One report we might want to get is

Industrial Consultants'

"Economic Feasiblity of Silica Sand Processing and Related Manufacturing in Chelan County Washington", June, 1966

The report was published by the

Economic Development ~~Dd~~ Administration
U.S. Department of Commerce. The
Contract number was C-107-65.
The report can be ordered from
National Technical Information Service,
U.S. Department of Commerce,
Springfield, Virginia 22151.

Mr. Truswell stated that
Oregon Portland Cement is moving its
Lake Oswego plant to Washington.
Truswell may be supplying the
silica for the new plant. The Lone Star
plant in Seattle may be bought and

moved north.

Lane Mt is the only source that can meet the needs of clear glass. The Lane Mt is owned by a Seattle glass company. The plant may be producing at capacity. The B.M dropped its rates for silica within ~~the St.~~ Washington from $11.80 down to $6.80.

Foundry Sand

Value depends on

(1) Natural bond or cohesiveness

(2) Permeability

(3) Grain size

4 Refractoriness

5. Durability

(1) The binding material of a molding sand is most important constituent. Each grain should be covered with thin film of binding material.

(2) Permeability affected by grain size. Should not be uniformly graded in size — so as to keep sand porous.

3. Grain size varies from 3 mesh to -200

4. Refractoriness depends on chemical and mineralogical comp. high in silica but, high in alkalies present

5. Durability the number of times it can be used.

Lack of durability is due to loss of bond by dehydration of the clay or limonite bonds to the extent that it will not rehydrate easily and to the destruction of the colloids by high temps.

No standard test for refractoriness, durability, or permeability

Should try sand out after chemical test shows good refractory possibilities.

Better write file on "Foundry Sand"

C
O
P
Y

File copy

SAND WASHING AND OTHER TESTS ON 16 SANDS FROM NEAR EUGENE, OREGON

Sand washing tests were made of 16 sand samples from near Eugene, Oregon, which were submitted by H. G. Iverson on October 7, 1943. Screen analyses, chemical analyses, magnetic separations, chemical analyses of the recovered non-magnetic products, and a friability test were also made of the washed sands. The results of these tests are given in Tables 1, 2, and 3.

After washing out the clay, the sands appeared to contain a relatively large amount of mica for foundry sand. Screen analyses showed that the sands were finer than those usually used in foundries.

The magnetic separations were made with a Ding's high-intensity induction magnetic separator. Megascopic examinations indicated that most of the material removed was mica, except for the sample from Hole 26, Reynolds number 1, which contained limonitic nodules.

The friability of a composite sample of 54 pounds was determined by blasting the sand against iron castings using air at 70 pounds pressure, and calculating the degradation in average grain size as a percent of the original size; values of 9.3 and 10.4 percent degradation were obtained. The value 9.3 represents the degradation after one blasting and 10.4 the cumulative after a second blasting. Previous friability tests of Ottawa, Illinois, sand under similar conditions gave values of 1.1 and 2.2.

Kenneth G. Skinner

U. S. Bureau of Mines
University Campus
Seattle 5, Washington

November 10, 1943

Table 1.--Percent drying loss, percent sand and clay, and screen analysis of the washed sand for 16 sand samples from near Eugene, Oregon.

Hole	Reynolds number	Drying loss 1/	Clay, %	Sand, %	Screen analysis of washed sand: +28	-28 +35	-35 +48	-48 +65	-65 +100	-100 +150	-150 +200	-200
16	1	3.7	41.5	58.5	0.1	1.2	6.1	50.8	28.0	6.3	4.1	3.4
					* .1	1.3	7.4	58.2	86.2	92.5	96.6	100.0
20	1	4.7	34.1	65.9	.3	1.2	8.0	46.2	27.4	8.1	4.8	4.0
					* .3	1.5	9.5	55.7	83.1	91.2	96.0	100.0
20	2	4.8	33.1	66.9	.4	2.0	8.9	42.8	28.2	8.5	4.8	4.4
					* .4	2.4	11.3	54.1	82.3	90.8	95.6	100.0
20	3	3.3	39.0	61.0	.4	1.4	7.8	41.4	33.1	7.9	4.4	3.6
					* .4	1.8	9.6	51.0	84.1	92.0	96.4	100.0
23	1	5.7	37.7	62.3	.5	1.1	8.1	43.6	30.9	7.9	3.9	4.0
					* .5	1.6	9.7	53.3	84.2	92.1	96.0	100.0
23	2	6.5	34.7	65.3	.9	2.2	10.5	41.6	29.1	7.9	3.9	3.9
					* .9	3.1	13.6	55.2	84.3	92.2	96.1	100.0
23	3	7.7	34.0	66.0	.9	3.0	13.4	44.4	24.4	6.6	3.6	3.7
					* .9	3.9	17.3	61.7	86.1	92.7	96.3	100.0
25	1	6.8	40.0	60.0	.7	1.7	8.8	48.6	27.2	6.6	4.1	2.3
					* .7	2.4	11.2	59.8	87.0	93.6	97.7	100.0
26	1	5.9	47.4	52.6	2.5	1.4	5.2	30.0	43.1	10.5	5.0	2.3
					*2.5	3.9	9.1	39.1	82.2	92.7	97.7	100.0
28	1	8.8	39.4	60.6	.6	1.3	9.5	47.0	27.3	7.6	4.3	2.4
					* .6	1.9	11.4	58.4	85.7	93.3	97.6	100.0
28	2	13.3	38.6	61.4	.7	2.2	12.3	45.4	25.4	7.1	4.0	2.9
					* .7	2.9	15.2	60.6	86.0	93.1	97.1	100.0
29	1	7.7	42.3	57.5	.5	.7	9.5	56.3	24.0	4.4	3.0	1.6
					* .5	1.2	10.7	67.0	91.0	95.4	98.4	100.0
29	2	9.8	39.4	60.4	.3	.3	4.9	35.3	45.1	9.4	3.1	1.6
					* .3	.6	5.5	40.8	85.9	95.3	98.4	100.0
32	1	10.0	33.7	66.3	2.5	4.4	13.5	43.1	24.7	6.0	3.3	2.5
					*2.5	6.9	20.4	63.5	88.2	94.2	97.5	100.0
33	1	7.0	32.9	67.1	2.1	5.9	15.8	42.8	23.7	5.3	2.7	1.7
					*2.1	8.0	23.8	66.6	90.3	95.6	98.3	100.0
Road cut 1		2.8	32.8	67.2	1.2	3.3	12.4	47.9	26.2	5.0	2.4	1.6
					*1.2	4.5	16.9	64.8	91.0	96.0	98.4	100.0
Composite 2/		---	---	100.0	.8	1.7	10.0	48.5	30.5	7.0	1.4	.1
					* .8	2.5	12.5	61.0	91.5	98.5	99.9	100.0

1/ Drying loss after drying on steam pipes. Grab samples indicated less than 0.5 percent additional loss at 130° C.

2/ Composite made in laboratory of equal parts of each preceding sample for friability test; composite was screened twice on a 150-mesh screen to remove most of the undersize.

*Cumulative percent.

2 cc - H. G. Iverson
1 cc - H. W. St. Clair
1 cc - P. T. Allsman
1 cc - N. L. Wimmler
1 cc - Files

Table 2.--Chemical analyses of 16 washed sands, from near Eugene, Oregon before and after magnetic separation. Percent recovery is also given.

Hole	Reynolds number	Total: Ign. loss, 950°C.	Total: SiO_2	Total: Fe_2O_3	Total: Al_2O_3	Total: TiO_2	After magnetic separation: Recovery	After magnetic separation: Ign. loss, 950° C.	After magnetic separation: SiO_2	After magnetic separation: Fe_2O_3	Decrease in Fe_2O_3
16	1	0.8	95.3	0.38	2.2	0.12	85	0.7	97.3	0.25	0.13
20	1	.7	95.7	.29	2.2	.10	92	.6	97.3	.21	.08
20	2	.6	95.4	.24	2.1	.10	87	.6	97.0	.19	.05
20	3	.8	94.4	.29	3.0	.10	93	.7	96.2	.21	.08
23	1	.7	95.7	.26	1.7	.12	83	.6	97.3	.16	.10
23	2	.8	95.3	.29	1.7	.12	89	.7	97.2	.19	.10
23	3	.9	94.8	.53	1.9	.12	92	.7	96.9	.31	.22
25	1	1.2	93.0	1.08	3.5	.16	95	1.0	95.8	.68	.40
26	1	2.1	87.7	3.59	5.8	.26	77	1.4	92.5	1.67	1.92
28	1	.9	94.5	.62	3.4	.12	91	.6	96.5	.40	.22
28	2	.7	95.2	.34	2.8	.12	89	.6	96.4	.28	.06
29	1	.9	94.1	1.16	2.8	.20	97	.8	95.7	.77	.39
29	2	.8	94.2	.76	2.9	.36	93	.7	95.7	.49	.27
32	1	1.1	92.4	1.48	3.0	.12	93	1.0	94.0	1.15	.33
33	1	.7	95.1	.35	2.6	.10	93	.7	96.2	.31	.04
Road cut 1		.6	95.6	.23	2.4	.10	95	.6	97.1	.11	.12

Table 3.--Friability of composite of Eugene, Oregon sand as determined by sand-blasting.

Test	Screen analysis: -10 +14	-14 +20	-20 +28	-28 +35	-35 +48	-48 +65	-65 +100	-100 +150	-150	Cumulative friability
Original	0.1	0.3	0.4	1.7	10.0	48.5	30.5	7.0	1.5	----
1	---	---	.2	.2	5.5	49.2	30.9	8.4	5.6	9.3
2	---	---	.1	.1	5.0	49.4	30.4	8.9	6.1	10.4

2 cc - H. G. Iverson
1 cc - H. W. St. Clair
1 cc - P. T. Allsman
1 cc - N. L. Wimmler
1 cc - Files

SILICA SAND

P 1767 - Eugene fire sand
P 1768 - Ottawa sand

P 1768 - 99.4 % SiO_2 (Chemical determination)

Spectrochemical	Fe_2O_3	-	0.05
	Al_2O_3	-	.19
	CaO	-	.02
	TiO_2	-	.01
	ZrO_2	-	.05
	MgO	-	.01
			.33

* 100 - .33 = 99.67 (not corrected for moisture)

P 1767 - 96.39 % SiO_2 (Chemical determination)

Spectrochemical	Fe_2O_3	-	.10
	Al_2O_3	-	.90
	CaO	-	.02
	TiO_2	-	.10
	ZrO_2	-	.01
	MgO	-	.04
			1.17
	Moisture		1.3
			2.47

* 100 - 2.47 = 97.53 %

* Percentage of SiO_2 by spectrochemical determined by difference and because all impurities were not determined, results are higher than chemical determination.

Foundry Sand

Foundry sands include those siliceous sands used to make the forms for casting metals. If they are employed for making molds, they are known as molding sands; if for cores, core sands. Sands are both natural and synthetic. "Sharp sand" is sand free from bonding clay.

The important properties are physical: fineness, bonding strength, permeability, sintering point, and durability.

Fineness refers to the size of the grains. "Grains" are those particles larger than 20 microns, while "clay" is smaller material. This property is expressed by the "grain-fineness number". These sieves are based on U. S. Bureau of Standards sieves.

Table 1

Mesh	Aperture Inch	Aperture mm.
6	0.132	3.36
12	.066	1.68
20	.033	0.84
30	.023	.59
40	.0165	.42
50	.0117	.30
70	.0083	.21
100	.0059	.149
140	.0041	.105
200	.0029	.074
270	.0021	.053

Table 2

Mesh Thru	Mesh On	Factor Factor
-	6	3
6	12	5
12	20	10
20	30	20
30	40	30
40	50	40
50	70	50
70	100	70
100	140	100
140	200	140
200	270	200
270	Pan	300

The American Foundrymen's Association specified that the grain fineness number should be calculated as follows:

(1) Multiply the weight or percent of sand on each sieve by the corresponding factor from table 2;

(2) Add the products of these multiplications;

(3) Add the weights or percents of material;

(4) Divide the sum of the products by the sum of the percents, and the result is the grain fineness number.

Continuation

Fineness is proportinal to surface area per unit of weight and influences permeability and strength. Fine sands make smooth castings.

Bonding strength is expressed in terms of compression, tension, or shear; and it is determined either when the sand is moist (green) or dry. Strength is a function of the clay content and of the moisture content with a maximum strength at about 5% moisture.

Permeability is the property of the sand to permit passage of gases, and it thus controls the venting characteristics of the molds. It is a function of fineness and clay content and of moisture content in the same manner as strength.

Sintering point is the point at which other sand fuses to castings. It is important since low-sintering sands will stick to the casting and will make for difficult cleaning.

Durability, or life, is the ability of a sand to regain most of its bonding strength after reclaiming from used molds.

Chemical analyses are made, but they do not influence the selection of general foundry sands. Analyses are made for water, solatite matter, silica, fenic oxide, titania, alumina, magnesia, carbon dioxide, and potassium and sodium oxides. Dye absorption tests are also made in some cases. A standard sand for testing purposes should have a dye absorption factor of 40 and fineness of 50±1 (100% minus 40 mesh, 95% minus 50 on 70 mesh, any thru 70 mesh should be retained on 100 mesh).

Testing and grading foundry sands (R671.2 A 51t)

Wilde Molders sand

Silica sand

July 10, 1952

Mr. Lloyd A. Williamson
Cascade Pumice
P.O. Box 1083
Bend, Oregon

Dear Mr. Williamson:

We fully appreciate your position as outlined in your letter of July 7. The Raw Materials Survey is revising their Report No. 1 "Industrial Silica for Pacific Northwest Industries" and I have asked them to mail you a copy immediately they have it reprinted. This report contains a great deal of good information on this industrial mineral and I am sure it will be a useful reference for you.

Large tonnages of high-grade limestone, readily available, are marketable for various uses. Agricultural requirements account for a large proportion of limestone, and material analyzing 98 percent $CaCO_3$ could stand rail transportation from the Bend area to Willamette Valley points. The chemical industry, such as calcium carbide manufacturers, requires extremely pure calcium carbonate and insists on guaranteed shipments of uniform material. Although there was a great demand for optical calcite during the last war this has now largely disappeared since the market is now being supplied by synthetic material. Shippers wishing to supply agricultural limestone should write to the Production & Marketing Administration, Eastern Building, Portland, and request information on prices and contracts under P.& M.A. cooperative liming programs.

We have investigated numerous nitrate deposits in the State, some of them extremely pure, but all of them have proved to be very limited in extent and completely uneconomic. If large tonnages of material having a substantial potassium nitrate content were obtainable there would be a likelihood that the material could be disposed of in the area. Nitrate deposits are inclined to be misleading since the mineral has a characteristic efflorescence which gives the impression that there is much more nitrate present than is actually the case.

Sincerely yours,

Ralph S. Mason

Ralph S. Mason
Mining Engineer

RSM:lk

WILLIAMSON
Cascade
PUMICE

AGGREGATES • ABRASIVES

LLOYD A. WILLIAMSON

MAIL ADDRESS P. O. BOX 1083 OFFICE 1031 BROOKS ST.
TELEPHONES: OFFICE 1408 W -- RES. 1408 R
BEND, OREGON

July 7,1952.

Oregon State Dept. of Geology & Minerals
Woodlark Bldg.,
Portland, Oregon.

Attention: Mr. Libby

Dear Mr. Libby:

Because we are mining in this part of the State, we get considerable quantities of samples of various material from this vicinity. Most of them I will confess I know very little about, hence the questions.

We have samples of silica sand testing from 93.7% to 98.2% silica. Can you tell me if this is of sufficient quality to justify mining and who would you suggest as possible users if it is of good enough quality? Also can you give me some idea of its value?

LIME

We also have samples of 98% calcite, and can you give me the same information on this and possible outlet for it and its value.

In addition to these, we have samples of 5% potassium nitrate which contains 1.8% available phosphoric and would like to have the date on it also if you can help us.

Thanks kindly for any assistance you can give us.

Very truly yours,

Lloyd A. Williamson

Lloyd A.Williamson

3/8 MAX
SAND BLAST

LAW/cw

PUMICE PRODUCERS ASSOCIATION
PPA
Uniform Gradation

RECEIVED
JUL 8 1952
STATE DEPT. OF GEOLOGY
& MINERAL INDS.

State Department of Geology and Mineral Industries

1069 State Office Building
Portland 1, Oregon

QUARTZ MOUNTAIN SILICA DEPOSIT
Sec. 2, T. 28 S., R. 1 E.
Douglas County, Oregon

SiO_2	98.75 %
Al_2O_3	0.27
Fe	0.12
TiO_2	0.25
CaO	0.013
MgO	0.015
P_2O_5	0.008

STATE OF OREGON

INTEROFFICE MEMO

TO: Jerry

DATE: August 2, 1984

FROM: Bev

SUBJECT: Silica sand open-file report

This is a brief summary of our discussion this morning on your open-file report.

1. Title--Bench testing of silica sand from deposits in Clatsop and Morrow Counties, Oregon.
2. Series--Open-File Report O-84-5
3. Funding number--Home base
4. Contents--a. Disclaimer
   b. Text
      1) Cover
      2) 6-page summary
      3) Data tables
      4) Recommendation
      5) References
      6) Appendix
   c. Figures
      1) Map showing location of other two figures
      2) Map of area of Clatsop County showing Miocene sandstone outcrop and sample-location sites
      3) Map of Morrow County showing pluvial glacial deposits, older loess, sand dunes, and sample-location sites.
5. Schedule--Jerry is currently waiting for more material from Alabama. The report should be draft typed and into editing by August 20. It should be edited, retyped, printed, and released by the end of the month. Chuck will start on the artwork tomorrow.
6. Number to be printed--Jerry anticipates a very limited demand for this report. A distribution list is attached. At this time I suggest we print only 100 copies of the report. This will take care of our regular free distribution of 50 copies, Jerry's distribution, and about 35 left for sale.

BFV:ak
cc: John B.
Chuck S.
Klaus N.

Attachment

Contains Recycled Materials

Split SB523
By Task

Split Timberline
By File

11 AM Dennis
memo to Gary

DED - Expand table

- Calling List

- Solicit boiler plate data

- Make calls

"+30 to -80 mesh"

- Coos Bay sample was favorable

- Lab

- Sample procedures + geol map
and also mineralogy negatives
- physical test } washing
grain size
- chemical test

- repeated analysis by phase
etc etc to better
document what we do have.

STATE OF OREGON

INTEROFFICE MEMO

TO: John B. and Jerry

DATE: October 27, 1983

FROM: Don

SUBJECT:

I have learned second-hand that initial testing of a sample of Coos Bay sand by a glass manufacturing company has revealed that this material may be suitable. A 50 pound sample has been forwarded as of October 19th for further testing by magnetic separation and floatation.

We have scheduled a meeting in our office at 9 a.m. on Tuesday, November 1st to meet with the principals and the DED staff to review progress and plan our future activities. You should plan to attend.

DAH:ab

Contains Recycled Materials

VICTOR ATIYEH
GOVERNOR

Department of Geology and Mineral Industries
ADMINISTRATIVE OFFICE
1005 STATE OFFICE BLDG., PORTLAND, OREGON 97201 PHONE (503) 229-5580

February 22, 1984

Mr. John C. Anderson, Director
Oregon Economic Development Department
595 Cottage Street, N.E.
Salem, Oregon 97310

Dear John:

As we discussed in Salem last week, it is very important for our geologists to meet with technical representatives of the glass company to review their testing results on samples of silica sand from various locations in Oregon and to share our latest information. We would like to confirm the earlier indication that the Coos Bay sand is adequate. If not, we should aggressively investigate alternative sources.

In recent weeks, we have not had feedback from the company regarding the questions raised earlier about testing procedures and results to date.

Best regards.

Sincerely,

Donald A. Hull
State Geologist

DAH:jr

STATE OF OREGON

INTEROFFICE MEMO

TO: John Beaulieu

DATE: February 23, 1984

FROM: Jerry Gray

SUBJECT: Glass Sand Assays

Doug Blender of Genstar called with the following assay data:

	SAMPLE NUMBER 1	2	3	4	5
SiO_2	70.15	67.07	70.06	67.04	82.83
Al_2O_3	12.97	13.89	12.76	12.99	12.94
TiO_2	0.14	0.22	0.13	0.14	0.01
Fe_2O_3	5.58	6.65	5.85	5.86	1.63
CaO	3.07	3.53	3.39	4.43	1.01
MgO	1.16	1.74	1.36	1.69	0.49
Na_2O	1.50	1.67	1.90	1.75	0.52
K_2O	1.98	1.86	1.97	2.05	2.07
SO_3	0.9	0.02	0.0	0.0	0.26
TOTAL	96.55	96.65	97.42	95.95	101.76

SIEVE SIZES					
+20	0.23	0.12	23.9	2.5	4.2
-20	37.9	2.3	57.2	43.1	84.2
-60	40.5	11.1	13.9	17.3	5.3
-100	15.4	33.6	3.2	15.2	2.1
-140	3.5	14.7	0.8	5.9	.1
-200	2.3	38.8	1.1	16.0	3.6
TOTAL	99.83	100.62	100.1	100.0	99.5

Contains Recycled Materials

Sample No. 1 is the dune sand - Department Sample No. PO 310D01.

Sample No. 2 is the older sand (Loess) - Department Sample No. PO 311D01.

Sample No. 3 is the washed sand from the Ready Mix plant - Department Sample No. PO 312D01.

Sample No. 4 is the dredge tailings - Department Sample No. PO 313D01. (This one is not to be sent to Alabama.)

Sample No. 5 was the sandstone at the creek level near Oregon Portland Cement's sand pit on Gnat Creek. The Department does not have a sample at this spot. The closest Department sample was taken within the nearby pit and was No. PO 315R01.

# # #

JG:bj

VICTOR ATIYEH
GOVERNOR

Department of Geology and Mineral Industries
ADMINISTRATIVE OFFICE
1005 STATE OFFICE BLDG., PORTLAND, OREGON 97201 PHONE (503) 229-5580

November 1, 1983

Wayne J. Wolfe
Department of Economic
Development
155 Cottage Street NE
Salem, Oregon 97310

Dear Wayne:

We are continuing our efforts to locate sources of silica, limestone, and dolomite in order to encourage the location of a float glass manufacturing facility in Oregon. A substantial amount of additional data is being compiled.

I am concerned that we are duplicating the efforts of others and continue to feel that it is critical to discuss technical aspects of raw material requirements with the principal and your staff. An exchange of information and ideas is crucial to our progress.

Sincerely,

Donald A. Hull
State Geologist

km

cc: John D. Beaulieu
Jerry J. Gray
Richard J. Schulberg

STATE OF OREGON

INTEROFFICE MEMO

TO: John Beaulieu

DATE: February 1, 1984

FROM: Jerry Gray

SUBJECT: Clatsop County Silica Sand Assays

The following are assays from the four samples taken by Mr. Blender of Gemstar Cement Company, Alberta Canada, (403) 432-0231.

SAMPLE #	1	2	3	4
S_1O_2	78.46%	72.89%	80.63%	80.12%
Al_2O_3	14.82	15.99	13.38	10.67
Fe_2O_3	3.32	5.24	2.28	3.14
CaO	1.20	1.14	1.27	1.57
MgO	.60	.84	.60	.67
Na_2O	.43	.55	1.10	1.12
K_2O	2.34	2.34	2.31	2.11
Total Alkalies as Na_2O*	1.97	2.09	2.53	2.51
Cl	0	0	0	0
SO_3	.24	.11	.20	.19
TOTAL	101.36%	99.11%	101.70%	99.59%

* Total alkalies are obtained by taking 65.8% of the K_2O figure and adding the Na_2O figure.

Contains Recycled Materials

Sample 1 was taken on Nicolai Mountain where John Beaulieu is pictured in Bulletin 79. Sample 2 is a composite of Oregon Portland Cement's six stockpiles of dark colored sand in the Gnat Creek Quarry. Sample 3 was from the lighter colored part of the outcrop in the quarry and was taken over a vertical distance of 12 feet. Sample 4 was taken from the NE¼ of Section 8, T8N, R7W from a light colored outcrop next to a paved road near a private bird refuge.

Mr. Blender is looking for a silica source with total alkalies of .6% or less. The samples were screened and the fraction assayed. None of the sizes were upgraded.

Mr. Blender will fly to Portland to go with us to get the Morrow County samples. He will get them assayed for us with a turn-a-round time of about three days.

# # #

JG:bj

Jerry

VICTOR ATIYEH
GOVERNOR

Department of Geology and Mine
ADMINISTRATIVE OFFICE
1005 STATE OFFICE BLDG., PORTLAND, OREGON 97201 PHONE (503) 229-5580

John

March 26, 1984

CONFIDENTIAL

Mr. William Cooke
Technical Services
AFG Industries, Inc.
P.O. Box 929
Kingsport, Tennessee 37662

Dear Bill:

Since our last meeting on November 21, 1983, we have undertaken sampling in two areas in Oregon for silica sand deposits. We would like to design our testing procedures so that the results of laboratory work will be directly applicable to your search for the high silica sand needed to support a glass manufacturing plant.

Feldspathic sand samples have been taken near Boardman in Morrow County in northeastern Oregon and near the Columbia River northwest of Portland. Preliminary analytical data are enclosed. Several of the samples will be processed at the University of Alabama Mineral Resources Institute to ascertain the preliminary feasibility of upgrading to a high silica product.

We would appreciate your detailed advice on both physical and chemical testing procedures as soon as possible. We also need an updated statement of your tonnage, screen size and grade requirements so that our future work can proceed efficiently. It is our understanding that the Coos Bay sand is a technically and economically feasible source for your silica raw material requirements; however, if this conclusion proves to be incorrect, we are prepared to provide any geologic support that you need to locate alternative sources of supply.

We hope the new data will be helpful and look forward to providing assistance as you proceed. Please be assured that we will treat this matter in strict confidence.

Best regards.

Sincerely,

Donald A. Hull
State Geologist

DAH:jr
Encl.
bc John C. Anderson

Put Glass in pub calendar

7/30

John B,

Here is the "black sand" memo. We should visit about this before Friday (since I'll be away from 5th - 8th. — Specifics of sampling data grain size associated data

2.6 assay lights + middles

2.7

>2.7

magnetic separation

★ diff process, but can't flotate - salt water effect at least near coast

have Canada data on Cons Bay / goes to 83.4 SiO_2 .6 Fe "2.3" Alkili

Clatsop ≈ 96.7% SiO_2 .439 Fe "0.1" Alkili

floatation etc.

Will or won't meet specs is a function of selected beneficiation

but greater loss in processing - yet lose 60% ± on all

Alkili Specs	are 0.6
Fe	.04
Silica	98%

Strategies for optimal location

SODA ASH on Boardman line

— backhaul transportation upwest to Canada (Texada Is)

1 cc John B.
~~1 cc Jerry G~~

VICTOR ATIYEH
GOVERNOR

Economic Development Department

595 COTTAGE STREET NE., SALEM, OREGON 97310 PHONE (503) 373-1200

March 15, 1984

Mr. Donald A. Hull
State Geologist
Department of Geology and Mineral Industries
1005 State Office Building
Portland, Oregon 97201

Dear Don:

Thank you for your recent letter regarding your activities in support of a major investment case that is looking for sand as a source of raw product in Oregon. Your department has been instrumental in providing data and expertise for this business.

Rick Schulberg will continue to be your contact for this case, and will be discussing with you further arrangements as this case progresses.

Sincerely,

John

John C. Anderson
Director

JA:vw

RECEIVED-PTLD
MAR 19 1984
DEPT. OF GEOLOGY

VICTOR ATIYEH
GOVERNOR

Department of Geology and Mineral Industries
ADMINISTRATIVE OFFICE
1005 STATE OFFICE BLDG., PORTLAND, OREGON 97201 PHONE (503) 229-5580

March 8, 1984

John C. Anderson
Department of Economic Development
595 Cottage St. N.E.
Salem, Oregon 97310

Dear John:

We urgently need to communicate with technical representatives of the "glass company" about our recent work on potential sources of silica sand in Oregon. We have collected samples of sands that will require careful testing to evaluate beneficiation methods for upgrading quality. To date we have not received the information requested earlier regarding testing procedures that are acceptable to the company in order to assure that our resulting data will be useful to them. We also need a definitive statement of quality and tonnage required for the proposed plant. We cannot make further progress until this information is available. Could you please send the name, address and telephone number of the appropriate individuals in the glass company.

Best regards.

Sincerely,

Don

Donald A. Hull
State Geologist

DAH:ab

bcc: John B

STATE OF OREGON

INTEROFFICE MEMO

TO: Don H.

DATE: March 5, 1984

FROM: Jerry Gray

SUBJECT: Silica Sand - A Status Report

A one-line summary of our silica sand work would be that it is on low burner. Before we proceed much further, we need some formal technical answers. We need to know the glass company's raw materials specifications. We need to know what they would like and what they could use from the standpoint of transportation costs. These specifications are not the same. We need to know how much raw materials will be needed.

The Department has collected seven sand samples which have been assayed and funding for beneficiation testing of six of the samples has been arranged with the Port of Morrow. Along with sending the six samples to the Mineral Resources Institute at the University of Alabama, we need to send the glass company specifications in terms of assays and sizing. Guessing what is needed is not the way to go. We will do just that when the agreement for the test work funding arrives from the Port of Morrow. In looking for a source of silica sand for the glass plant, the Department has received help from a Canada cement manufacture. This firm is looking for a source of low alkali silica sand. The firm's specifications are 85% plus silica and less than 0.6 combined alkali. The sand source must be near barge transportation. This firm has agreed to assay all our raw samples and all the beneficiated sample splits. The attached table gives the raw sample assay data. If material from one of the sand source samples can be upgraded to meet both glass and cement needs, the cement firm might build a sand plant

to supply both markets. For those areas served by barge, Oregon may have a real cost advantage. Limestone for the Portland market comes from Canada. Those barges go back empty. Empty barges go up the Columbia and come back loaded with grain. A sand deposit on the lower Columbia could supply a cement plant in Canada and a glass plant at Boardman through barge backhaul rates.

A Departmental find is its unpublished data generated in the 1940's for foundry sands. Sand deposits from Grants Pass to Astoria were sampled and mapped. Test work included sizing, assaying, and some clay washing. One sample from the Eugene area, after the clays were washed out, ran 97.42% SiO_2 and only 1.22% Al_2O_3-Fe_2O_3. This data is contained in three folders entitled "Eugene Sand", "Sand Reconnaissance - Western Oregon" and "Miscellaneous Foundry Sand Data."

# # #

JG:bj

y	P031D01	P0311D01	P0312001	P0313D01	P0314R01	P0315R01	P0316R01
	70.15%	67.07%	70.06%	67.04%	78.46%	80.63%	80.12%
	12.97	13.89	12.76	12.99	14.82	13.38	10.67
	0.14	0.22	0.13	0.14	-	-	-
	5.58	6.65	5.85	5.86	3.32	2.28	3.14
	3.07	3.53	3.39	4.43	1.20	1.27	1.57
	1.16	1.74	1.36	1.69	.60	.60	.67
	1.50	1.67	1.90	1.75	.43	1.10	1.12
	1.98	1.86	1.97	2.05	2.34	2.31	2.11
	0.9	0.02	0.0	0.0	.24	.20	.19
	96.55%	96.65%	97.42%	95.95%	101.41%	101.71%	99.59%
	0.23%	0.12%	23.9%	2.5%	-	-	-
	37.9	2.3	57.2	43.1	-	-	-
	40.5	11.1	13.9	17.3	-	-	-
	15.4	33.6	3.2	15.2	-	-	-
	3.5	14.7	0.8	5.9	-	-	-
	2.3	38.8	1.1	16.0	-	-	-
	99.83%	100.62%	100.1%	100.0%	-	-	-

Sample Number	County	Sample Type	Township	Range	Section	¼ Section
P0310D01	Morrow	Dune Sand	4N	25E	20	SW
P0311D01	Morrow	Loess	3N	26E	29	NW
P0312D01	Morrow	Washed Sand	4N	25E	10	NE
P0313D01	Morrow	Dredge Spoils	4N	25E	3	SE
P0314R01	Clatsop	Sandstone	7N	6W	6	SE
P0315R01	Clatsop	Sandstone	8N	6W	19	NW
P0316R01	Clatsop	Sandstone	8N	7W	8	NE
Cement Firm Sample	Clatsop	Sandstone	near P0315R01			

AGREEMENT

The Oregon Department of Geology and Mineral Industries hereby agrees to collect six sand samples (three from the Boardman area and three from the Wauna area), split out a ten-pound portion of each sample, save and store the rest of each sample, and ship the ten-pound splits to the University of Alabama Mineral Resource Institute. After the Institute does their testing, each of the ten-pound samples will be separated into a high silica fraction and other fractions. These sample portions will be sent to the Department for transshipment to a cement plant in Canada for assaying. The Institute, after receiving the assays, will submit a final report to the Department. The Department will pay the Institute $2,500.00 for testing the six samples and for their final report.

The Port of Morrow agrees to reimburse the Department for the cost of the University of Alabama Resource Institute's test work and final report. The cost is to be $2,500.00. The $2,500.00 is to be paid when the Department submits the Port a copy of the Institute's final report.

Oregon Department of Geology and Mineral Industries

John D. Beaulieu
Deputy State Geologist

Date 2/22/84

Port of Morrow

Wayne L. Schwandt
Manager

Date 2-29-84

RECEIVED-PTI
MAR 5 1984
DEPT. OF GEOLOGY

STATE OF OREGON

INTEROFFICE MEMO

TO: John B.
Jerry G.

DATE: October 20, 1983

FROM: Don H.

SUBJECT: Glass manufacturing

We need to proceed quickly with the evaluation of silica, limestone and dolomite resources that would support a new float glass manufacturing operation located in Oregon. The following approach is suggested.

(1) Develop a priority list of silica sources and evaluate each for quality and reserves. The list should include present producers, dormant past producers and undeveloped deposits. Telephone and letter inquiries should be used initially to answer questions about quality and quantity at current producers. Extensive travel will be required. Analytical data should be standardized, e.g., use Fe_2O_3 throughout rather than Fe. Land use aspects of each site should be evaluated. Field work needs to be prioritized. A list of this type will frequently need to be revised but should always be current.

(2) For limestone and dolomite resources, similar priority lists are needed. These evaluations must be done together keeping in mind the magnesia content of the various limestone deposits. Magnesite or magnesian limestone deposits may offer an alternative to dolomite.

(3) A standardized analytical procedure for treatment of samples is needed before logical field work can proceed. The procedure should be planned on two scales - first a bench scale and later a pilot scale. The analytical procedure should be designed to mimic later plant requirements in terms of contaminants.

The analytical procedure needs to be an interactive combination of geological, physical and chemical testing including detailed mineralogy, field mapping, screening, washing and chemical analysis.

Selected samples will need to be evaluated with more specialized methods such as magnetic separation, attritution scrubbing, and/or flotation. Combinations of these procedures will have to be used on both bench and pilot scales.

(4) After the testing procedures are outlined and reviewed by the potential glass manufacturer, various testing facilities will need to be evaluated in depth for cost, speed, etc. Key facilities include Colorado Research Foundation, ceramic engineering laboratories at schools such as Cal-Berkeley and the Mineral Research Institute of the University of Alabama.

Contains Recycled Materials

(5) In order to expedite the evaluation of raw material sources an in-depth discussion will be needed with the technical staff of the glass manufacturing firm. The procedures outlined above must be critiqued by this company. This discussion should be completed by mid-December, 1983.

(6) The cost of field work and laboratory evaluation will have to be budgeted in a careful manner and an Emergency Board appearance in January, 1984 may be desirable.

(7) The following deadlines are suggested.

November 30, 1983 - Complete the collection of available analytical and reserve data for established producers in California, Idaho, Oregon, Montana and Washington.

December 15, 1983 - Complete discussions with glass manufacturer regarding scope of our involvement in field sampling and mapping, lab testing and calculation of reserves for silica, limestone, and dolomite raw materials.

July 1, 1984 - Complete the initial field sampling and mapping of dormant and undeveloped deposits.

August 31, 1984 - Complete the initial mineralogical, physical and chemical analysis of dormant and undeveloped deposits. A detailed review of results with the manufacturing company should be held in September, 1984. Subsequent schedules cannot be predicted pending tentative decisions with regard to plant site locations and scope of pilot scale testing of promising deposits of silica, limestone and dolomite.

All of the work outlined above should be undertaken with the understanding that a comprehensive publication of results will be desirable at the appropriate time.

The project described above should be given highest priority and Jerry Gray should delay additional field work in central Oregon until the 1984 field season or beyond. All field sampling should include geologic mapping in order to allow later evaluation of lab results.

cc: Wayne J. Wolfe
Richard Schulberg

GEORGE D. WARD & ASSOCIATES

4941 S.W. 26th Dr., Portland, Oregon 97201
293-6075

ENVIRONMENTAL CONSULTING ENGINEERS

July 31, 1990

Mr. Dave Leppert
Teague Mineral Products
1925 Hwy. 201
South Adrian, OR 97901

Dear Mr. Leppert:

Thanks for your quick response to my inquiry regarding your firm's zeolite mineral and its possible use as a stabilizing agent for Teledyne Wah Chang Albany's waste lime.

The sample you sent arrived in good shape and I have had an opportunity run a few tests on it. Based on results observed to date, s.c. zeolite does appear to react as a pozzolanic material when mixed with pulverized quicklime. Tests of s.c. zeolite when mixed with lime and other materials including Wah Chang's lime sludge are continuing and the preliminary results are encouraging.

I have had several discussions regarding natural deposits for pozzolanic materials and your firm's zeolites with Jerry Gray at Oregon's Department of Geology, and how a combination of the two might provide us with a local option for the fixation of Wah Chang's wet lime sludge. Your letter indicated that you may have access to a nearby formation of known pozzolanic materials. We would like to know more about this material. Would it be possible for you to obtain a small characteristic sample of it. Also, does your lab have the capacity to mill and screen a small amount for us to work with. About two gallons would be enough for initial testing.

A sample of your bentonite would also be appreciated. Since it is also likely to react as a pozzolan, there might be an opportunity to include it in our trial formations. Cost information would also be helpful.

In the interest of saving time, I have enclosed an EPA Request For Proposals that you may also find of interest. I've reviewed it with Jerry Gray to determine if the Department of Geology might wish to be a participant. I've also sent a copy to Dave Nelson at Wah Chang and am waiting to hear if Wah Chang might also want to take part. It was Jerry Gray's suggestion that I send you a copy and inquire if your company might also wish to be a participant.

Thanks again for the sample and literature. I'll keep you informed of our results.

Cordially yours,

George D. Ward

George D. Ward
Professional Engineer

cc: Dave Nelson, TWCA
Jerry Gray

MEMORANDUM

TO: JOHN B. JULY 30, 1990

FROM: DON

SUBJECT: SUPER FUND CLEAN-UP TECHNOLOGY PROPOSAL

Jerry Gray has called my attention to a current EPA RFP for emerging technology for super fund site clean-up. He has been discussing activities of this type with respect to the Wah-Chang site in Albany with George Ward, an environmental consultant engineer from Portland.

It is possible that we can help with the clean-up at Wah-Chang, by linking Oregon mineral producers of bentonite and zeolite with other state agencies, CH2M Hill (the principal contractor) and Ward, who has a subcontract with Hill. At this time, and because of other planned commitments, it seems unrealistic for DOGAMI to take the lead on a research proposal to EPA. It would appropriate for us to facilitate a discussion among the respective parties and call to their attention the possibility of using such funds for innovative work on the Wah-Chang site.

The ideal outcome from the Wah-Chang clean-up would be a stable, large pyramid made of the Wah-Chang leftovers mixed with Oregon industrial mineral products and constructed in a manner that would create an instant appeal to tourists passing through northeastern Oregon. We could even consider casting the waste material in the form of a sphinx in addition to one or more pyramids.

cc: Jerry G.

DAH:dej

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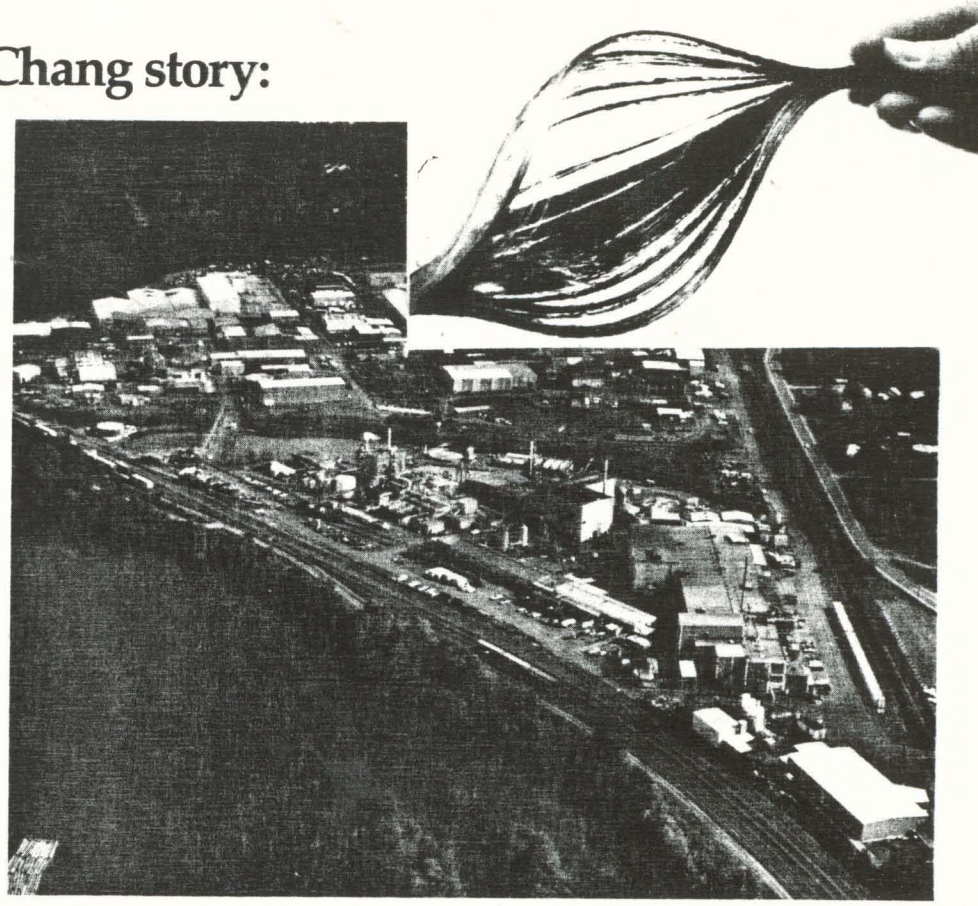
The Teledyne Wah Chang story:

Pure research "made in Oregon"



THOUSANDS OF STRANDS of columbium-titanium are contained in a single cable with the capacity to carry enough electricity to power a city the size of Portland in this Teledyne Wah Chang product. An aerial view of the TWC complex in Albany, Ore.

SOMETIME IN THE NEXT 10 YEARS, if all goes according to the hopes of American physicists, the world's most massive scientific research facility will be built somewhere in the continental United States. It might be in Oregon, although competition is stiff.

But, wherever the $6 billion project is located, its most crucial components will probably come from an Oregon company — Teledyne Wah Chang Albany.

The project is called the Superconducting Supercollider, SSC for short. The SSC is a giant underground tube, four-stories high and anywhere from 56 to 100 miles in circumference, depending on the final design chosen. Inside the tube, electromagnetism will be harnessed to send nuclear particles careening around a circular course at nearly the speed of light. By studying subnuclear particles produced by collisions between protons and antiprotons in the SSC, scientists hope to learn more about how our universe was born and, thus, more about the laws of physics that govern our life in the universe today.

Teledyne Wah Chang Albany is involved because the Willamette Valley company is one of the world's leading producers of a metal called columbium (also known in the chemical and metallurgical world as niobium). Columbium, when alloyed with titanium or tin, has an unusual property. Cooled to about 440 degrees below zero-Fahrenheit, the metal has virtually no electrical resistance. This means that a charge put in at one end of a columbium-alloy wire will come out the other end with no loss of power.

Without the superconducting property of columbium alloys, operation of the SSC would require the combined electrical energy of several large cities. But with wire made of a columbium-titanium alloy produced by Teledyne Wah Chang, it becomes practical to satisfy the energy demands of the immensely powerful electromagnets that propel and control the paths of the nuclear particles inside the SSC.

One of a family

Columbium is one of several special metals produced by Teledyne Wah Chang at its plant in Albany. All of them are prized by scientists, engineers and industrial designers for special qualities — exceptional weight-to-strength ratios, corrosion resistance, strength at high temperatures, malleable fabrication and superconductivity.

The other metals in the family have equally exotic names — tantalum, titanium, hafnium, vanadium, zirconium. For those of us more used to talking about tin cans, steel girders, copper pennies and aluminum foil, zirconium sounds like a piece of dialogue from *Star Trek*.

But in spite of their unusual names, these metals are part of a lot of everyday items familiar to us all. In one form or another, the materials are used in street lights, flash cubes, stereo headphones, medical equipment, airplanes and the space shuttle. TWCA produces the material in virtually all the familiar forms of metal — ingots, plate, rod, tube, bar, wire, sheets and foil. In building space shuttles, a technician might ask for "a piece of columbium C-103, please."

Zirconium was the first special metal to be manufactured by Wah Chang in commercial quantities. Working with the U.S. Bureau of Mines, Wah Chang built its Albany plant in 1956 and began turning out zirconium in 1957. Beginning in an infant industry, TWCA has maintained a leading pace. Now the Albany enterprise is the free world's largest producer of those specialty metals with the odd-sounding names.

A metal-making town

Zirconium was the start. In the early '50s TWCA was chosen by the Bueau of Mines to build the first commercial production facility to extract and refine zirconium from simple beach sand. The technology for production of other special metals followed.

In the '60s, demand for columbium led to installation of new production facilities. Process technologies developed by TWCA's research and development department led to practical methods for refining still other special metals. Market demand grew, and so did the plant and its workforce.

Today, the plant has become what amounts to a small town within the city of Albany. The 110-acre site has its own districts (eight separate plants), its own neighborhoods with about 130 buildings, an employee population of more than 1,300 people and even its own municipal services, ranging from a waste-water treatment plant to a fire department. With a weekly payroll and benefits of more than $1 million, TWCA is Linn

County's largest employer and highest taxpayer.

Inside the plant is more than $40 million worth of sophisticated refining, processing and fabricating machinery. Some of it is relatively familiar, even to an unsophisticated visitor. Forges and rolling mills turn out slabs, rods and round stock, much as it might be done in a conventional steel mill. But an understanding of a machine like a Sendzimir mill is best left to the experts. For the rest of us it's enough to know that the machine turns out metal foil as thin as two-ten thousandths of an inch, about 10 times too thin for covering leftovers, but just right for communication satellites and space shuttles.

All in all, the products are more impressive, and understandable, to the layman than the processes. One more example: The cables that will power the magnets in the SSC are only about one quarter of an inch in diameter. Each cable is made up of about 50,000 separate strands of columbium-titanium wire. Each wire is as small or smaller than a fine human hair and just as flexible. Each cable, the size of a household extension cord, is able to carry the electricity needed to power a city the size of Portland.

Problem-solving people

Like any industrial town, TWCA has had to cope with the inevitable leftovers of processes that turn raw materials into useful products. But TWCA also has had an advantage. In fact, it's a two-fold advantage: a population of professional problem-solvers and an unusually sophisticated analytical laboratory. With its own resources, TWCA has developed techniques to control the environmental effects of its operation and sometimes even to find a benefit in what looked like a problem.

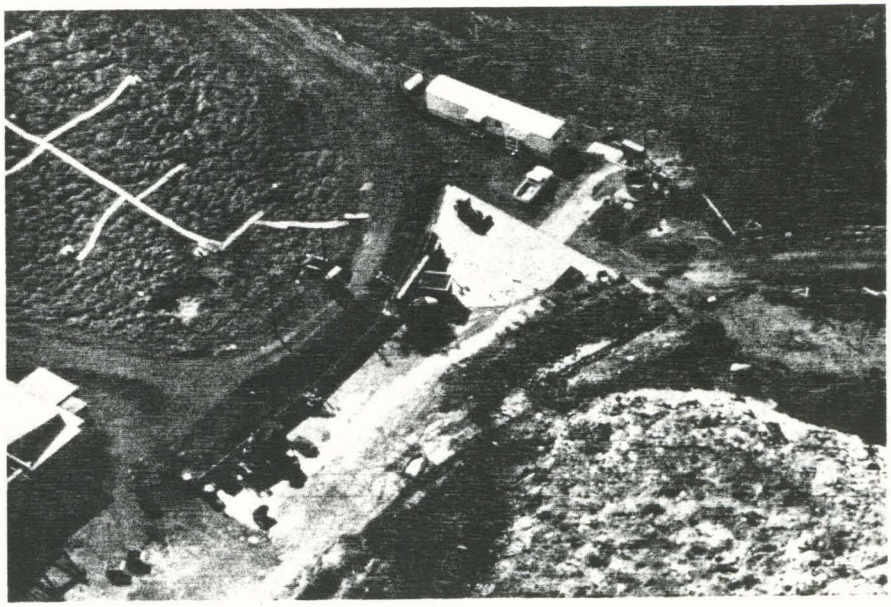
The first problem arose, literally, soon after start-up of the Albany plant in 1956. It was an odor in the air around the plant. Nobody could describe what it smelled like, except that it smelled bad.

The source of the indescribable odor was difficult to detect. A lot of time and more than $1 million in labor and materials was put into the search. Finally the villain was captured. It turned out to be a mercaptan, one of a family of sulfur-containing hydrocarbons that can disturb the human nose even in minute quantities. It came from only one of the several process plants on the site. By fine-tuning that one process, TWCA engineers chased the culprit away.

Magnesium wastes were another problem. Through the years a pile of the material had built up in a back section of the plant site. One conventional solution would have been to pack up the wastes and ship them to a disposal site, but

(continued on page 46)

Oregon is home to the free world's largest production facility for zirconium, hafnium, columbium and titanium alloys and a leading research center for the refractory metals.



LITTLE HOUSES dot the waste pond at Teledyne Wah Chang's Albany plant and contain instruments to monitor radon emissions. In second photo, an aerial of the same pond. From magnesium waste that would otherwise be a disposal problem, TWCA makes a milk-of-magnesia solution to control the pH in its water-treatment plant.

Teledyne Wah Chang

(continued from page 45)

TWCA developed a better solution. In a three-year program, magnesium waste is now being turned into magnesium hydroxide, which is approximately the same thing as milk of magnesia. The alkaline product is being used in place of lime to adjust the pH of the water in TWCA's treatment plant. The Albany project is the first major demonstration in Oregon of the successful application of the mandates of the federal Resource Conservation and Recovery Act.

A relatively simple approach was used to turn magnesium waste into an environmentally and economically desirable commodity. Far more complex equipment and technology has been needed to study TWCA lime-solid wastes for potential radon emissions.

Radon is a natural radioactive gas emitted through the breakdown of radium. Most minerals and most things made from minerals release some amount of radon. City buildings are prime sources of radon and most of our houses are built on radon-emitting soil. In fact, everything from water to fertilizer contains small amounts of the radioactive material that produces radon.

But the concentration of the gas in these cases is far below the level at which radon is considered a health hazard, and so are emissions from TWCA's waste ponds, according to testimony to Oregon's Energy Facility Siting Council by the State Health Division. In its report, the Health Division said the risk to a person living in a house directly on top of the waste ponds would be about the same as smoking one pack of cigarettes a year.

Nonetheless, TWCA is working with Battelle Pacific Northwest Laboratories, on a multi-year study to quantify radon emissions precisely and refine plans for closure of its waste ponds. Even though the risk is minimal, TWCA's goal is to reduce it to zero.

Following standards established by the State Health Division, three small houses, all conforming to Oregon building codes, have been built on top of waste-disposal sites. To a visitor, the houses may look a little silly perched out in the middle of nowhere, but each of them is crammed with enough state-of-the-art detection and analysis devices to stock a sophisticated laboratory. By spring 1986, those mini-labs will complete true annual measurements of radon at their sites.

Oregon — part of the SSC

TWCA's radon study is the most thorough of its kind, and the technology and results will be shared with other industries and government agencies. Working with others and sharing knowledge has become something of a tradition of the company, from its first joint venture with the U.S. Bureau of Mines to the development of superconducting columbium-titanium wire for pure-research projects like the SSC.

Competition for the SSC is nationwide. Its 3,000-person employment base and an operations budget of $150 to $200 million a year has attracted interest from Illinois, California, Texas, North Carolina and Missouri. With a modest budget for site exploration, Oregon may not be in the running, but even if the project goes elsewhere, its most crucial component will be made in Oregon.

California urban center sets pace

Orange County's sometimes trying childhood is at an end. After more than 30 years in the shadow of Los Angeles, Orange County has come of age with the '80s and now is able to stand on its own merits.

At the heart of Orange County's expanding retail and cultural activities is South Coast Metro. More than any other single area in the county, South Coast Metro embodies the depth and sophistication of a mature urban center.

For all that South Coast Metro is today, however, it is not an overnight success. Glass bank towers, trendy European boutiques and top-rate stage productions did not rise spontaneously from the lima bean fields owned by Orange County's land barons, the Segerstrom family.

In 1953, this section of Orange County was rural farmland. All that began to change with the construction of the San Diego Freeway (I-405) on Segerstrom property. As developers, the family refrained from immediately capitalizing on their good fortune, opting instead to pursue a carefully planned development schedule designed to nurture and maximize the area's tremendous market potential.

During the post-World War II years, Orange County experienced an acute population explosion. Following the freeways, commuters began to settle in Newport Beach, Costa Mesa, Anaheim and the city of Orange, but the county still lacked a clearly defined urban center whose cultural, commercial and residential identity would be strong enough to anchor the suburban sprawl with a singular sense of community.

The far-sighted Segerstroms conceived of South Coast Metro as a response to these needs. In conjunction with other developers, they would create a centralized cosmopolitan environment on a three-and-a-half square mile tract of land sitting astride the border of Costa Mesa and Santa Ana. South Coast Metro would be a new presence, bounded by the Newport-Costa Mesa Freeway (California 55) on the east, I-405 on the south, the Santa Ana River on the west and MacArthur Boulevard on the north.

In a revolutionary approach to developing an urban area, an exclusive retail center was built in 1967, long before there was any local residential support. Conceived to be a super-regional center, South Coast Plaza established a tremendous marketing base for the area's further development. Today, a daily average of 20,000 shoppers from as far away as San Diego and Los Angeles patronize the mall's 200 top-caliber specialty stores. In 1985, South Coast Plaza's gross revenue will approach $400 million.

The '70s saw major growth in South Coast Metro as national and regional corporations, financial institutions and residential contractors built highrises and business complexes around South Coast Plaza. Many moved into the office space in South Coast Plaza Town Center adjacent to the mall, and residential developers continue to advertise the walking-distance proximity to South Coast Plaza.

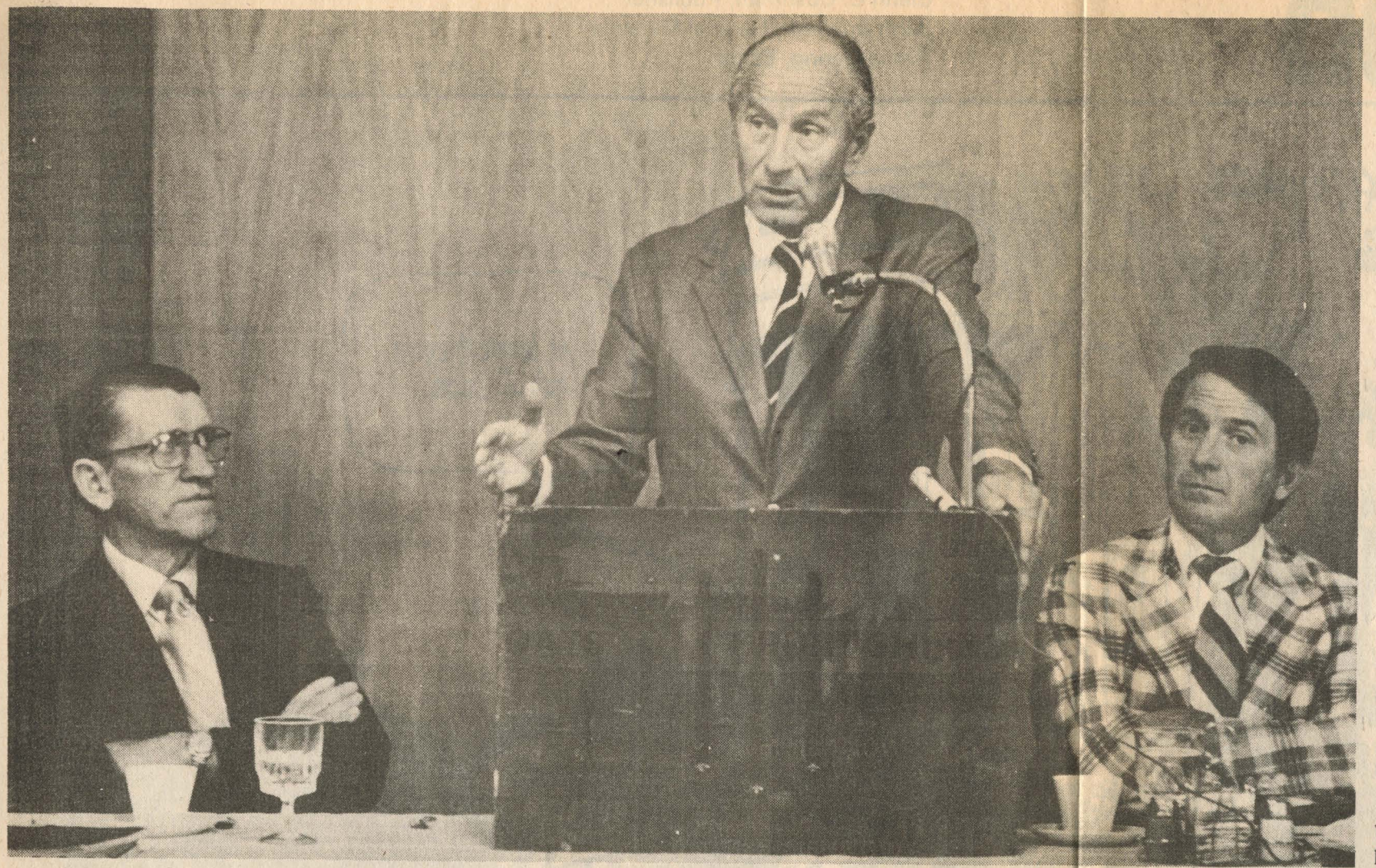
Performing arts center to cost $65 million

This fall, the South Coast Metro's cultural coup de grace — the Orange County Performing Arts Center, or The Center, will add to the area's growing prosperity. Scheduled to open in October 1986 with a performance by the Los Angeles Philharmonic, The Center will treat audiences to full-scale productions by the San Francisco Opera, as well as performances by major American ballet companies and touring Broadway shows during its first season. The larger of The Center's two theaters seats 3,000 and has a fly space over the stage capable of handling complete opera sets, a feature no theater in Los Angeles can match. The smaller 1,000-seat theater will host local performing groups. The Center also has recording, videotape, film and broadcast facilities. The estimated price tag on this nearly completed, state-of-the-art entertainment complex is $65 million — every penny of which will be privately donated by individuals and corporations.

Lincoln City shopping mall nears completion

A new indoor retail shopping mall known as Lincoln Square is nearing completion in Lincoln City. Lincoln Square is approximately 150,000 square feet with a combination of indoor retail space and office suites.

It will feature a 30,000-square-foot McKay market and ocean front dining in Ricardo's Fine Dining Restaurant. Dick Rouske is Lincoln Square's owner and developer.



Staff photo by Stanford Smith

Weaver talks to Albany audience as Hector Macpherson, left, and Dr. Dan Moore, chamber president, listen.

Rep gives advice to zirconium industry

The Albany area's zirconium industry received some advice from Rep. Jim Weaver Wednesday: Start making components for the solar-power industry if you don't want to get caught in the decline of nuclear power.

Weaver, D-4th District, [illegible] stead seek election to a fourth term in the House. His 4th District takes in part of Linn County, including Lebanon and Sweet Home.

Weaver got a polite, even cordial, reception even though his stands on nuclear power, regional energy [illegible] Environmental Protection Agency to start such studies.

State Rep. Bud Byers, D-Lebanon, urged Weaver to support the so-called Jackson bill, a measure already passed by the Senate and calling for a Northwest

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By KATHLEEN GLANVILLE
Democrat-Herald Writer

The temporary closure of a storage dump for low-level nuclear waste at the Hanford Nuclear Reservation in Washington won't have any immediate impact on Teledyne Wah Chang Albany Corp., the company said today.

But the company may be in trouble if the storage site is not re-opened within two months.

Washington Gov. Dixy Lee Ray decided Wednesday to close the dump temporarily after the Washington State Patrol reported three improper shipments Wednesday. None of those shipments came from Wah Chang.

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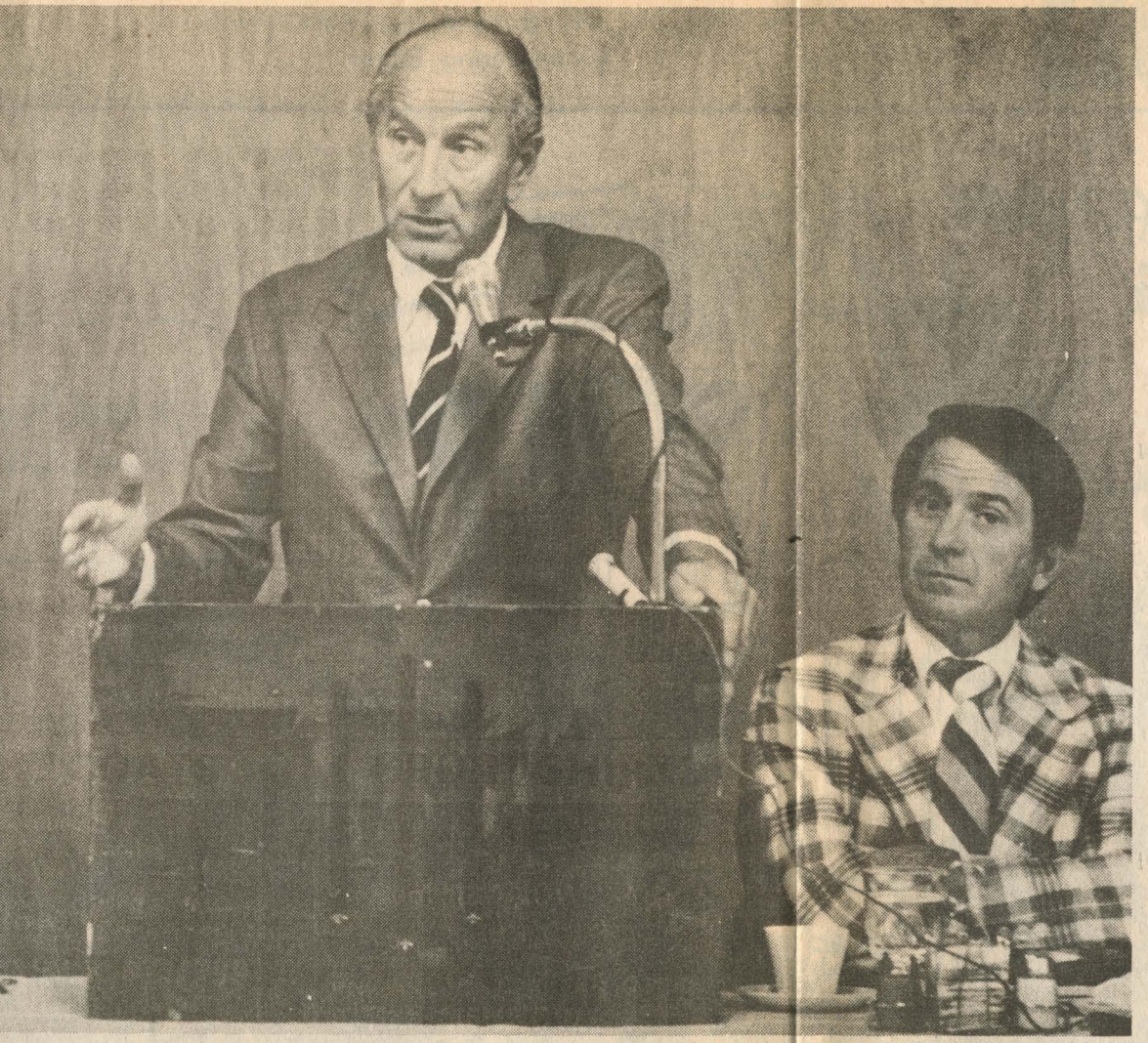

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Wah Chang will hold sludge

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Wah Chang spokesman Jim Barrett said the company normally ships a truckload of low-level radioactive sludge to Hanford every two weeks.

"Right now we are about two weeks behind and we were ready to send some of the stuff," he said. "We can store it up to 60 days under our permit, so right now we are not hurting.

"But inside of two months, we don't know what will happen. We hope they settle this thing soon."

Wah Chang's low-level radioactive waste is chlorinated residue from the zirconium-production process. Wah Chang produces zirconium used in the nuclear industry and other exotic metals.

The governor ordered the site closed until she gets guarantees from the federal Nuclear Regulatory Commission that it will ensure proper packaging of radioactive waste.

There was no word today on how long the site may be closed.

When shipments are resumed, the governor said troopers would inspect shipments at the border before allowing them into the state.

(Related story, page 16)

State safety inspectors probe blast that hurt two at Wah Chang

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The two workers were cleaning an outdoor storage area just outside the hafnium-reduction area when the explosion occurred shortly after 4 p.m. One man was blown off a forklift by the force of the explosion. Neither worker was injured seriously and both were back at work the following day.

Company safety officials believe the explosion was caused by metallic residue from the hafnium-reduction process which spilled from a 55-gallon barrel in the storage area. Hafnium is an exotic metal which is highly flammable when finely ground.

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October 4-13

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Rep gives advice to zirconium industry

The Albany area's zirconium industry received some advice from Rep. Jim Weaver Wednesday: Start making components for the solar-power industry if you don't want to get caught in the decline of nuclear power.

Weaver, D-4th District, a longtime opponent of nuclear power, spoke at a luncheon arranged by the Albany Area Chamber of Commerce.

"I want you to start making components for the solar industry," Weaver told the audience, which included representatives of Teledyne Wah Chang Albany Corp. and related industries in the zirconium field. Zirconium goes into the fuel rods of nuclear reactors.

Solar power using "photovoltaic cells" that convert sunlight to electricity is the "wave of the future" even though the government spends far less on its development than on nuclear-power research, Weaver said.

The congressman also said he saw no hope of resolving a congressional deadlock on wilderness legislation, he would insist that any Northwest power bill include a two-tier rate system and he intended to seek a congressional ban on the use of the weed killer 2,4-D in forests.

Weaver appeared at the chamber luncheon one day after he announced he would not challenge Republican Sen. Bob Packwood in 1980 and would instead seek election to a fourth term in the House. His 4th District takes in part of Linn County, including Lebanon and Sweet Home.

Weaver got a polite, even cordial, reception even though his stands on nuclear power, regional energy legislation, the use of herbicides and wilderness proposals did not sit well with many in his audience.

As called for by the format of the meeting, Weaver responded to challenges or questions from four speakers.

Al Riesen, vice president of marketing at Wah Chang, challenged Weaver and the rest of Congress to push ahead with the development of storage sites for nuclear wastes. Unless "intermediate storage sites" are developed, he said, the whole system of nuclear power will "run down."

John Davis, general manager of Western timber and logging for Willamette Industries Inc., warned of timberland being lost to the federal RARE II wilderness-review process and urged that land not designated for wilderness be returned to full multiple-use status quickly.

Liz VanLeeuwen, vice president of the Linn County Farm Bureau, criticized Weaver's stand against the use of certain herbicides and urged that people who have used the chemicals for years be used as subjects in tests of the substances' effects. Weaver said he thought that was a great idea and he would press the Environmental Protection Agency to start such studies.

State Rep. Bud Byers, D-Lebanon, urged Weaver to support the so-called Jackson bill, a measure already passed by the Senate and calling for a Northwest regional energy program. Weaver said most of the Jackson bill actually follows proposals he had made for years but he would push his own Northwest energy bill in the House.

Weaver said he would insist that any regional energy legislation give less authority to the Bonneville Power Administrator and include a two-tier rate structure for electricity. One rate schedule would reflect cheap hydropower and the other would reflect more expensive nuclear power.

"The Weaver bill will incorporate those provisions," he said.

He said nuclear plants were much too expensive and said he was told that storage of nuclear wastes would cost $30 billion "if we can ever do it." The cost of five new nuclear plants being built in Washington represents a greater per-capita debt in the Northwest region than the national debt does for the country, he said.

The government is spending $300 million a year just on the subject of nuclear-waste disposal, and this is more than the research budget for photovoltaic solar cells, he said.

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"We were very lucky," said DeEtta Burrows, spokeswoman for the accident-prevention division of the Oregon Workman's Compensation Department. "It was just after the shift had changed, so the shrapnel that did fly didn't hit anybody."

She said the state inspector at Wah Chang today is trying to determine what was in the barrel and what ignited the material.

"It's an old, outdoor storage area filled with 'bone-yard' material — barrels and scrap metal loaded on pallets. They're moving the material because they plan to build there. Our real concern right now is what is left out there and how they plan to dispose of it," she said.

Dennis McQueary, Wah Chang safety officer, said the company would take "appropriate action to handle the barrels in a safe manner so we can dispose of them and protect the employees."

Wah Chang spokesman Jim Barrett said the explosion did not break any windows at the plant but did loosen some acoustical ceiling tiles in a nearby building.

The Accident Prevention Division was notified of the accident by company officials Wednesday morning. The company is not under any legal obligation to report any accidents except those which result in fatal injuries or are considered catastrophic.

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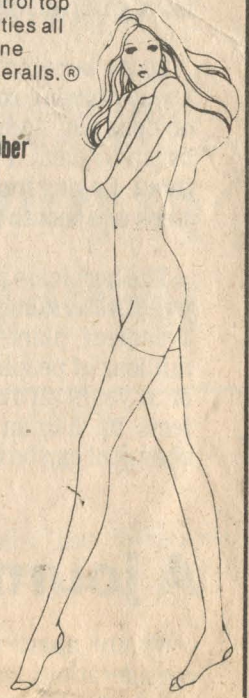
October 4-13



Mon-Sat: 9:30-5:30
124 S. Broadalbin
926-8616

Wah Chang's V-P raps U.S. agencies

By PATRICK O'NEILL
Democrat-Herald Writer

Dick Blunk, vice-president of Teledyne Wah Chang Corp., hurled bolts at federal regulatory agencies this morning in a speech to the Albany Area Chamber of Commerce.

Blunk said activities of an "alphabet soup" of federal agencies — Equal Opportunity Employment Commission (EEOC), Environmental Protection Agency (EPA), Atomic Energy Commission (AEC), National Labor Relation Board (NLRB), Occupational Safety and Health Administration (OSHA), to name a few — are causing a "major drain" on Wah Chang resources.

"What I am concerned about," said Blunk, "is the power that has been given to these governmental agencies."

The industrialist warned his audience to watch closely the effects of the regulatory bodies, "or the Big Brother George Orwell predicted will become a reality."

Blunk strongly criticized OSHA, an agency charged with administering a multitude of regulations concerning occupational safety and health.

"What often happens is that the OSHA inspector — quite often a young kid out of college or off welfare — comes in and feels obligated to find violations," Blunk said.

Blunk complained that the appeal process is so unwieldy that the expense of refuting arbitrary charges of an inspector often far outweighs the amount of fines that would be incurred.

He said that since businesses already are inspected for safety by insurance companies and union representatives, much of OSHA's work is unnecessary.

Blunk said agents from the EEOC sometim fabricate stories by asking leading questio during their inspections.

Wah Chang has been accused of discriminati against women because the company employs women out of a work force of 1,200, Blunk sai

But they (the EEOC) doesn't even know wh we (Wah Chang) do," he said.

Blunk said Smoke-Craft Inc. was tagged with suit for false advertising in connection with t company's trademark — a campfire.

A federal agency demanded that Smoke-Cra change its trademark because the company d not use an open log fire in its processing, Blu said.

Smoke-Craft finally complied with t agency's ultimatum by building a small log fi in its smokehouse.

The Wah Chang vice-president had kind wor for the Oregon Department of Environment Quality, which, he said, "takes the right a proach."

Being "close to home," he said, the DEQ "more sensitive to the needs of local industry

Blunk urged his listeners to avoid involveme with federal funds which he said often obliga the recipient to cooperate with federal agenci

Earlier in his talk, Blunk predicted Wah Cha would increase its output by more than 10 p cent next year.

In other chamber business, Dr. Fran Kaiser, Albany veterinarian, and Allen Cha wick, of Pearce, Chadwick and Robb Insuran Co., were named as first-place winners in t chamber's 1972 membership drive. They ea win trips to Hawaii.

Firm Moves Into Metals

Deal Involves Oregon Plant

HAWTHORNE, Calif. (AP) — Teledyne Corp., officials said Monday they have bought 50 per cent of Wah Chang Corp., a New York-based firm that makes exotic metals.

The assistant to the president of Teledyne, Berkeley Baker, said Wah Chang's manufacturing of metals for electronics and aerospace work fits in with Teledyne's activities in electronics and materials technology.

The formal announcement of the deal was by the respective board chairman, K. C. Li Jr., of Wah Chang and Henry E. Singleton of Teledyne.

Wah Chang has plants at Albany, Ore., Glenn Cove, Long Island, N.Y., Huntsville, Ala., and Texas City, Tex., and employs some 1,200 persons. Baker said there will be no changes in Wah Chang's operations or management because of the Teledyne purchase.

Baker said Wah Chang makes tungsten, molybdenum, tantalum and columbium for electronics equipment. It manufactures zirconium and hafnium for nuclear-powered reactors. The company reported $40.7 million sales in 1966.

Wah Chang issued new shares of stock to Teledyne in exchange for an undisclosed amount of cash.

Six-year-old Teledyne is headquartered in the Los Angeles suburb of Hawthorne. It has plants in 15 states.

The company is a technologically based firm in the fields of electronics, geophysics, oceanography and materials technology.

"Gron" - 10-67

Wah Chang To Build New Tech Center At Albany Complex

Wah Chang Corporation, Albany producer of zirconinum and other exotic metals, has announced plans to construct a new technical center building.

The $500,000 center will consolidate the company's research and development and testing laboratories and staffs in one building.

The new two-story, 21,000-square-foot building, will contain 9800 square feet of laboratory space and an equal amount of office space. About 1400 square feet will be provided for utility installations. Parking space will be provided for 68 cars.

New analytical and testing equipment will be installed in the technical center.

Wah Chang currently is engaged in a $2.5 million expansion program which will approximately double its production facilities. The program includes a new rolling mill and other facilities and equipment.

Teledyne Buys Half Interest In Wah Chang

Statesman News Service

ALBANY — Teledyne Inc., a Hawthorne, Calif., electronics firm, has purchased 50 per cent interest in the Wah Chang Corp., which has a plant here, it was announced Monday.

Announcement was made by K. C. Li Jr., chairman of the New York based Wah Chang Corp., and Henry E. Singleton, Teledyne chairman, in Hawthorne.

In addition to the Albany plant, Wah Chang has plants in Long Island, N.Y., Huntsville, Ala., and Texas City, Tex. Wah Chang has issued new shares to Teledyne for an undisclosed amount of cash.

Wah Chang manufactures refractory metals such as tungsten and molybdenum used in aerospace and electronic products and is a producer of elements used in nuclear power reactors. It reported sales in 1966 of $40.7 million.

Teledyne Inc., is in the fields of electronics, geophysics and oceanography and materials technology. No change in operations or management of Wah Chang is contemplated, the announcement said.

Teledyne Now Sole Owner of Albany Plant

Statesman News Service

ALBANY — Teledyne Inc. is now sole owner of the Wah Chang Corp. operations here, the Hawthorne, Calif., firm announced Friday.

In April Teledyne acquired a 50 per cent interest in Wah Chang, an industrial complex manufacturing exotic metals for the space age. Stephen W. H. Yih, who had been general manager since the firm started here 10 years ago, resigned May 8, effective June 1.

Teledyne said the outstanding stock of Wah Chang was acquired from private interests in exchange for an undisclosed amount of Teledyne's $3.50 preferred stock.

Purchase of the remaining stock was announced by K. C. Li Jr., chairman of the Wah Chang board, and Henry E. Singleton, chairman of Teledyne.

Wah Chang is one of the leading producers of rare metals including hafnium and zirconium used primarily in nuclear power reactors and several other rare metals. It employes some 850 at its various plants located north of Albany.

WAH CHANG ALBANY
P. O. BOX 460
ALBANY, OREGON 97321
(503) 926-4211

A TELEDYNE COMPANY

January 11, 1968

Mr. Ralph S. Mason
Dept. of Geology & Mineral Industries
1069 State Office Building
Portland, Oregon

Dear Ralph:

We are submitting the following information regarding Wah Chang and changes during the past year for your information and inclusions in the Ore Bin annual round up.

1. Wah Chang Corporation was purchased by Teledyne, Inc.

   a) The Albany Division was reorganized as a subsidiary company of Teledyne and renamed Wah Chang Albany Corporation. The board of directors consists of George A. Roberts, President of Teledyne; James D. Nisbet, Vice-President of Teledyne Materials Group, and Stephen Wei Hong Yih, President of Wah Chang Albany.

   b) The remainder of the Wah Chang organization consisting of the Glen Cove Tungsten Reduction plant, the Texas City Tin plant, and the Huntsville, Alabama Tungsten/Molybdenum rod and wire plant were established as another separate Teledyne Company.

2. As a result of the acquisition by Teledyne, funds became available for expansion of the Albany facility. During 1967, zirconium sponge production was increased 80 percent. The new ownership placed heavy emphasis on fume and waste disposal controls, and capital expenditures include large sums exclusively for this purpose.

3. Erection of a new technical center having a total of 21,000 square feet in two stories was started. The first floor of the building will house the complete analytical laboratory consisting of Wet Laboratory, Spectrographic, X-ray and Neutron Absorption facilities. It will also house a new quantometer unit. (recording spectrograph).

The second floor will house the technical library, complete technical staff, drafting facilities, and plant engineering staff. Completion is scheduled for May 15, 1968.

Yours very truly,

J. H. McClain

J. H. McClain

JHM:nh

Oregonian 4/26/80

Sandpile date fixed by county

By STEVE JENNING
of The Oregonian staff

Multnomah County Executive Don Clark said the county will move within a week to halt dumping of low-level radioactive sand on Sauvie Island, unless state agencies act sooner.

The sand, which includes a 10 percent mixture of radioactive zircon, is being deposited on the east side of Sauvie Island by ESCO Corp., a Portland industrial equipment manufacturing company. Clark said island residents have complained that their children play near the dumping site and that health problems could result.

Clark said that the state has not forced ESCO to file for a required dumping permit and that the county will stop the company under nuisance-abatement ordinances unless the state acts.

"Because of inaction at the state agency level and the recalcitrance of ESCO, it is impossible to determine the extent to which ESCO's operations at ... Sauvie Island now endanger the public or will do so in the foreseeable future," Clark said in a letter mailed Wednesday to Gov. Vic Atiyeh. "The present situation is intolerable."

Clark said he will direct the county counsel to "take all available legal measures" in the event that the "present bureaucratic stand-off persists."

Marshall Parrott, manager of the state Health Division's radiation control office, said measurements of the sand dumped on Sauvie Island indicate "that it poses no immediate danger to health," although he admitted that ESCO is in "technical violation" of state laws.

Although radiation readings indicate the sand is about 14 percent below the minimum level legally defining radioactive waste, Parrott said ESCO has not yet filed state-required reports showing that the sand does not exceed radioactively "safe" levels.

"Our hands are tied," Parrott said. "Technically, if we try to close them down on a paper problem, the court will laugh us out of the room."

ESCO President Nick Collins and company attorney Sean Gironan said that the firm was not even in technical violation.

"It's a problem of confusion of agency jurisdiction," Gironan said.

The zircon sand mixture is used in molds for metal castings. ESCO has been dumping the sand on company-owned Sauvie Island property since late 1979. Officials said the sand is being used as road-bed material.

The firm previously had been dumping the sand on company-owned land in Northwest Portland. Separate permits had been issued by the state's Department of Environmental Quality and the state Health Division. The Health Division is charged with control of hazard-

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Although Clark said Wednesday that the Sauvie Island dumping violates the Radioactive Materials License issued by the Health Division, company officials claimed that the DEQ permit alone is sufficient to allow dumping at the island site.

Company officials said new definitions of "radioactive waste" by the state exempt them from the Health Division permit requirement.

Clark said that the company has justified operation in violation of state laws by arguing "that it anticipates that it will qualify for a licensing exemption.

"To date, ESCO apparently has been successful in using this argument to fend off enforcement action by the state — in effect playing off various state agencies against each other," Clark said.

"The principal legal controls clearly lie at the state level," Clark's letter said. "At a minimum, immediate inspections

8-19-60

Wah Chang Producing Items Of Rare Metal

By PAUL MANLEY
Journal Staff Writer

ALBANY — Forks for the crew of the Nautilus, filaments for flashbulbs and control rods for atomic reactors: these exemplify the range of products made from the rare metals refined here by Wah Chang Corp.

Columbium, hafnium, tantalum and zirconium have merited the designation of "space age" metals because of their numerous applications in atomic-powered devices and vehicles destined for outer space.

Their chief value in these installations lies in their high melting points and special properties in relation to atomic particles.

Zirconium, for example, was developed especially for the reactor of the USS Nautilus, first atomic-powered submarine. It does not absorb neutrons, the sub-atomic particles released in a nuclear explosion. Because it repels them, it is an ideal material for constructing nuclear fuel containers.

This same property gained for zirconium the choice as the substance for tableware for crew members on the Nautilus. In the event that any fission products escape from the sub's reactor, they would not then be able to contaminate the crew's eating utensils.

Having turned out parts for the Nautilus' reactor as well as the metal for the crew's tableware, Wah Chang is now applying its experience in other directions. At present it is supplying zirconium to International Chemical Co., contractor for construction of the first British atomic-powered submarine.

Neutrons Absorbed

To control radiation in a nuclear reactor it is necessary to employ a substance that will absorb rather than reject neutrons, a function directly opposed to the one performed by zirconium. Because hafnium absorbs neutrons, it is ideally suited as the material for the control rods, slowing down or speeding up the reaction. At present this is the only commercial use for hafnium, so Wah Chang markets it in only one form, whereas the other three rare metals are fabricated in a variety of shades and sizes. beach sands. Years of research

Curiously, hafnium and zirconium — diametrically opposed in their reaction to nuclear fission —are usually found together in beach sands Years of research preceded the discovery of a practical method for separating them, now employed in large-scale production by Wah Chang.

While the average person has never set eyes on an article fabricated from hafnium, a common product has been evolved from zirconium. In foil form it is being used increasingly as the filament material for photographers' flashbulbs. Much of this filament is turned out by Wah Chang's $1 million foil rolling mill, the only foil rolling mill west of the Mississippi River. Feed stock for this mill is only 60 mills in thickness —six hundredths of an inch.

Columbium, until recently, was in demand commercially almost exclusively as an alloying material for steel. While this continues to be the major commercial use of this interesting metal, new developments indicate a growing market among nuclear and space vehicle manufacturers.

At present, Pratt & Whitney Aircraft is the only major buyer of refined columbium in the United States. This jet-engine manufacturer is now putting together a prototype of a nuclear reactor which one day may propel an atomic-powered plane into the skies. Not long ago this project was so hush-hush that Wah Chang's deliveries of columbium to Pratt & Whitney had to be trans-shipped under guard at a military base.

Advantages Cited

Chief advantages of columbium for such applications appear to be its high melting point — almost twice as high as that of steel — and its corrosion resistance to liquid metal.

The outlook for tantalum is tied closely to the electronics industry, although it is also employed in surgical equipment, chemical processing equipment and cutting tools for metalworking. Like the columbium with which it is found in mineral ore, tantalum is valued for its hardness and resistance to corrosion. It cannot be dissolved by most acids.

The metals for which Wah Chang is steadily finding new uses are no longer "wonder metals". Each has its limitations. None is the all-purpose metal of tomorrow. But to each can be applied the prediction made for columbium by K. C. Li, president of Wah Chang, in an address earlier this year:

"Ever-expanding chemical industry, aircraft and missile industry, power-generating plants and nuclear energy industry will find increasing uses for this element, which was discovered so long ago but is just now reaching some prominence."

4-22-57

Zirconium Plant Opens At Albany

ALBANY, Ore. (AP) — Sen. Neuberger (D-Ore) Monday said the reactivation of a zirconium plant here "will serve to take up the slack in jobs recreated by recurring unemployment in Oregon's basic lumber industry."

Neuberger spoke at the dedication of the plant, as it was reopened by the Wah Chang Corp., under a lease from the federal government.

The plant will "contribute a vital material to the defense of America," Neuberger said, as it has an annual production capacity of 300,000 pounds of zirconium, a metal used in atomic reactors.

Before the plant was closed in May, 1955, as a federal Bureau of Mines operation, zirconium it produced was used as a jacket around uranium fuel on the first atomic-driven submarine, the Nautilus.

Millions of kilowatts of electricity will be needed to "maintain leadership in the atomic field," Neuberger said. "It is of utmost importance that our government follow water resource policies using to the fullest the Northwest region's hydro-power potential."

4-23-57

Albany Plant to Expand

Million Dollar Addition Due

Statesman News Service

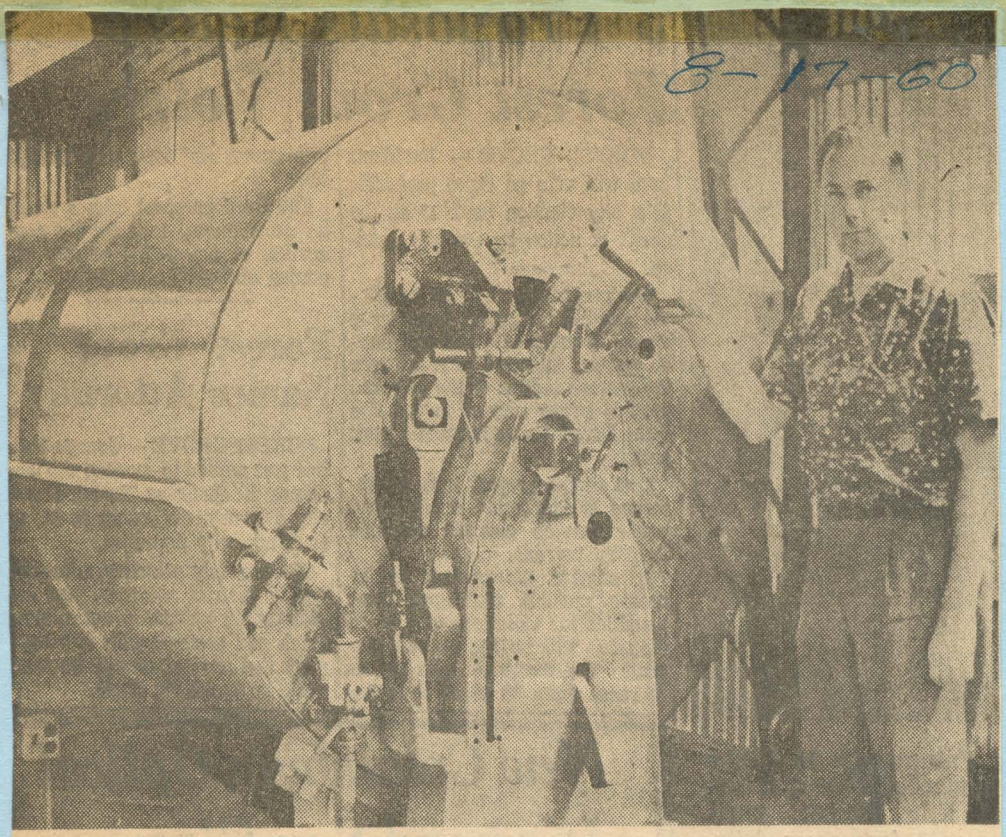
ALBANY, April 23 — Plans for construction of a one-million dollar addition to the two-million-dollar zirconium plant which was dedicated here Monday were announced today by Stephen Yih, general manager of the Wah Chang Albany metallurigal operation.

The addition is to include a zirconium purifaction plant similar to one now operated by Wah Chang for the Atomic Energy Commission at Northwest Electro Development Laboratories, under lease from the U. S. Bureau of Mines.

Yih said the capacity of the proposed plant will be greater than at existing facilities.

The new plant will enable the Wah Chang corporation to sell zirconium on the open market, he said. Sales now are restricted to the AEC because government-owned facilities are used in the metal's production.

8-17-60



8-17-60

SIXTEEN-INCH GUN used at Wah Chang's Albany plant for compacting powdered metal is demonstrated by Carl W. Carlson, process engineer. Gun reputedly was once part of armament aboard USS Colorado.

Wah Chang Plant Scours World Seeking Zirconium, Hafnium Ores

By PAUL MANLEY
Journal Staff Writer

ALBANY, Ore. — Starting with a basic raw material as common as beach sand to turn out a finished product worth upwards of $75 a pound is perhaps the most glamorous aspect of the work at the rapidly expanding Wah Chang Corp. plant here.

Of course, even beach sand isn't exactly common when it's imported from Australia, but then the sand along the Oregon coast is also a potential source of the rare metals zirconium and hafnium, though the native variety harbors more impurities. For the ore to produce columbium and tantalum, Wah Chang's import division scours Malaya, Indonesia, Nigeria and Brazil.

Acids and heat are the principal agents employed here to extract the new "precious" metals from their ores and to purify them. Such unglamorus materials as carbon black and powdered sugar are introduced along the way. Electric power is the favored source of heat, largely because it is clean, introducing no contaminating materials, and it can be controlled closely over a wide range of temperatures. A plentiful supply of water for cooling is another essential responsible for location of the Wah Chang plant here.

Hafnium was once considered an impurity in zirconium. Now it is carefully extracted and refined, instead of being discarded. The ratio of production is about 50 pounds of zirconium to one of hafnium. Zirconium oxide, emerging from the purification plant, is dried in a huge rotary kiln, while the hafnium oxide is dried in trays.

"We even save the floor sweepings around the hafnium plant," a Wah Chang guide commented, pointing up the scarcity of the metal.

At one stage Wah Chang brings into play a 16-inch naval gun, reputedly from the USS COLORADO. The gun's hydraulic compression mechanism is used to compact the powdered metal into slugs resembling ingots.

Rigid Specifications

Some 10 per cent of Wah Chang's total Albany payroll consists of chemists and physicists employed in its laboratories to test and torture the metals at every stage of refining. While many of the operations are reminiscent of steel smelting, the resulting product must conform to specifications far more rigid than have ever been imposed on steel. The slightest irregularity in metals destined for atomic reactors and space vehicles would be disastrous.

Another disparity between steel and a majority of the Wah Chang metals is their greater weight. Only zirconium is lighter than steel, having a density of .234 pounds per cubic inch against steel's .284. Pure hafnium is approximately twice as heavy as zirconium, and pure tantalum nearly twice as heavy as columbium. Because of the awkward weight of the refined products, coupled with the absence of a ready market, theft is no problem for Wah Chang.

Recent installation of a 22-inch hot rolling mill and a 20-inch cold rolling mill has substantially increased Wah Chang's ability to fabricate various shapes and sizes of the metals it refines. Sharing occupancy of the rolling mill building are a 750-ton forge press, a rod mill and a $1 million foil rolling mill. The last piece of equipment is supported by a battery of electronic panels that makes a "brain" computer look like a toy by comparison.

The company markets the four metals produced at its Albany plant in six forms: Sponge (resembling porous rock), ingots, sheets, bars, plates and tubes. Storage facilities for the finished products are now under construction, in the form of a corrugated metal shed about 30 feet wide and 100 feet long. Up to now, Wah Chang's products have been moving out so rapidly that warehousing never became a problem.

5-7-57

$3,000,000 Payroll Built on Rare Metals

Three speakers at the Portland Chamber of Commerce luncheon Monday told in dollars and cents how the production of rare metals has changed the livelihood of residents of the Albany area.

Stephen Yih, Wah Chang corporation; Steven Shelton, Oregon Metallurgical company, and Mark Wright, U. S. bureau of mines, limited their discussion to the production of zirconium and titanium.

Some 600 persons are employed in the two commercial plants and the bureau of mines research laboratories in the Albany area. The facilities, they added, represent an investment of over $6,000,000 and a payroll of $3,000,000.

SHELTON, vice president and general manager of Oregon Metallurgical, envisaged a "bright and new future" for the two metals as production is increased and costs reduced. He expects titanium to be used in the manufacture of truck parts, and he saw no reason why damaged bones could not be replaced by the light, strong metal.

Mayor W. L. Fitzpatrick and Roy Collins, Albany Chamber president, led a delegation of 25 to the luncheon. Russell Tripp, president of the Albany Timber carnival, presented a "log-rolling" shirt to R. L. Clark, president of the Portland Chamber of Commerce board.

Jobs in Store For 50 Men

Wah Chang corporation Thursday announced start of construction on a metal separation and purification plant at Albany.

The 76x240-foot plant with five-story tower is being built near the company's recently completed zirconium reduction plant.

Of precast and prestressed concrete construction, the plant will house a metals purification operation involving separation of hafnium from zirconium and another purification process.

A two-story wing will provide space for laboratory facilities and a research section. About 50 persons will be employed in the new plant, with 35 in production and 15 in laboratory, research and office, according to Steven Yih, manager of the zirconium division of the Wah Chang corporation.

The Albany operation of the New York metallurgical firm produces zirconium from which reactors such as used in atomic submarines like the Nautilus are built. Wah Chang is one of three private companies under contract to the atomic energy commission to supply zirconium.

George Moore & Associates are building the plant, from plans by James & Honey, Portland consulting engineers. Under direction of Steven Yih, Jim McClain and Ralph Nielson of Wah Chang, James & Honey are handling the structures with architectural assistance from Johnston & Koch. Cornell, Howland, Hayes & Merryfield are doing the mechanical and electrical work.

Raw Materials Survey
News Letter
July 1957

WAH CHANG OPENS NEW ZIRCONIUM PLANT

The Wah Chang Corporation dedicated its new zirconium sponge plant in North Albany, Oregon in April of this year. This plant, which uses the Kroll process developed by the U. S. Bureau of Mines, has a capacity of 30,000 lbs. of zirconium sponge per month.

Wah Chang Corporation also operates the zirconium plant of the U. S. Bureau of Mines at Albany, Oregon, under lease and this plant also produces about 30,000 lbs. per month. Zirconium sponge is shipped to the Oregon Metallurgical Company, Allegheny Ludlum Corporation and others, and the final zirconium ingots are used by the Atomic Energy Commission.

Zirconium tetrachloride is the starting raw material for these plants, although Wah Chang Corporation is giving some consideration to the preparation of its own raw material in the future. The company is also seeking new uses for the by-product magnesium chloride made in the process. In addition, in another facility at the new site, the company produces titanium slag and pig iron. The company also expects to go into production of niobium (columbium), and tantalum at Albany later this year.

Announcement was made of a new addition to be built to provide a zirconium purification plant similar to the one new operated under lease for the AEC. This new plant will have a greater capacity than the plant now being operated and will add considerably to the $2 million already invested by Wah Chang in its Albany plant buildings and equipment.

Activation of the plant in September, 1957, will enable Wah Chang to supply zirconium on the open market. Sales are restricted to the AEC when government-owned facilities are used.

Wah Chang Corporation has been in business for about forty years. Until recently the interests of this company have been almost exclusively in tin, antimony and tungsten. However, the company is now committed to an extensive expansion in the field of rare metals and is to be highly commended for establishing the first commercial privately-financed zirconium and rare metal plant in the Pacific Northwest.

kc

NOTE: This is a first draft - it has been dictated and transcribed directly without any editing.

MEMORANDUM CONCERNING DISCUSSION HELD BETWEEN REPRESENTATIVES OF WAH CHANG CORPORATION (Stephen Yih, James McClain, and George Hargreave) AND THE DIRECTORS OF THE DEPARTMENT OF PLANNING & DEVELOPMENT AND DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
Held in Room 1069 State Office Building, Portland, Oregon, the morning of October 10, 1958.

Mr. Yih reported that when the production facilities of Wah Chang's zirconium-hafnium plant are operating at full capacity, 350 people are employed. At the present Wah Chang is operating at a reduced schedule and they employ but 250 people. At the conclusion of its contract with the Atomic Energy Commission, Mr. Yih reported that a standby crew of around 100 would be retained.

In 1957 Wah Chang spent around 9 million dollars at the plant. This was broken down as follows:

Gross payroll	1.75 million dollars per year
Power	0.5 million dollars per year
Supplies	3-4 million dollars per year
Construction	3-4 million dollars per year

Operating at full capacity, it was estimated that Wah Chang's zirconium plant would be spending for payroll, power, materials, and supplies, around

7 3/4 million dollars per year. It is significant that Wah Chang has made a point to purchase as much material and supplies within the Willamette Valley area as possible.

Employment and supply factors indicate that the loss or reduction in employment at the Wah Chang plant is of vital concern to the planning and development of the State and to the advancement of its mineral industry. Because of this, it is thought that the State departments noted above should take an active part in trying to maintain employment levels of this industry at the highest rate possible. Therefore it is concluded that interjection of these departments into activities that might achieve this end would be to the benefit of the State of Oregon and is a function of the duties of these departments.

At the present time zirconium and hafnium sponge is produced in four plants as follows:

(1) Carborundum Corporation in West Virginia has a contract to furnish one-half million pounds of zirconium sponge per year to the AEC at a contract price of $7.72 per pound. This contract is to run for five years. Carborundum Corporation has been in production for approximately one year.

(2) National Distilleries, Inc., whose plant is located at Ashtabula, Ohio, has a contract for one million pounds of zirconium sponge per year for a period of five years at a negotiated price of $4.53 per pound. National Distilleries has been in production for three months.

(3) National Reserves, now known as Columbia National, has a contract for three-fourths million pounds for five years at a contract price of $6.50 per pound. This plant is located in Pensacola, Florida. As yet no production has come from this plant.

(4) Wah Chang Corporation, Albany, is completing a contract for 0.54 million pounds of zirconium sponge this year. This contract was completed within two years. The first contract called for a payment of $12 per pound and the second contract called for a payment of $8.24 per pound of zirconium sponge.

Contracts for Carborundum, Columbia National, and National Distilleries were let in April 1956, and the original contract with Wah Chang was

let in August of 1956. It will be noted that only Wah Chang has made any quantity of deliveries to date.

It was pointed out that cost per pound for production of the sponge is dependent upon allocation of cost per pound - that is, the larger the contract, the lower cost for sponge. The Wah Chang representatives stated that they could meet, at the present time, the cost of production of any of the companies now in operation. It was also pointed out that cost per pound of zirconium sponge is open to renegotiation up to 120 percent of the original contract amount. This could mean that Columbia National could possibly be paid a good deal more than the supposed $6.50 per pound which it has agreed upon if and when it ever reaches production. It also means that both Carborundum and National Distilleries may possibly increase their price per pound if need be. Probably most significant is the fact that Wah Chang is the only one that has actually had sizable production. It appears as if Wah Chang's success is to be penalized whereas the nonproductive efforts of the other companies are to pay off.

Termination of AEC contracts with Wah Chang is reportedly due to cancellation of nuclear reactors for the military. It was brought out that there is no stockpile of zirconium or hafnium sponge as there is a stockpile for other strategic and critical materials. Inventories are "in process inventories" - that is, production from the various plants is allocated to the various reactors based upon the production of the plants.

A product in the production of zirconium metal is hafnium metal. Hafnium metal is used in reactors at the rate of about 3 pounds of hafnium to 100 pounds of zirconium. Production of hafnium amounts to about 2 pounds of hafnium to 100 pounds of zirconium. The Atomic Energy Commission predicts a shortage of hafnium metal within fiscal 1959.

At the present time the Atomic Energy Commission is having difficulty purchasing zirconium and hafnium because of contractual setups with other government bureaus and private organizations that use zirconium and hafnium. As explained, the Atomic Energy Commission purchases from the plant producing the metal. The Commission or agency building the reactor then purchases from the Atomic Energy Commission. The Atomic

Energy Commission has no working fund and once its original capital has been spent it must await repayment by the agencies using the material. Until the repayment has been made, the Atomic Energy Commission is hamstrung on allocating future purchases. The inability of the Atomic Energy Commission to borrow money for purchases is apparently an administrative decision based upon the desire of the federal administration request to not go to Congress for funds. Short circuiting AEC payment by the purchasing agencies is not desirable to the agency as hafnium is in greater supply than zirconium. The agency, by purchasing its metals directly from AEC, causes the Commission to absorb the unwanted zirconium, thus reducing the cost of the hafnium metal to the agency using the metal.

Recently 330,000 pounds of zirconium sponge was obtained from Japan through barter arrangements with the Department of Agriculture. This sponge, it is understood, was then sold by the Atomic Energy Commission to other agencies. Wah Chang Corporation has made overtures to the Department of Agriculture for similar deals - that is, exchange of zirconium sponge for surplus agricultural commodities with the idea that

Wah Chang would dispose of the agricultural commodities to nations of the Free World and thus receive payment for their sponge. A conference was held with the Department of Agriculture on this early in October. Wah Chang was informed that due to a revision of barter regulations and barter procedures within the Department of Agriculture, a conference would have to be held between representatives of the Department of Interior, the Atomic Energy Commission, the State Department, and the Agriculture Department if such a procedure would be acceptable. It was estimated that for a committee such as this to be designated and to hold deliberations would take a minimum of six months. By that time Wah Chang would be out of business at Albany.

Wah Chang is in the process of investigated the possibility of sale of zirconium oxide to the ceramic industry and other non-atomic uses of zirconium metal and oxide. If this can be done, Wah Chang could possibly produce hafnium metal (which is in greater demand than zirconium) at a price much less than is quoted for hafnium metal alone today.

Wah Chang points out that the efficiency of their plant is probably just as high, if not higher, than any other plant in operation today. Supporting this is the fact that Wah Chang is the only company to have had sizable production. The original research on zirconium and hafnium was done in the Bureau of Mines laboratory at Albany and many of the men who were in on this original research are now employees of Wah Chang. Location is made attractive also by the fact that it is right next door to a melting plant (Oregon Metallurgical Corporation). Although three out of the four zirconium sponge plants are located in the East, the West Coast has melting plants at Albany (Oregon Met.) and at Torrance, California (Harvey Machinery). Because of the high price of zirconium metal, transportation of material is not a very large item.

It would appear to me that there are several avenues which the State of Oregon should investigate in trying to keep the payroll and basic manufacturing plant at Albany. They are as follows:

(1) Stockpiling of zirconium and hafnium by the AEC or General Services Administration. As mentioned above,

there is no stockpile and only "in process inventories". Stockpiles are maintained for most other mineral commodities and there should be no objection to the addition of such strategic materials as zirconium and hafnium. Perhaps inquiries to Mr. Leo Hecugh, Director of the Office of Civilian and Defense Mobilization, could shed light on this possibility.

(2) Replacement of the 330,000 pounds of zirconium sponge obtained through barter. It is my information that all barter materials are placed in a stockpile that cannot be touched unless authorized by Congress. However there are so many categories of stockpiles and they are handled in so many different ways, this particular barter may be an exception. If, however, there has been an illegal drawing on this particular stockpile, contracts should be let to domestic plants to replenish the supply. If the barter program has been to fulfill contracts that could be made in the United

States, some Congressional action should be taken to curtail this type of activity.

(3) The Atomic Energy Commission should have a working capital fund that would allow it to purchase materials in order to keep plants open and to keep a continuing supply of metal. This idea of being able to purchase only when repaid by other commissions is strictly not good business.

(4) Wah Chang has stated that they are willing to operate on a cost-plus basis for the next three years, the cost-plus being cost of operation, plus materials, plus labor - amortization not included. This would make the Wah Chang plant by far the lowest cost producer in the United States. The Atomic Energy Commission has repeatedly stated that Wah Chang is a high-cost producer and contracts let to it are costing the government taxpayers more than they should. Wah Chang representatives have stated that now that the plant is running and the high cost of starting has been completed

they can match prices with anyone and undoubtedly undercut most, if not all, of them. Therefore if the Atomic Energy Commission is worried about cost, Wah Chang should be their pigeon.

(5) Operating through administrative heads should cut a lot of the red tape in the AEC - Interior Department - State Department - etc., thus saving complete shutdown of the Albany plant and the excessive cost of restarting.

Wah Chang Corp.

8-12-58

Navy's Lag In A-Vessels Hurts Plant

(Story also on Page 1.)

ALBANY — Threatened closure of the Wah Chang zirconium plant here is blamed on a lag in construction of atomic naval vessel engines as well as awarding of several large contracts to other producers by the Atomic Energy Commission.

The Wah Chang firm and its 350 workers face a possible shutdown after a contract with ABC is completed in October, officials announced.

Another reason for the threatened closure is that civilian requirements have not reached proportions to provide an adequate open market for reactive metal, pointed out Stephen Yih, the Albany division's general manager.

Protest Sent AEC

Meanwhile efforts were being made to remedy the threatened shutdown. Secretary of State Mark Hatfield wrote a letter of protest to AEC. Albany Chamber of Commerce manager Hal Beyer was attempting to reach Sen. Richard L. Neuberger to enlist his aid.

Oregon Metallurgical plant here, which employes about 200 men, will not be seriously affected by Wah Chang's possible closure — even though zirconium sponge is obtained from the other plant.

Sufficient Sponge Available

Stephen Shelton, metallurgical general manager, said his plant was assured of sufficient sponge to complete its current $1 million contract for delivery of zirconium ingots to Westinghouse Co.

"We probably will be able to obtain sponge from other sources to fill future orders if Wah Chang is forced to close," Shelton said.

"But availability of sponge here has been of distinct advantage to Oregon Met in cutting freight costs."

8-12-58

Zirconium Plant May Shutdown

Statesman News Service

ALBANY—The Wah Chang zirconium plant here and its 350 employes face a possible shutdown this fall because of Atomic Energy Commission contract cutbacks.

The threatened closure brought a protest Monday from Secretary of State Mark Hatfield in a letter to the AEC. Hatfield, in pointing out the unemployment that would result from a shutdown, said he hoped interim assignments could be given the Albany plant until it is needed again.

A plant official said present contract with the AEC runs out in October. The Albany division, located at northeast edge of the city, has been in operation about two years.

The secretary of state said he understood zirconium can be stockpiled and that ultimately it will have many civilian utilization possibilities.

"As you begin to give more attention to civilian development in the decades ahead, it is apparent you will want to have plants of this kind in operation," Hatfield added in the communication to the AEC.

Meanwhile officials of the 200-employe Oregon Metalurigal plant here, which obtains zirconium sponge from Wah Chang, said their operations will not be seriously affected by threatened closure of the other operation.

(Add. details on Page 3.)

9-15-58

Wah Chang Layoff Set

Zirconium Orders By Government Dip

ALBANY, Or., Sept. 15.—Wah Chang Corp. reports it will lay off 101 members of its Albany work force before Oct. 1.

The big metals plant, faced with a cutback because of dwindling government orders for zirconium, said it will lay off 78 employes in production, warehousing and maintenance work this week. Thirteen college students working part time will be laid off when school starts and 10 members of the clerical force will leave their jobs Oct. 1.

Bill Walker, personnel manager for the plant, said the reduction will cut the working force to 214.

WALKER SAID plans call for continuing with this number until near the end of the year.

The terminations and recall will be on the basis of seniority, Walker said.

Tantalum and columbium divisions were not affected by the cutback, Walker said.

Walker said plant owners are doing everything possible to obtain orders and contracts.

Oregonian 11-24-59

Research Center Aim

ALBANY (Special) —Wah Chang Corp., producers of refractory metals, will definitely establish a research center here, Stephen Yih, general manager, said last week.

Yih said the center may be ready for operation in three or four months.

At present, not much information is available on the research facility. It is still in the early planning stages. Location, size, and exact scope of the operation depend on "future planning," according to Yih.

While the research plans are being drawn, construction at the Way Chang plant just north of Albany has started on a rolling facility for turning out rods and sheets of refractory metals.

The building to house the rolling mill will be near the North end of the large Wah Chang industrial site. It will be near a new arc furnace building which Yih said is now 90 per cent complete. He said the new furnace capable of producing the extremely high temperatures needed for melting the atomic age metals processed at Wah Chang, is now in operation.

In the same building will be an electron beam melting furnace used in refining the heat-resistant metals used in atomic reactors.

Another building expansion, that of the tantalum - columbian processing plant is now Chang manager said.

February of 1960 is the target date for starting the rolling mill, Yih said.

3576

STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
1069 STATE OFFICE BUILDING
PORTLAND 1

December 22, 1960

Bob

Wah Chang Corporation
% Mr. Stephen Yih, General Manager
1600 Old Pacific Highway
Albany, Oregon.

Dear Mr. Yih:

The annual round-up of information on the mineral and metallurgical industry of Oregon will appear in the January issue of the Ore.-Bin. A copy will be mailed to you immediately it is printed.

Before we go to press, however, we would like some first-hand information on your activities during the past year. News about improvements in your operation, changes in ownership, new markets or products is particularly welcome. If you wish you may write the information on the bottom of this sheet.

A stamped, self-addressed envelope is enclosed. Since we go to press about January 15, we would appreciate hearing from you promptly.

Sincerely yours,

Ralph S. Mason

Ralph S. Mason
Mining Engineer

RSM:lk
Encl.

Dear Mr. Mason:

6 January 1961

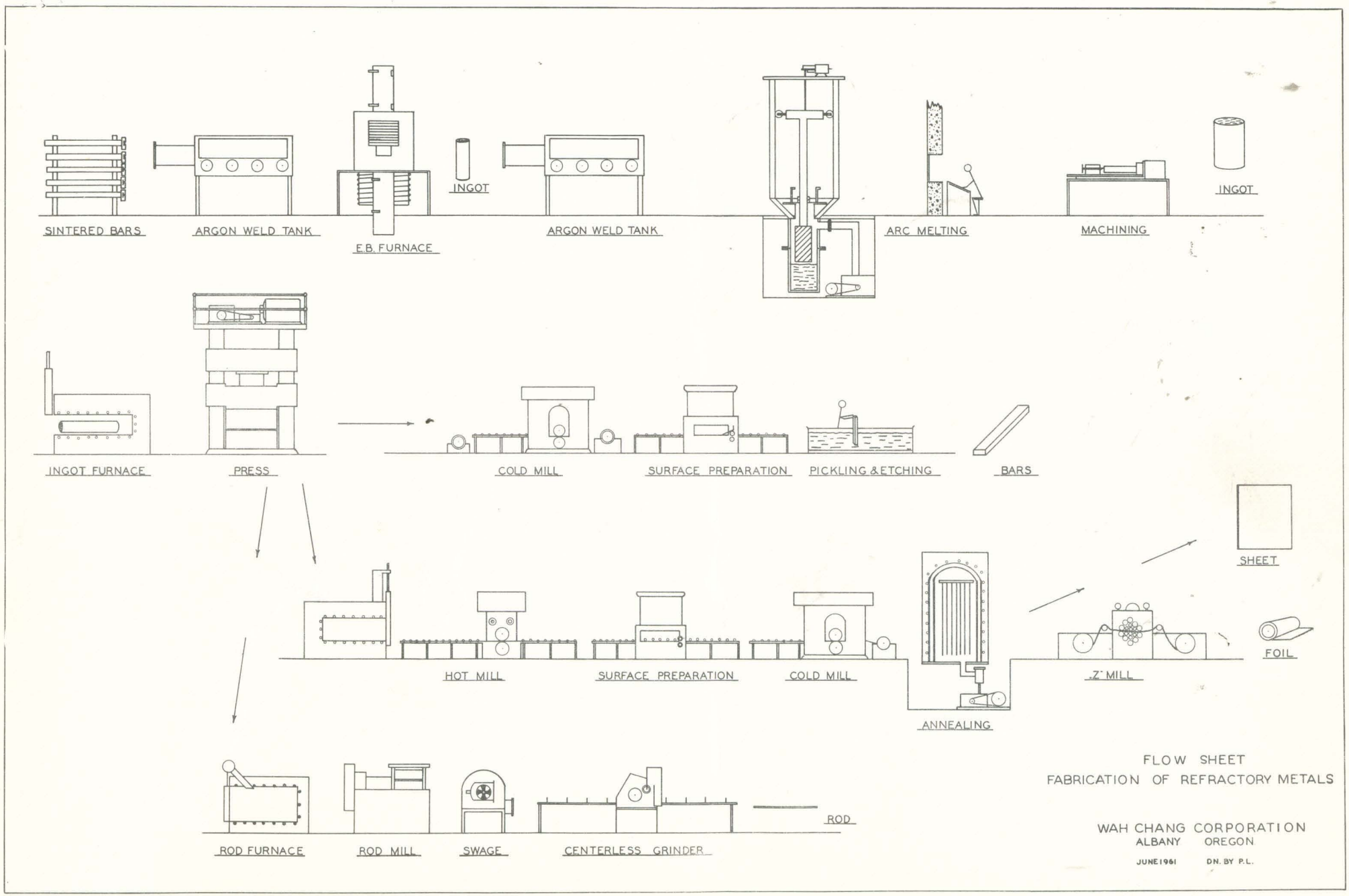
Mr. Stephen Yih became President of the Corporation on January 1, 1961 His new address is: Wah Chang Corporation, Woolworth Building, 233 Broadway, New York 7, New York.

Mr. D. S. Fairgrieve is now Acting General Manager.

In 1960 the Albany Division continued moderate production of Zirconium Metal Sponge, and increased the production of Hafnium+Columbium metal. New facilities were installed for Ingot production (Electron Beam Melting and vacuum Arc Melting) and for the manufacture of metal rod, bar, sheet and foil.

R. G. JONES
Manager of Services

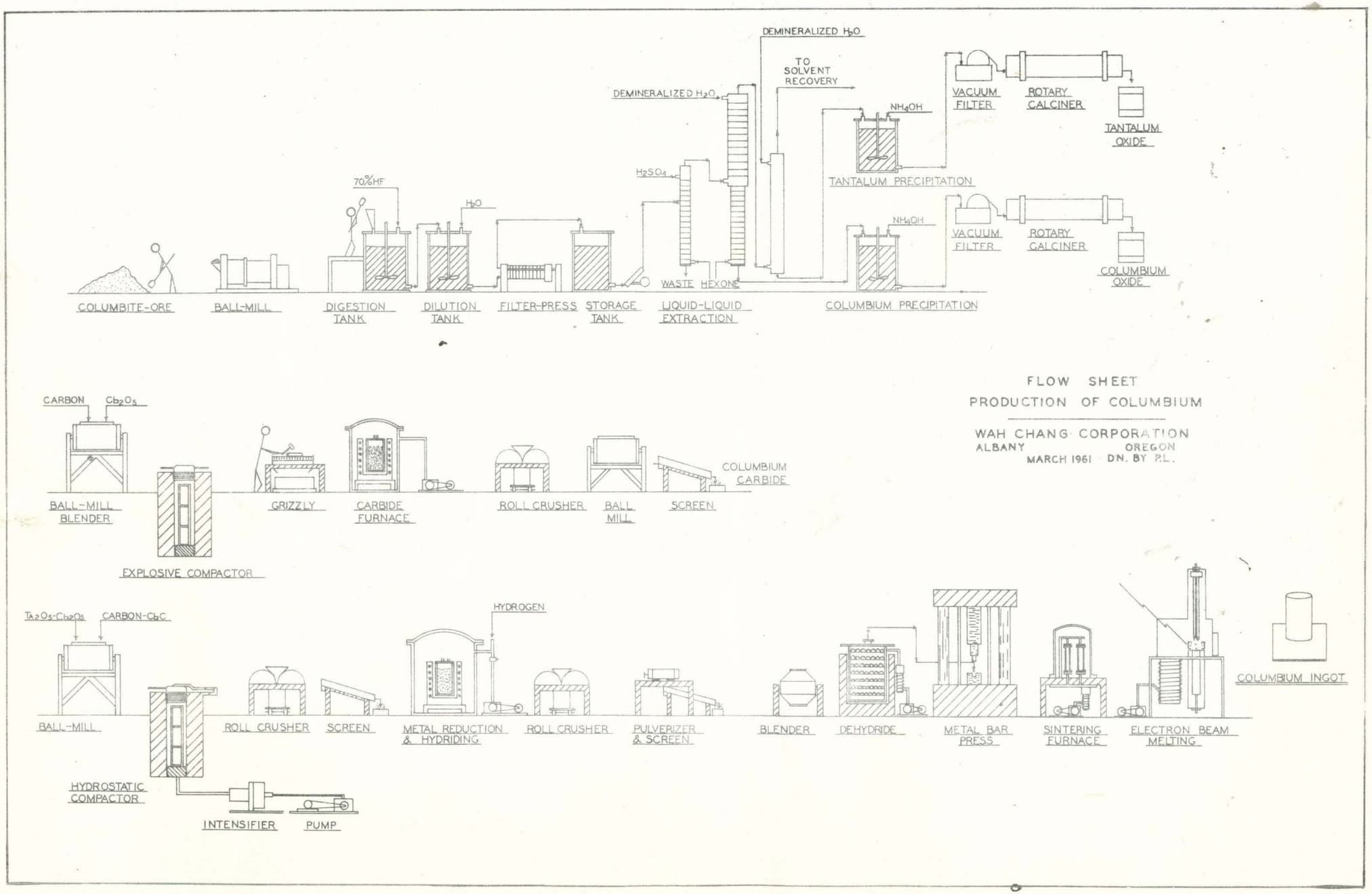
RGJ:emk



FLOW SHEET
FABRICATION OF REFRACTORY METALS

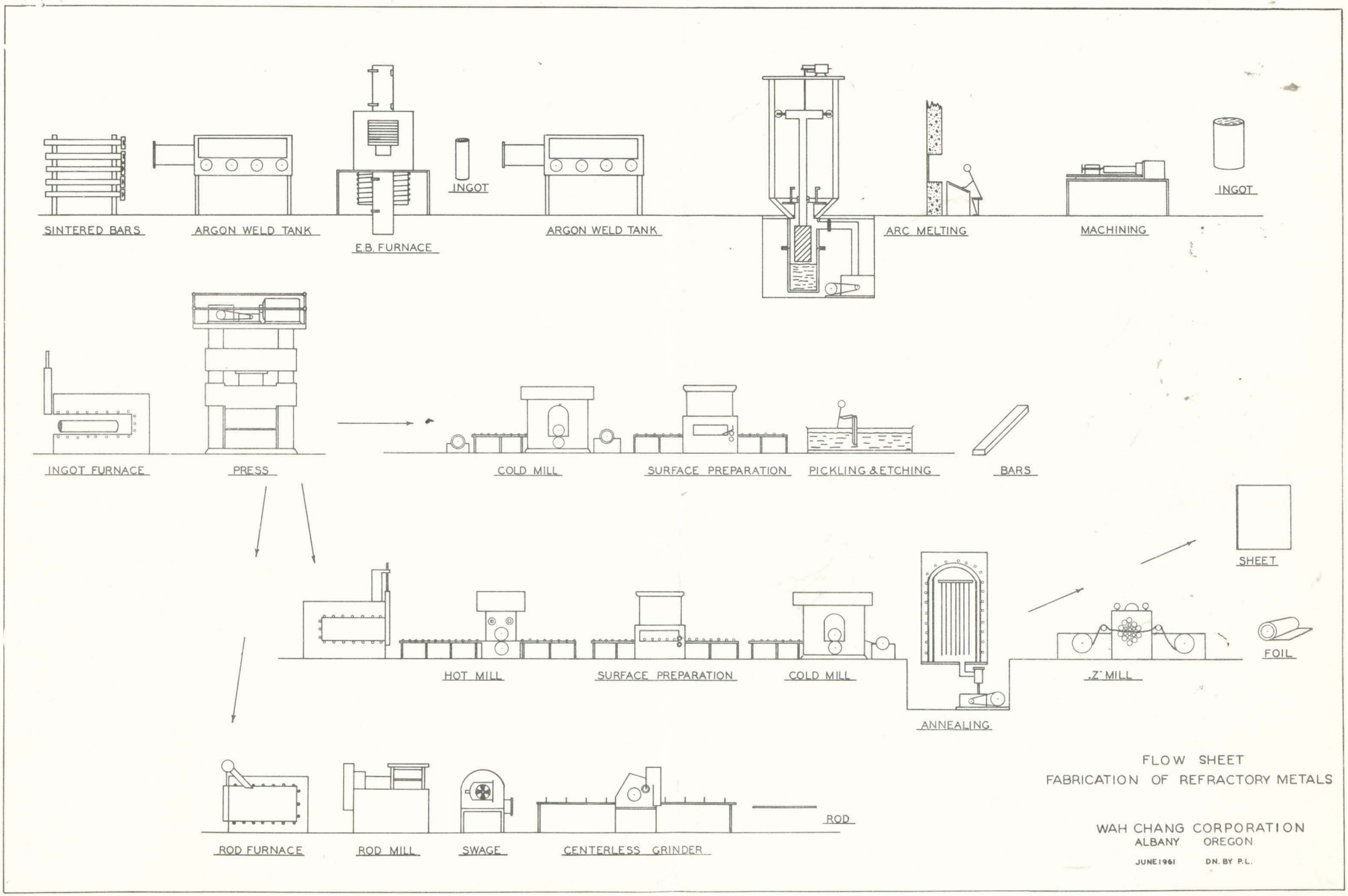
WAH CHANG CORPORATION
ALBANY OREGON

JUNE 1961 DN. BY P.L.



FLOW SHEET
PRODUCTION OF COLUMBIUM

WAH CHANG CORPORATION
ALBANY OREGON
MARCH 1961 DN. BY P.L.



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ALBANY OREGON

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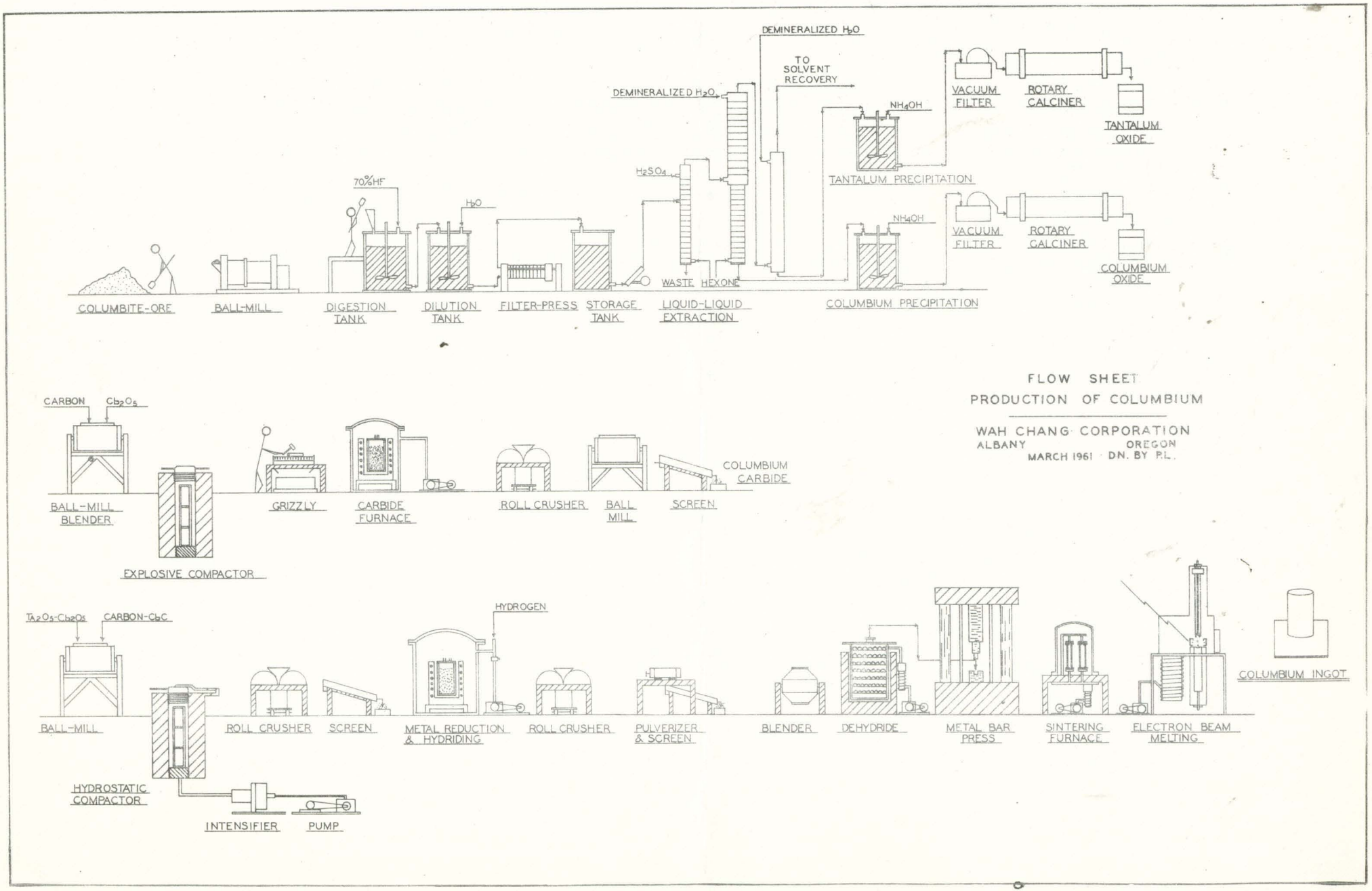
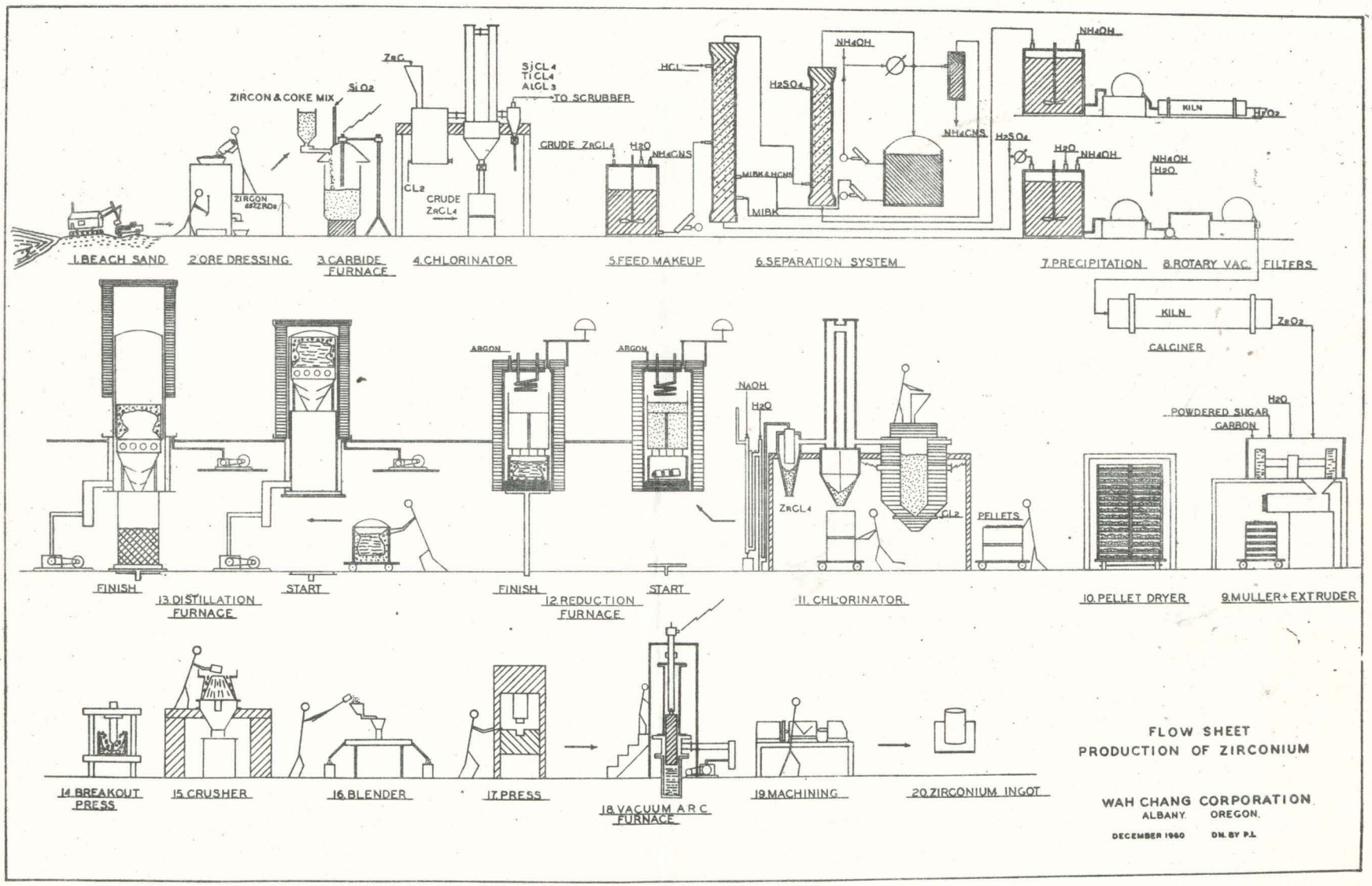


FLOW SHEET
PRODUCTION OF COLUMBIUM

WAH CHANG CORPORATION
ALBANY OREGON
MARCH 1961 · DN. BY P.L.



FLOW SHEET
PRODUCTION OF ZIRCONIUM

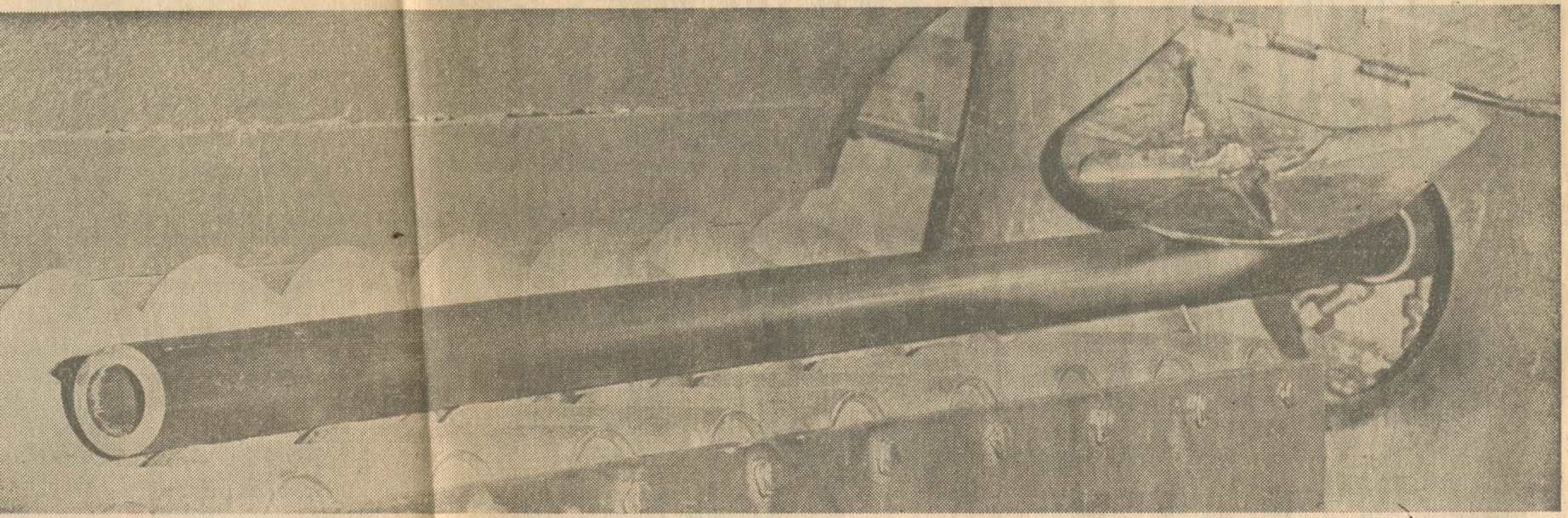
WAH CHANG CORPORATION
ALBANY OREGON.

DECEMBER 1960 DN. BY P.L.

GENIUS — Scientific genius responsible for founding of Wah Chang in Albany is Dr. Stephen Yih, president.

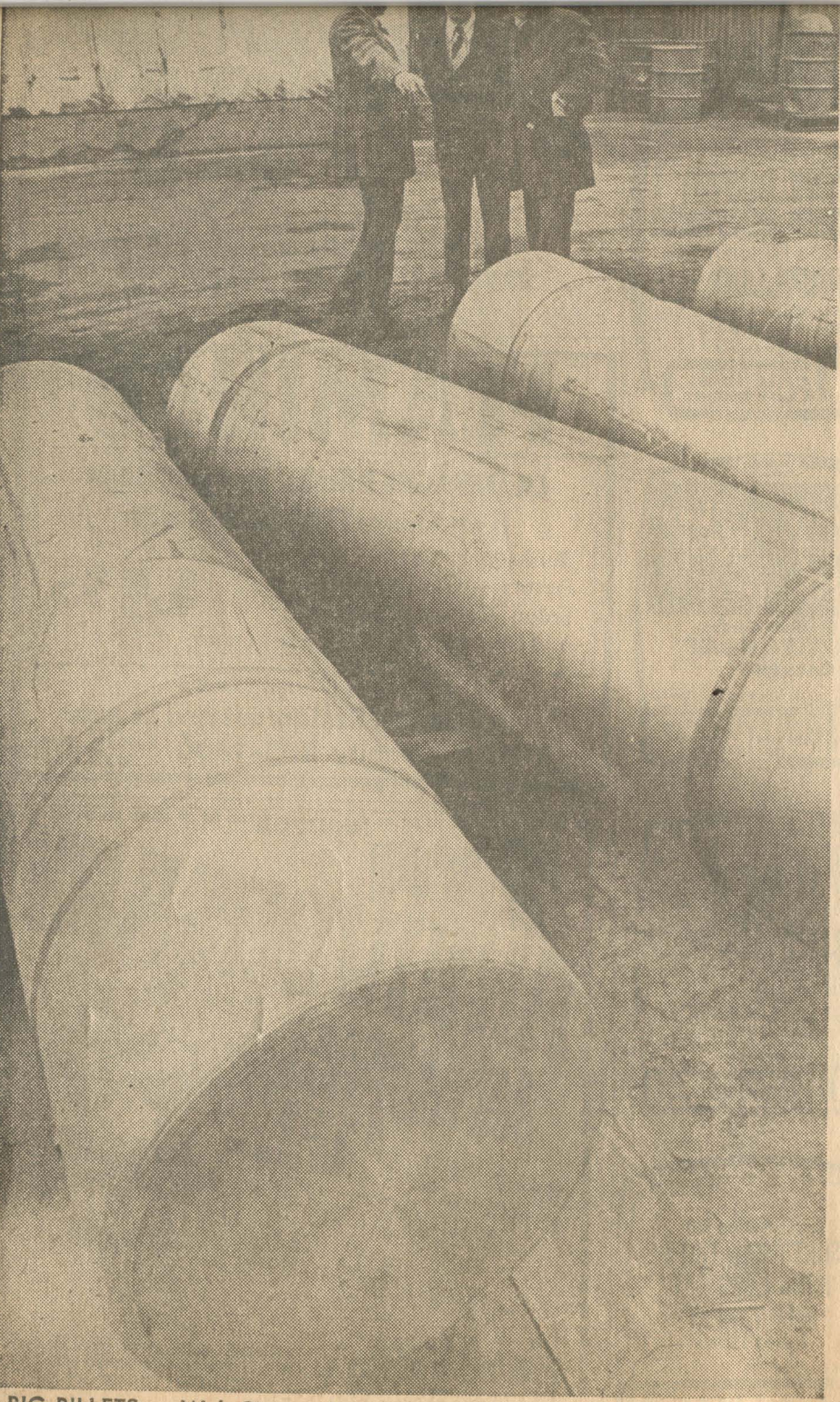
Staff Photos
By BOB ELLIS

Rare metals industry in Albany supplies most of world's zirconium



HOT STUFF — Heated billets of zirconium are forced by 3,500-ton press into tubes 15 feet long 1 7/8 inches in diameter, shipped to Westinghouse plant for further reduction to house uranium pellets in heart of reactor.

BURSTING SEAMS — Albany Wah Chang chemical plant, shown from air, is bursting at seams, expanding every year to meet growing demand for nuclear power plants.



BIG BILLETS — Wah Chang plant turns out four-ton billets of purest alloys of rare metals for use in nuclear, chemical and aerospace industries.

HEART OF REACTOR — Tubes like these will be shaped into fuel cells for Trojan plant. Wah Chang imports 10,000 tons of sand from Australia annually, extracts zirconium which sells for $10 a pound in tube form. Bright coins (above) are refined zirconium.

By LEVERETT RICHARDS

of The Oregonian staff

ALBANY — There is no recession in sight for Teledyne's Wah Chang plant in Albany, world's biggest supplier of zirconium.

"Our biggest problem is to expand fast enough to meet the demand," said Dr. Stephen Yih, the physicist who put Wah Chang on the map 18 years ago and now is president of the Teledyne Wah Chang Co.

Wah Chang produces zirconium, which is the heart of all nuclear reactors such as the $345-million Trojan plant, being built by Portland General Electric Co.

The plant, near Rainier, is about 75 per cent complete, with loading of the nuclear fuel cell scheduled to start in February, 1975. The 1.1 million-kilowatt plant is to go on the line in July, 1975.

Heat is generated by fission of uranium 238, enriched with uranium 235. The fuel cells must be built of metal that permits free passage of the thermal neutrons, yet will not conrode in contact with the uranium pellets in the 500-degree temperature of the water-cooled reactor.

Zirconium is the only metal that is tough enough to do the job. And Wah Chang produces most of the world's zirconium.

Fuel for Trojan will be inserted in tubes 17 feet long and three-eighths inch in diamater. Each bundle will contain 264 rods, plus 24 guides or control rods designed to absorb neutrons and thus control the temperature of the core.

This new design, approved by the Atomic Energy Commission, limits the maximum possible temperature in the core in case of emergency to 1,990 degrees, more than 200 degrees below the maximum possible in most existing reactors, said Wayne A. Huddleston, PGE power resources engineer.

The first load of fuel will cost about $32 million. About $1.2 million of that will be spent for zirconium from Wah Chang.

Each year, one-third of the spent fuel cells are removed for reprocessing, Zirconium is consumed in the process and must be replaced with about $750,000 in new zirconium each year.

So each new nuclear reactor means an annual market for more than $750,000 worth of zirconium, of which Wah Chang gets the lion's share.

Today there are 34 commercial nuclear power plants in operation in the United States, with 57 under construction and another 81 reactors on order for a total of 172. By 1980, R.L. Blunk, vice president of Wah Chang, expects 150 nuclear reactors will be in operation about 75 per cent of them supplied with zirconium by Wah Chang.

Wah Chang last year produced about 7 million pounds of zirconium of which about 5 million pounds went into nuclear reactors. By 1990, Dr. Yih expects to be producing 10 million pounds for nuclear reactors alone.

About 80 per cent of the company's production is zirconium, the rest other rare metals such as tantalum, columbium, vanadium, hafnium and titanium and their alloys.

Teledyne does not reveal Wah Chang's gross annual product, but the work force has grown from 650 in 1965 to 1,400 today with an annual payroll in excess of $15 million, Dr. Yih said. Another 500 or more are employed in Albany's growing complex of metals fabricating plants.

"We expand a little every year," said Dr. Yih. "We don't really have room enough on our present site, but we can manage up to about 1980.

"After that, we will need more land. That is a problem now with all the land use and zoning laws. We think we have our pollution problems under control now, but expansion here is difficult."

Zirconium Output Ends At Albany's Federal Plant

ALBANY -- Zirconium production at the U. S. bureau of mines laboratory here has ended. A plant of the Carborundum Metals company at Akron, N. Y., is now supplying the rare metal to the atomic energy commission.

The laboratory here was the first, and until recently the only, plant anywhere producing zirconium in commercial quantity. Since it started production in 1949 it has turned out 1,250,000 pounds.

The atomic energy commission has taken all of the output.

Stephen M. Shelton, regional director for the bureau of mines, said Thursday that production was halted May 2 under the department of the interior policy of getting out of commercial operations when private firms are able to take over.

The Carborundum company, he said, started deliveries to the AEC about the first of this year.

Zirconium is found in coastal sands — Coos bay area sands were first used here—and the problem has been getting it sufficiently pure. Dr. Wilhelm Kroll—who also developed a titanium reduction process—perfected a method that permitted commercial production.

Plant Capacities Rated

The metal, Shelton said, is a structural material used in atomic reactors — whether in submarine, electric power plant or other fields. It is relatively transparent to thermo-neutrons and also is resistant to corrosion in hot water, two qualities which Shelton said make it unique among metals.

When production ended here, the local plant was geared to turn out about 300,000 pounds a year. The Carborundum company plant has only about half that capacity, Shelton said, but since zirconium stands up in reactors three times as long as expected this will be adequate.

The laboratory here has some 375 employes. This number is being reduced gradually to 250, partly due to the cutback in zirconium production and partly because of what Shelton called a "reshuffling" of work.

Although production has ended, blending and other work will keep shipments going from here for several months. And the laboratory will still be working with the metal, experimenting with developing uses in other fields.

Zirconium Plant At Albany Closes

ALBANY, Ore. (UP) — Closure of its Albany zirconium plant after more than a decade of operation has been announced by the U. S. Bureau of Mines.

Closure of the plant, situated at the bureau's electro-development laboratory here, had been expected for some time, since the Atomic Energy Commission intended to make zirconium only until it was available commercially.

Most of the 65 employes had permanent civil service status and have been offered positions elsewhere, Stephen M. Shelton, regional director of the bureau said.

NEIL GOLDSCHMIDT
GOVERNOR

Department of Geology and Mineral Industries

ADMINISTRATIVE OFFICE

910 STATE OFFICE BLDG., 1400 SW 5th AVE., PORTLAND, OR 97201-5528 PHONE (503) 229-5580

October 12, 1988

The Honorable Victor Atiyeh
519 Southwest Park, Suite 208
Portland, Oregon 97205

Dear Mr. Atiyeh:

The following information on Oregon silica sand is in response to the request you made of Donald Hull. Oregon does not have any raw sands that approach the specifications you have listed nor does our one producer beneficiate its sand to that degree of purity. Some sand deposits in the state possibly could be processed to meet those specifications but high technology separation procedures would be required and the economic feasibility would depend in part on having a market for the up to 50% coproduct clay and feldspar that would be generated.

If you require further details, please contact me.

Respectfully,

Ronald P. Geitgey
Industrial Minerals Geologist

RPG:dg

c: Donald Hull
John Beaulieu

geitgey/atil012/1259

Bristol Silica Co. Relocating

Bristol Silica Company is moving from its location at the City of Rogue River railroad crossing to a new place next door to Del Rio orchards.

The move is necessitated by the route of the new four-lane U. S. Oregon Route 99 which takes in the plant location. The moveout must be accomplished by Feb. 15, Representative Fay Bristol, owner of the plant, says.

Not only will the State Highway Commission sell at auction the buildings of the silica firm but all equipment at the site is included. The auction will be conducted Feb. 23, starting at 1 p.m. Prospective bidders may view the property and equipment from 8 a.m. until sales is consummated.

The silica firm will be housed at its new location in a steel and concrete structure. Plenty of parking and freight and truck loading space is being made available, Bristol explains. The new site will be about 4¼ miles east of the one they are abandoning.

Bristol Silica Company was formed 23 years ago and started in business at the present site at the railroad crossing into Rogue River. The business consists of production of silica for driveways, poultry grit, roof granules and silica for gasoline cracking plants in the refining of high test fuels. Shipments of the well known products go to as faraway places as Saudia Arabia, where the silica is used in the gasoline and oil fields; to Japan, Venezuela, among a few of the countries Bristol does business with.

NON-METALLIC CONSUMERS

January, 1960

Use	Silicon Carbide	Product	Carborundum
Consumer	The Carborundum Co.		
Consumption	Pre-war	Present 4000 T/month	Next 12 Mo.
Price paid FOB plant			
Present source of supply	Bristol Silica Co. and from Northport, Washington		

Specifications Required or Desired

Maximum price	
Delivery schedule	approximately 4000 tons a month
SiO_2	99.5% or better
Al_2O_3	.10 max
CaO	.20 max
iron	no problem

Miscellaneous

Form SOS-2

MINERAL INDUSTRY SURVEYS

UNITED STATES DEPARTMENT OF THE INTERIOR

BUREAU OF MINES

DOUGLAS McKAY, Secretary J. J. FORBES, Director

FERROSILICON REPORT NO. 39

FERROSILICON IN THIRD QUARTER 1954

Production and shipments of silicon alloys in the third quarter of 1954 rose slightly over the previous quarter, according to the Bureau of Mines, United States Department of the Interior.

Production and Shipments of Silvery Pig Iron, Ferrosilicon, Silicon Metal, and Miscellaneous Silicon Alloys in the United States, in short tons

GRADE	PRODUCTION		SHIPMENTS	
	2nd Qtr '54	3rd Qtr '54	2nd Qtr '54	3rd Qtr '54
Blast Furnaces (Silvery Pig Iron) ---	38,420	32,227	40,366	30,918
Electric Furnaces (Ferrosilicon) ------	111,235	119,588	98,665	113,528
Silicon Briquets, Silicon Metal and Other Silicon Alloys-	14,146	13,328	16,420	14,486
TOTAL --------	163,801	165,143	155,451	158,932

The apparent consumption (shipments from domestic furnaces, plus imports, minus exports) of silicon alloys also increased slightly over the second quarter.

Imports were more by approximately 9 percent, while exports dropped 45 percent and were the lowest since the second quarter of 1953. All imports came from Canada and amounted to 4,370 short tons, containing 715 tons of silicon, valued at $295,803. Exports totaled 293 short tons, valued at $68,800. Brazil, Mexico, and Canada received the bulk of this material.

Salient statistics of silvery pig iron, ferrosilicon, silicon briquets, silicon metal, and miscellaneous silicon alloys in the United States, 1951-54, in short tons

	Shipments Domestic Furnaces	Imports	Exports	Apparent Consumption
1951----------	887,462	29,652	2,485	914,629
1952----------	801,697	12,823	7,239	807,331
1953----------	815,562	13,803	1,698	828,182
1954: 1st Quarter----	155,710	3,006	573	158,143
2nd Quarter ----	155,451	4,010	532	158,929
3rd Quarter ----	158,932	4,370	293	163,009

Prepared by Robert W. Geehan and Loretta M. Walker, November 30, 1954, under the supervision of Norwood B. Melcher, Chief, Ferrous Metals and Alloys Branch, Minerals Division.

Interior--Duplicating Section, Washington, D. C. 71445

12-9-57

SILICA

98% SiO_2

QUARTZ MT. LAKE COUNTY
T37S R16E

DEAN E. LANGE
308 N. 'H'
LAKEVIEW
~~457~~ WHITEHAVEN 7-4572 (?)

SOFT SILICEOUS SINTER (?)

INTERESTED IN SELLING.

MANZANITA CLAIMS

SILICA
4-30-59

Sec 21, T34S, R2W
TRAIL QUAD

Hanna exploring Silica deposit, supposed to spend $10,000

On E. Fk of Evans Ck
1/2 mi south of Meadows School

On Carl Berkman
Rt #1, Box 131
Rogue River

11-7-57

Rannells Reports Discovery Of Large Silica Deposits

The location east of Myrtle Creek of one of the largest if not the largest silica deposits in the United States was announced today by Roy W. Rannells of Riddle, who said that he and his nephew, G. D. Rannells, operator of a construction company, had completed all location work and the property is now on record.

The deposit, which Rannells estimates as in excess of 100 million tons, lies at the head of Boulder Creek, a tributary of the South Umpqua river, at about 5,000 feet elevation. The Riddle man said that his estimate of quantity was based on sight observation—that there was that heavy a bed in sight without drilling.

Silica is used in a great many products beside the manufacture of glass. Approximately 200,000 tons are consumed annually by a few major industries in this state alone.

Rannells said that he and his nephew are beginning development work on the property but that they will probably be able to make only one more trip into the area prior to spring. Due to the elevation it will be snow-bound this winter.

At present the silica beds can be reached only by road via the North Umpqua and Red Butte area, but access roads being extended in the Boulder creek area from the South Umpqua should give access and egress by this route — a much shorter haul for shipping purposes as the ore body is developed in the future.

SILICON

NOT A METAL IN OLDEN SENSE
OR WITHIN A STRICTER DEFINITION
BASED ON THE ELECTRONIC BINDING

NOT PLASTIC
LOW ELEC CONDUCTIVITY
1. IMPROVED AT HIGHER TEMP
XTAL - SOLID CLOSES - BRITTLE

NOT TRUE NONMETAL
1. SOLID, HARD, METALLIC LUSTRE

SEMI-CONDUCTOR OF ELEC

IMPORTANT AS ALLOY

CALLED SEMIMETAL OR METALLOID

MOST ABUNDANT SOLID ELEMENT
ALWAYS COMBINED.

WIDELY DISTRIBUTED IN COMPOUNDS
AS SILICA (SiO_2) EITHER HYDROUS OR
ANHYDROUS - IN MINERALS SUCH AS
QTZ, CHAL, TRIDY, CRISTOBALITE
OR OPAL

MOST ABUNDANT SILICON COMPOUNDS
ARE SILICATES OF AL, MG, FE AND
ALKALI AND ALKALI EARTH METALS
IN SUCH FORMS AS CLAYS, SOILS, ROCKS

SILICON-2

SILICA USED - GLASS, FUSED SILICA, BRICK FOR FURNACE LININGS, FERROSILICON,

SILICATES - BRICK - TILE POTTERY

SILICON ISOLATED FROM ITS OXIDE COMMERCIAL BY FUSING SILICA SAND AND COKE IN C LINED ELEC FURNACE

98% Si COMM ALAL @ 23¢/LB

Si HAS DENSITY 2.33 GM/CC
MELT PT 1415° ± 2° C

FERROSILICON ADDED TO IRON & IRON ALLOYS MFD BY ELEC HEATING C, SAND AND FE OR STEEL TURNINGS IN OPEN TOP C BOTTOM FURNACE

COMM GRADES FE Si -15 TO 90%

Si ADDED TO CAST IRON MAKES IT MALLEABLE

Si " TO LOW C STEEL INCREASES YIELD STRENGTH

Si TO MED C STEEL INCREASES HARDNESS

Si PROMOTES HARDENABILITY OF STEELS

SILICON - RE

SI ADDED TO CU AND NI ALLOYS

1. TO DE-OXIDIZE MELT
2. TO INCREASE FLUIDITY OR MOLTEN METAL
3. IMPROVE PHY PROP OF ALLOYS

GREATEST USE IN NON FE FIELD IS IN PROD OF CU-SI BRONZE

USE 2.25 TO 3.5 % SI

BRONZES WORK HARDEN RAPIDLY

AMENABLE TO WELDING.

NON-METALLIC CONSUMERS

Use	FERROSILICON	Raw Product	SILICA
Consumer	GENERAL		
Consumption	Pre-war	Present	Next 12 Mo.
Price paid FOB plant			
Present source of supply			

Specifications Required or Desired

Maximum price	
Delivery schedule	
SiO_2	96-97% MIN
Fe_2O_3	—
ALUMINA	2.00% MAX
CaO	.50% MAX
MgO	.20% MAX.
PHOS	NIL
IGNITION LOSS	
SIZE	1" TO 3" (VARIES)

Miscellaneous

45

720.2

G.

Form SOS-2

NON-METALLIC CONSUMERS

Use	PAINT FILLER	Product	SILICA
Consumer	PAINT MFRS. GEN.		
Consumption	Pre-war	Present	Next 12 Mo.
Price paid FOB plant			
Present source of supply			

Specifications Required or Desired

Maximum price	
Delivery schedule	
SIZE	2-5 MICRONS (.002-.005 MM) (-400 MESH)(!)
SiO_2	99%
IGNITION LOSS	0.5%
R_2O_3 (AL FE OT)	0.5%

Miscellaneous: USED IN EXTERIOR PAINTS - TRAFFIC PAINTS

45

INF FROM USBM IC 7264

800

G

Form SOS-2

NON-METALLIC CONSUMERS

Use	SILICON CARBIDE	Raw Product	SILICA*
Consumer	GENERAL		
Consumption	Pre-war	Present	Next 12 Mo.
Price paid FOB plant			
Present source of supply			

Specifications Required or Desired

Maximum price	
Delivery schedule	
SiO_2	99% MIN
Fe_2O_3	LOW
ALUMINA	"
CaO	TRACE
MG	"
PHOS	"
IGNITION LOSS	
SIZE	-20+150 MESH

Miscellaneous *GLASS SAND USUALLY USED FOR THIS PURPOSE

45

100.1

Form SOS-2

NON-METALLIC CONSUMERS

Use	ROOFING GRANULES	Product	SILICA SAND
Consumer	ROOFING MFRS. IN GENERAL		
Consumption	Pre-war —	Present	Next 12 Mo.
Price paid FOB plant			
Present source of supply	SHINGLE SPRINGS, ELDORADO CO CALIF.?		

Specifications Required or Desired

Maximum price	
Delivery schedule	
SCREEN SIZES	VARY BOT AVER. GIVEN BELOW:
	ARTIFICIALLY COLORED QUARTZ
	MINIMUM % MAXIMUM
ON 8 MESH	0 0
" 10 "	5 15
" 14 "	25 45
" 20 "	25 35
" 28 "	10 18
" 35 "	5 10
THRU 35 "	0 4
TOTAL (?)	70 % (?) 12 7% (?)

Miscellaneous: NATURAL GRANULES BRING ABOUT $60.00-$90.00 AT PLANT. ARTIFICIALLY COLORED BRICK $12.00-$25.00. CAPITAL INVESTMENT HIGH - $1,500,000 FOR PLANT & INVENTORY. SMALL NATURAL PLANT $100,000

45

LINE FROM "MINING TECHNOLOGY" 3-44 — 1000

Form SOS-2

NON-METALLIC CONSUMERS

GLASS SAND FOR

Use	WINDOW GLASS (6TH QUALITY)	Raw Product	SAND
Consumer	GENERAL		
Consumption	Pre-war	Present	Next 12 Mo.
Price paid FOB plant			
Present source of supply			

Specifications Required or Desired

Maximum price	
Delivery schedule	
SiO_2	98% MIN
Fe_2O_3	0.3% MAX
Al_2O_3	0.5% MAX
CaO+MgO	0.5% MAX
LOSS ON IGNITION	0.17% TO 0.36%
SIZE	-20 +150 MESH

Miscellaneous

42

600.6

Form SOS-2

G.

OWENS-ILLINOIS PACIFIC COAST COMPANY

ANALYSIS REPORT

SAN FRANCISCO, CALIF.

Att'n. of: W. D. Miller

Copies to: Earl K. Nixon

DATE: November 24, 1943

FILE NO.: 11.22.750.1

MATERIAL: Sample of Pit Sand

SAMPLE NO.: 557I

SAMPLE RECEIVED ON: 11-10-43

Sample is washed thru 100 mesh screen.

Loss 36.7%

The sand is then scrubbed for 15 minutes.

Loss 11.3%

The total washing loss is 43.8%.

On	16 mesh	none			
"	20 "	Trace		R_2O_3	1.01%
"	30 "	0.1		Fe_2O_3	0.085
"	40 "	0.5		Heavy Min.	0.052
"	50 "	17.0		Fe_2O_3 - HM	0.078
"	60 "	31.5		Fe_2O_3 - HM plus	
"	80 "	35.6		An acid leach	0.040
"	100 "	9.5			
"	140 "	4.2			
thru	" "	1.6			

REMARKS: Sample submitted by Mr. Earl K. Nixon and is from a deposit near Eugene, Oregon.

Washing loss is essentially clay.

A. R. HOLLAND
CHEMIST

500.

Uses of Silica		Types of Silica Used
Abrasive Uses.		
In scouring and polishing soaps and powders.		Quartz, quartzite, flint, chert, sandstone, sand, tripoli and diatomaceous earth; all in finely ground state.
In sandpaper.		Quartz, quartzite, sandstone and sand; coarsely ground and closely sized.
In sand blast work.		Quartz, quartzite, sandstone, and sand, crushed into sharp angular grains uniform in size.
For sawing and polishing marble, granite, etc.		Sharp, clean sand graded into various sizes.
As whetstones, grindstones, pulpstones, oil stones, etc.		Massive sandstone from very fine to moderately coarse grained.
Tube mill lining.		Chert, flint and quartzite in dense, solid blocks.
Tube mill grinding pebbles.		Rounded flint pebbles.
In tooth powders and pastes.		Various forms of pure silica finely ground.
Refractory Uses.		
In making silica fire brick and other refractories.		Fairly pure quartzite known as gannister; no less than 97% SiO_2 nor more than 0.40% alkalies, tightly interlocking grains desired.
Metallurgical Uses.		
In making silicon, ferro-silicon and silicon alloys of other metals such as copper.		Moderately pure sand and massive crystalline quartz.
As a flux in smelting basic ores.		Massive quartz and quartzite.
Foundry mold wash.		Ground sandstone and quartz.
Foundry parting sand.		Fine sand and ground tripoli.

Form SOS-3

Uses of Silica (cont.)		Types of Silica Used (cont.)
Chemical Industries.		
As a lining for acid towers.		Massive quartz or quartzite.
As a filtering medium.		Massive diatomaceous earth and tripoli, sand finely granular quartz or quartzite, finely ground tripoli, diatomaceous earth and other forms of silica.
In the manufacture of sodium silicate.		Pure quartz sand.
In the manufacture of carborundum.		Pure quartz sand.
Paint.		
As an inert extender.		Finely ground crystalline quartz, quartzite and flint often preferred; also finely ground sandstone, sand and tripoli.
Mineral Fillers.		
As a wood filler.		Finely ground crystalline quartz, quartzite and flint preferred, but all types of ground silica used.
As a filler in rubber, hard rubber, pressed and molded goods, phonograph records.		Finely ground silica of all types.
Ceramic Uses.		
In pottery industry as ingredient of bodies and glazes.		Flint and chert, and other amorphous silica preferred; also all other forms of very pure silica, all finely ground.
In the manufacture of ordinary glass.		Pure quartz sand.
In the manufacture of fused-quartz chemical apparatus, such as tubes, crucibles and dishes.		Very pure massive quartz preferred.

Uses of Silica (cont.)		Types of Silica Used (cont.)
Decorative Materials.		
In manufacture of gems, crystal balls, table tops, vases, statues, etc.		Rock crystal, amethyst, rose quartz, citrine quartz, smoky quartz, chrysoprase, agate, chalcedony, opal, onyx, sardonyx, jasper, etc.
Insulation.		
Heat insulation for pipes, boilers, furnaces, kilns, etc.		Massive and ground diatomaceous earth.
Sound insulation in walls, between floors, etc.		Massive and ground diatomaceous earth.
Structural Materials.		
Sand-lime brick.		Moderately pure sharp, angular sand, preferably finer than 20 mesh.
Optical quartz.		
For the manufacture of lenses and accessories for optical apparatus.		Clear, colorless, flawless rock crystal or massive crystallized quartz.
		From U. S. Bureau of Mines Report of Investigations 2307.

Form SOS-3

A.W. Pedersen

Thank you for your letter of January 22nd concerning silicon. Silicon is not a mineral. It is a reduction product of the mineral quartz which is composed of one molecule of silicon and two of oxygen. Silicon is produced in electric furnaces in much the same manner that iron ore is treated to make metallic iron. Large quantities of quartz are reduced to silicon at the Hanna Nickel Smelting plant at Riddle. Hanna adds iron to the silicon to make ferrosilicon which in turn is used to refine nickel ore into ferronickel. At another plant operated by National Metallurgical Corporation at Springfield quartz is reduced to high purity silicon which is used extensively in the electronics industry and also as an alloy for aluminum and other metals. An alloy is a mixture of two or more metals.

Chemically silicon is a member of the metalloid (metal-like) group. Metalloids may act either like metals or non-metals depending upon the use to which they are put. The U.S. Bureau of Mines classifies silicon as a minor metal. ~~In view of the foregoing facts the department considers silicon to be a metal and feels that it should be~~

Most of the quartz produced in Oregon is converted into silicon which is used for the manufacture of ferrosilicon, silicon carbide or elemental silicon. In view of the foregoing facts the department considers silicon to be a metal and feels that it should be designated as such in view of the preponderance of uses to which it is put.

RSM

June 9, 1964

Mr. David Feldman
David Feldman & Associates
P.O. Box 10723
Caparra Heights, Puerto Rico 00922

Dear Mr. Feldman:

Thank you for your inquiry of May 8 concerning our silica deposit in Douglas County, Oregon.

Here are some representative analyses of the silica from our Quartz Mountain operation. Although numerous analyses have been made by our various customers, we are not at liberty to publish them. The following assays were made by the State of Oregon Department of Geology and Mineral Industries as part of their geological study of the property:

SiO_2	Al_2O_3	Fe	TiO_2	CaO	MgO	P_2O_5	Loss on Ignition
98.75	.27	.12	.25	.013	.015	.008	—
98.37							.82
98.45							.73
98.34							.49
98.92							.25
98.68							.54
98.44							.66
98.82							.37
96.23							.94

We hope these analyses are of interest to you. We have a large deposit of remarkably uniform silicified tuff which can be supplied in practically any quantity and size range.

Sincerely yours,

G. D. Rannells
Manager

GDR:k

cc GDR
BC RSM

David Feldman & Associates
~~Calle Himalaya 237~~ Box 10723 Caparra Heights
~~Rio Piedras~~ San Juan Puerto Rico 00922
~~Puerto Rico~~

Attn: Mr. David Feldman:

Thank you for your inquiry of May 8th concerning our silica deposit in Douglas County Oregon.

Here are some representative analyses of the silica from our Big Quartz Mountain operation. Although numerous analyses have been made by our various customers we are not at liberty to publish them. The foloowing assays were made by the State of Oregon Department of Geology and Mineral Industries ~~and we feel that~~ as part of their ~~examination~~ geological study of the property.

SiO_2	Al_2O_3	Fe	TiO_2	CaO	MgO	MgOz	P_2O_5	Loss on Ignition
98.75	.27	.12	.25	.013	.015		.008	
98.37								.82
98.45								.73
98.34								.49
98.92								.25
98.68								.54
98.44								.66
98.82								.37
96.23								.94

We hope these analyses are of interest to you. We have a ~~very~~ large deposit of remarkably uniform silicified tuff which can be supplied in practical any quantity and size range.

sy g d rannells

FOOTE MINERAL COMPANY

P.O. Box 361, Wenatchee, Washington 98801 (509) 884-7171

August 20, 1968

State Department of Geology and Minerals Industries
1069 State Office Building
Portland, Oregon

Attention: Mr. Ralph Mason

Dear Mr. Mason:

In keeping with our Mr. B. J. O'Neill's suggestion, we are listing below our chemical specifications for silica rock.

SiO_2	Fe_2O_3	Al_2O_3	CaO
99.50 MIN	.07 MAX	.20 MAX	None Allowed

In addition, we require a sizing of 4" x 1-1/2". The silica must be washed and free of any foreign material.

When operating at full capacity our consumption is approximately 50,000 NT per year. This will vary to some extent depending on the number of furnaces in operation but for the past several years we have used a minimum of 40,000 NT.

If any new discoveries come to your attention we would appreciate hearing from you.

Very truly yours,

FOOTE MINERAL COMPANY
KEMCO DIVISION

R. S. Schrader

R. S. Schrader, Purchasing Agent

RSS:mr

SILICON

Elemental silicon is produced from very pure quartz in an electric furnace. Carbon is added to the charge to reduce the quartz, which is silicon dioxide, to silicon. Petroleum coke and wood chips are usually used as a source of carbon. Silicon is used as an alloy in various grades of aluminum used in die casting, as a de-oxidizer in steel furnaces, in transistors (after ultra-purification), and in waxes, oils, resins, and silicones.

Silicon has a metallic luster, is silver-gray in color, is light weight and has an uneven fracture. Commercially produced silicon is about 98.8 percent pure; the small amounts of impurities are derived from the carbon used in the smelting operation.

The National Metallurgical Corporation plant at Springfield is the only producer of silicon in Oregon. Quartz is imported from Nevada, wood chips are obtained locally, the petroleum coke is from California, and the electrical power is purchased from the Springfield Municipal Power Company. The plant has two electric furnaces, the newest of which holds 40 tons and is 16 feet in diameter. The entire furnace rotates back and forth through an arc slightly less than a full circle. The motion permits the three electrodes which are suspended above the furnace and reach down into it to "stir" the melt gently. The furnace is tapped periodically into ladles which are emptied after the silicon has hardened. Crushing and screening complete the manufacturing process.

December 1, 1970

Mr. C. D. Gould
Vice President and General Manager
Berkley Oil and Gas Ltd.
Suite 402
330 Ninth Avenue S.W.
Calgary 2, Alberta
Canada

Dear Mr. Gould:

Thank you for your letter inquiring about silica sand deposits in Oregon.

To the best of our knowledge there are no suitable deposits of silica sand in Oregon, particularly if the material is to be used for glass making purposes. There are vast quantities of beach sand along the Oregon coast which are readily available but unfortunately they contain a mixture of half a dozen or more minerals other than quartz. Although it is technically possible to separate the quartz grains from the other minerals, it has been discovered that a sufficient percentage of the grains are either coated with an iron oxide film or have cracks in the grains which are lined with iron oxide.

The only silica production at the moment in the State is an operation in Jackson County where massive quartz, which runs about 98.5% SiO_2 is being produced by Bristol Silica Company of Rogue River. Local markets include the Carborundum Company, Vancouver, Washington, and Hanna Nickel Smelting Company, Riddle, Oregon.

Soils maps are not distributed by this office, but we would like to suggest that the State Department of Agriculture, Agriculture Building, Salem, Oregon, might be able to assist you in this respect.

Sincerely yours,

Ralph S. Mason
Mining Engineer

RSM:lk

TELEPHONE (403) 269-8221

BERKLEY OIL AND GAS LTD.

SUITE 402, 330 - NINTH AVENUE S.W., CALGARY 2, ALBERTA

November 20, 1970

Department of Industry
State of Oregon
SALEM, Oregon

RE: SILICA SAND - DEPOSITS AND BENEFICIATION

Our Company is interested in locating one or more deposits of silica sand in your State.

We would appreciate receiving any publications that your Department might have related to this subject. In particular, we are interested in reports which include the following:

- sand analyses
- present silica sand production and markets in your State
- research concerning silica sand prepared by your Research Council or local university
- soils maps of your State

BERKLEY OIL AND GAS LTD.

C. D. Gould,
Vice-Pres. & Gen. Mgr.

CDG/nbh

RECEIVED
NOV 24 1970
STATE DEPT. OF GEOLOGY

RECEIVED
NOV 23 1970
CORPORATION DIVISION

Nov. 24, 1970
Respectfully Referred to:
State of Oregon Department of Geology and Mineral Industries,
Portland.

By: Information Service
Oregon Department of Agriculture
Salem, Oregon 97310

b.g.

SILICA

July 20, 1966

Mr. George De Long
Route 4, Box 63-A
Roseburg, Oregon

Dear Mr. De Long:

Thank you for your telephone inquiry concerning specifications for metallurgical grade silica.

Here are several sheets of analyses which we hope will be of use to you. We have noticed in the past that sometimes published specifications can be waived slightly if there are other factors involved which tend to offset any minor deficiencies. In other words, if you have a product that comes reasonably close to what is desired, you may be able to fill a contract even though you may have some impurities that are slightly more than desired. We are also enclosing a copy of our monthly publication, the Ore Bin, which contains a report on the Quartz Mountain deposit.

In the event that you are not familiar with the following reference it may be of interest to you: U.S. Bureau of Mines I.C. 8112, 1962, Industrial Silica Deposits of the Pacific Northwest, by G. J. Carter, Hal Kelly, and E. W. Parsons. This publications is available from the Superintendent of Documents, Washington, D.C., for 40 cents postpaid.

Should you wish to get in touch with the Carborundum people, they may be addressed at Vancouver, Washington, and the National Metallurgical plant is located at Springfield, Oregon.

If we can be of any further help to you in your present problems, please do not hesitate to call on us.

Sincerely yours,

Ralph S. Mason
Mining Engineer

RSM:lk
Encl.

From "Silica"..... by Hodge.

Mineralogical Composition

An ideal glass sand should be 100 per cent pure quartz grains, which, however, is not found in nature. The quartz grains themselves contain gaseous, liquid and solid inclusions. Besides the inclusions there are many other impurities which occur either as individual grains or as thin films on the surface of quartz grains. Those which contain iron in some proportion are removable by magnetic means. The feldspathic minerals are the most difficult to remove.

The principal harmful impurities of limestone and dolomite are iron-bearing minerals, and silica and alumina. Silica is not necessarily harmful, if constant in amount from shipment to shipment.

Physical Properties

The two principal physical properties of glass sands which affect its desirability are: (1) size of grain and (2) shape of grain.

Uniformity in grain size is perhaps more important than actual size, although it is essential that the sand be neither too coarse nor too fine. During the fusing reaction the viscosity increases with the silica content. If the sizes of grains vary from small to large, the small ones go into the liquid phase first. Then as the viscosity increases and melting becomes more difficult, the large grains have considerable difficulty in becoming liquid. If the grains are too fine, the first reaction takes place so rapidly that large volumes of carbon dioxide are released and the batch foams badly and quantities of material are lost into the regenerators and flues. Too fine a sand may also be responsible for the formation of a fine persistent seed in the glass. If the grains are too large, there is difficulty in melting, and a greater tendency to form batch scum. If the sand grains are uniform in size they will dissolve at a uniform rate.

The finer portions of the glass sand are apt to contain a large part of the undesirable iron-bearing minerals such as magnetite and ilmenite. Careful screening will eliminate these difficulties.

The grain size of typical glass sands are shown by the following table:

Results of Screen Tests in Four Typical Washed and Dried American Glass Sands

	1	2	3	4
-10 +14 mesh	---	---	0.42	---
-14 +20 mesh	0.07	0.05	0.78	0.04
-20 +28 mesh	1.59	1.23	2.18	2.16
-28 +35 mesh	13.11	4.88	7.28	19.81
-35 +48 mesh	61.71	34.80	30.75	38.04
-48 +65 mesh	20.25	41.03	37.06	14.19
-65 +100 mesh	2.79	15.04	19.93	10.15
-100 +150 mesh	0.16	2.09	0.85	6.66
-150 +200 mesh	0.03	0.49	0.10	3.68
-200 pan	0.01	0.16	0.03	4.76
	99.72	99.78	99.38	99.49

1. From the Oriskany sandstone at Mapleton Depot, Huntingdon County, Pennsylvania.
2. From the Oriskany sandstone at Vineyard, Mifflin County, Penna.
3. From the Pottsville sandstone at Kennerdell, Venango County, Penna.
4. From the St. Peter sandstone at Ottawa, La Salle County, Illinois.

Proposed tentative specifications of the American Ceramic Society:

Through No. 20 screen	100%	
Through No. 20, retained on No. 40.	-60%	+40%
Through No. 40, retained on No. 60.	-40%	+30%
Through No. 60, retained on No. 100	-20%	+10%
Through a No. 100 screen	-5%	

The screen size for limestone or dolomite is recommended by Gelstrop (Ceramic Industry, Nov., 1932) as:

	Range	Average
% on 16 mesh	None	None
% on 30 mesh	15-80	42.0
% on 60 mesh	15-50	28.0
% on 120 mesh	0-15	10.0
Through 120 mesh	0-20	20.0

There has been some controversy as to the relative advantages of rounded quartz grains and angular or subangular grains. The fact that angular grains present a greater surface over which reaction can take place for a given weight of sand than rounded ones and hence should go into solution more rapidly, has not been found to make any appreciable difference in actual practice.

Chemical Properties

The committee on standards of the glass section of the American Ceramic Society in cooperation with the United States Bureau of Standards has drawn up the following tentative specifications for silica sand for glass making:

SPECIFICATIONS FOR SILICA SAND USED FOR GLASS MAKING
(American Ceramic Society)

Quality	SiO_2		Al_2O_3		Fe_2O_3		CaO + MgO	
	Min.	Tolerances	Max.	Tolerances	Max.	Tolerances	Max.	Tolerances
First quality, optical glass	99.8	±0.1	0.1	±0.05	0.02	±0.005	0.1	±0.05
Second quality, flint glass containers and tableware	98.5	±0.5	0.5	±0.1	0.035	±0.005	0.2	±0.05
Third quality, flint glass	95.0	±1.0	4.0	±0.5	0.035	±0.005	0.5	±0.1
Fourth quality, sheet glass, rolled and polished plate	98.5	±0.5	0.5	±0.1	0.06	±0.005	0.5	±0.1
Fifth quality, sheet glass, rolled and polished plate	95.0	±1.0	4.0	±0.5	0.06	±0.005	0.5	±0.1
Sixth quality, green glass containers and window glass	98.0	±1.0	0.5	±0.5	0.3	±0.05	0.5	±0.1
Seventh quality, green glass	95.0	±1.0	4.0	±0.5	0.3	±0.05	0.5	±0.1
Eighth quality, amber glass, containers . . .	98.0	±1.0	0.5	±0.5	1.0	±0.1	0.5	±0.1
Ninth quality, amber	95.0	±1.0	4.0	±0.5	1.0	±0.1	0.5	±0.1

In view of the increasing use of alumina in glass and of the varying amounts of iron allowable in green or amber glass, sand of lower grade may be used by many manufacturers. The above specifications show a variety of qualities and state more or less definitely the types of glass they may be used for. The quality number is not to be interpreted necessarily as an index to the value of the product.

Published analyses of glass sands are hardly comparable as methods of analysis differ and the sands come from various districts. The following table, however, gives analyses of a few of the better known sands.

Chemical analyses of glass sands

Sample number and source	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	Ignition	Analyst
Crystal City, Mo., average of unwashed sand	99.405	0.210	0.075	0.072	0.068	0.170	Pittsburgh Plate Glass Co.
Crystal City, Mo., washed	99.78	----	----	----	----	----	Pittsburgh Plate Glass Co.
Pennsylvania Glass Sand Co., Mapleton, Pa., Keystone No. 1. . . .	99.82	.12	.017	Trace	Trace	----	Booth, Garrett & Blair
Mineral Supply Co., Dike, Nev., unwashed .	97.56	1.07	.23	.39	.16	.36	Smith-Emery Co.
Fox Silica & Stone Co., Daguscahonda, Pa. . .	96.08	2.35	.37	.18	.08	.67	[illegible]
.....							

Technology and Uses of Silica and Sand, by W. M. Weigel. 1927.

GENERAL SPECIFICATIONS FOR MAJOR
RAW MATERIALS FOR MANUFACTURING
FLINT GLASS

I Grain Size

The grain size of sand, soda ash, and limestone should match as closely as possible on all screens. In general these materials should all be finer than 20 mesh and essentially coarser than 100 mesh (U.S. Standard Series Screens), with the distribution on the intermediate screens approximately as follows:

Plus 30 mesh	1%
" 40 "	5%
" 50 "	25%
" 60 "	30%
" 80 "	25%
" 100 "	9%
Minus 100 "	5%

Some tolerance can be allowed in the finer sizes; however, the minus 100 mesh fraction should not exceed 20%.

II Chemical Composition

A. Sand

1. Iron Oxide (Fe_2O_3) not over 0.04%

2. Titanium Oxide (TiO_2) not over 0.03%

3. Material should be essentially silica, although some feldspathic material can be tolerated provided the contents and ratios of alumina (Al_2O_3), sodium oxide (Na_2O), potassium oxide (K_2O), and calcium oxide (CaO) do not vary.

B. Soda Ash

1. Iron Oxide not over 0.02%

2. Sodium Carbonate not less than 99%

3. Sodium Chloride not over 0.5%

4. Up to 5% Sodium Sulfate (Na_2SO_4) or borax ($Na_2B_4O_7 \cdot 10H_2O$) may be substituted for sodium carbonate, provided the amounts of these constituents is constant.

C. Limestone

1. Iron Oxide not over 0.04%

2. Essentially calcium carbonate ($CaCO_3$) with combined total of calcium oxide (CaO) and magnesium oxide (MgO) not less than 55%.

W. A. Mahaffy
11-13-43

600.

EXTRA COPY IN PSM DESK DRAWER FILE

GENERAL SPECIFICATIONS FOR MAJOR
RAW MATERIALS FOR MANUFACTURING
FLINT GLASS

I Grain Size

The grain size of sand, soda ash, and limestone should match as closely as possible on all screens. In general these materials should all be finer than 20 mesh and essentially coarser than 100 mesh (U.S. Standard Series Screens), with the distribution on the intermediate screens approximately as follows:

Plus 30 mesh	1%
" 40 "	5%
" 50 "	25%
" 60 "	30%
" 80 "	25%
" 100 "	9%
Minus 100 "	5%

Some tolerance can be allowed in the finer sizes; however, the minus 100 mesh fraction should not exceed 20%.

II Chemical Composition

A. Sand

1. Iron Oxide (Fe_2O_3) not over 0.04%

2. Titanium Oxide (TiO_2) not over 0.03%

3. Material should be essentially silica, although some feldspathic material can be tolerated provided the contents and ratios of alumina (Al_2O_3), sodium oxide (Na_2O), potassium oxide (K_2O), and calcium oxide (CaO) do not vary.

W. A. Mahaffy
11-13-43

600-1

October 28, 1959

To: H.M.D.
From: R.S.M.

W.W. Slade, general engineering department, Owens-Illinois, Oakland, was in today. OI is interested in the possibility of beneficiating the beach sands for container glass use. At Ione they use both high inensity electrostatic circuits to remove the 2-3% of heavies, and flotation, so they are familiar with the possible problems of our sands. Slade mentioned that they have even considered that an acid leach might be required to get the irnn down to acceptable limits.

Slade may call on you today. I discussed possible areas, such as the Clatsop Plains north of Seaside, and helped him with maps and a bit of misc. info. He asked if our dept. could help them with this work and he was told that we would do all we could, that we encouraged investigations of this type etc., but that any decision as to what and how much work we could do rested with you.

OI is just about to wrap up a deal with Oregon Portland Cement for some specially sized limestone from the old MK quarry at Durkee. It seems that OI had almost come to terms with MK when OPC took over.

r.

SILICA

Copy

Mr. Frank R. Lindell, Chief Engineer
Penberthy Instrument Company, Inc.
6701 Maynard Avenue
Seattle 8, Washington

Dear Mr. Lindell:

Thank you for your letter of September 29, inquiring about sources of silica sand in Oregon.

There are two major sources of high grade quartz in the State:

1. Bristol Silica Company
   F. I. Bristol
   P.O. Box ~~427~~ 400
   Rogue River, Oregon 97537

   Average analysis: 98.7 % SiO_2
   0.27 Al_2O_3
   0.089 P_2O_5

   Quarry located in sec. 30,
   T. 36 S., R. 3 W.
   Jackson County

2. Quartz Mountain deposit
   G. D. Rannells
   Route 2, Box 204
   Aurora, Oregon

   Average analysis: 98.7 % SiO_2
   0.27 Al_2O_3
   0.008 P_2O_5

   Quarry located in sec. 2,
   T. 28 S., R. 1 E.
   Douglas County

In addition to these two properties there are large quantities of beach sands along the Oregon coast which could be beneficiated to produce a 98%+ silica sand.

Sincerely yours,

Ralph S. Mason
Mining Engineer

RSM:lk

P-4178 6ft. channel white ss

SiO_2	81.36
Fe	1.18
Al_2O_3	10.40

P-4177

SiO_2	77.78
Fe	1.27
Al_2O_3	13.00

GENERAL SPECIFICATIONS FOR MAJOR
RAW MATERIALS FOR MANUFACTURING
FLINT GLASS

I. Grain Size

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B. Soda Ash

1. Iron Oxide not over 0.02%

2. Sodium Carbonate not less than 99%

3. Sodium Chloride not over 0.5%

4. Up to 5% Sodium Sulfate (Na_2SO_4) or borax ($Na_2B_4O_7,10H_2O$) may be substituted for sodium carbonate, provided the amounts of these constituents is constant.

C. Limestone

1. Iron Oxide not over 0.04%

2. Essentially calcium carbonate ($CaCO_3$) with combined total of calcium oxide (CaO) and magnesium oxide (MgO) not less than 55%.

W. A. Mahaffy
11-13-43

SILICA REF

INDUSTRIAL SILICA DEPOSITS OF THE PAC. NW
G. J. CARTER, HAL KELLY, E. W. PARSONS.

I. C. 8112 - USBM 1962

GOOD BASIC DOPE 40¢

SEE: REPORT BY RAMP ON
QUARTZ MT SILICA DEPOSIT
IN UMPQUA DIST DOUGLAS
CO. BINDER.

SEE: ORE-BIN - NOV 1960
BIG QUARTZ

Form 6-1274-A
Ind. (5-88)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES
WASHINGTON, D.C. 20241

O.M.B.No. 1032-0038.
Approval Expires: 4/30/91

INDIVIDUAL COMPANY DATA-PROPRIETARY

Unless authorization is granted in the section above the signature, the data furnished in this report will be treate in confidence by the Department of the Interior, except that they may be disclosed to Federal defense agencies or to the Congress upon official requ for appropriate purposes. Unless objec ion is made in writing to the Bureau if Mines, the information furnished n this report will be disclosed to th espondent's State Geological Survey or similar State agency).

FACSIMILE NUMBER
1-800-543-0661

G09

INDUSTRIAL SAND AND GRAVEL SOLD OR USED

91 ANNUAL REPORT 1990
G09 35 41 A

QUARTZ MOUNTAIN SILICA
INDUSTRIAL SAND AND GRAVEL
ATTN: MR. GERALD RANNELLS
16870 SOUTHWEST MATADOR
KING CITY OR 97224

(Please correct if name or address has changed.)

Public reporting burden for this collection of information is estimated to average 1 HOUR per response, including the time for reviewing instructions, searching data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to: Bureau of Mines, Office of Statistical Standards, Washington D.C. 20241, and Office of Information and Regulatory Affairs, Office of Management and Budget, Washington D.C. 2050

Please provide the following information and return this form in the enclosed envelope. A separate report should be completed for each single operation active during any part of the calendar year. A single operation consists of one extraction area, or several extraction areas that are adjacent to each other within a county. Boulders and/or cobbles from the mining of sand and gravel that were crushed, and sized should be reported as sand and gravel, not crushed stone. Estimate when exact figures are not available. If you do not have production to report, please complete items 1 and 2, sign and return this form.

"Collection of non-fuel minerals information is authorized by Public Law 96-479 and the Defense Production Act. This information is used to support executive policy decisions pertaining to emergency preparedness and defense and analyses for minerals legislation and industrial trends. The Bureau relies on your voluntary and timely response to assure that its information is complete and accurate

NOTE: Federal, State or local agencies that operated a pit, a pit and plant for processed material, or dredge, with their own crew and/or equipment, should also complete this form. Give market value of material produced, including royalties.

1. Name and location of operation

Name of operation Quartz Mt. Nearest town Tyler, or Roseburg - Or

State Oregon County Douglas Section 11 Township 29S Range 1E

If operating company is a subsidiary, please name controlling company

Please indicate number of pits or extraction areas covered in this report One

2. Status during year

[X] (1) Active From 6/1/89 To 12/31/89 [ ] (2) Shipping from stockpile only

[X] (3) Idle entire year 1990 [ ] (4) Went out of business - Date 1990 + waiting for Plant to Start

If ownership changed during year, give date of change None [ ] (5) Purchased [ ] (6) Sold

Name and address of other party to or from whom transferred

3. Mining method (Check one or more) [X] (1) Open pit [ ] (2) Underground mine [ ] (3) Dredge

4. Type of Processing Plant: [ ] (1) Stationary [X] (2) Portable [ ] (3) Both [ ] (4) None

Rated capacity of processing plant tons/hour.

Number of days processing plant operated during year Twenty days.

FOR BUREAU USE

5. If production is reported in cubic yards, indicate Pounds per cubic yard: Sand Quartz for Ferrosil Silicon Plant Gravel

6. Did your operation produce any CONSTRUCTION SAND AND GRAVEL such as concrete aggregate, road material, etc.

[ ] (1) Yes [X] (2) No

OVER

7. Use, quantity, and value of industrial sand sold or used

Use (1)	Code	Quantity (Short tons (2)	OR	Cubic yards) (3)	Value (f.o.b. plant or p (4)
Glass making					
Containers	601				$
Flat (plate and window)	602				
Specialty	603				
Fiberglass (unground)	604				
Fiberglass (ground)	605				
Foundry					
Molding and core	610				
Molding and core facings (ground)	611				
Refractory (silica brick, ramming mixtures, and furnace linings)	612				
Metallurgical					
Silicon carbide	620				
Flux for metal smelting for market	621	19038 tons		13,000 cuyd	618 73
Abrasives					
Blasting	630				
Scouring cleansers (ground)	631				
Sawing and sanding	632				
Chemicals (gr. & ungr.)					
Sodium silicate, silicon tetrachloride silicones, activated silica gel	640				
Fillers (ground)					
Rubber, paints, putty, wood filler, epoxy, enamel, glazes, porcelain, polyester resin, acid-proof cements, etc.	650				
Ceramic (ground)					
Pottery, bricks, earthenware, tile, whiteware, sanitaryware	660				
Filtration	670				
Traction (engine)	671				
Coal washing	672				
Roofing granules and fillers	673				
Hydraulic fracturing (oil and gas)	674				
Silica flour	680				
Other (specify)					
TOTAL	699	19038.		13000	618 73

8. Use, quantity, and value of industrial gravel sold or used

Use (1)	Code	Quantity (Short tons (2)	OR	Cubic yards) (3)	Value (f.o.b. plant or p (4)
Metallurgical					
Silicon, ferrosilicon	741	19038		13000	$ 618 73
Filtration	742				
Grinding	743				
Other (specify)					
TOTAL	799	19038		13,000	618 73

9. Transportation of industrial sand and gravel to first point of sale or use, by method

Method of transportation (1)	Code	Quantity (Short tons (2)	OR	Cubic yards) (3)	Approximate dista in miles to princi site of sale or u (4)
Truck truck	811	19038		13000	70 mile
Railroad	812				
Waterway	813				
Other transportation (specify)	814				
Not transported (used or sold at extraction site)	815				
TOTAL (should equal codes in Sections 7 & 8; lines 699 + 799.)	819				

PUBLICATIONS: Annual statistical information for sand and gravel is published in two forms: (1) Commodity reports and (2) State reports covering all mineral commodities in a State. If you desire a copy of one or both of these reports, please check the appropriate box. ☐ (1) Commodity ☐ (2) State ☒ (3) Both

Name of person to be contacted regarding this report	Tel. area code	No.	Ext.
Gerald - Ramnells	503	684-1042	

Address (No. & Street)	City	State	Zip
16870 SW Matador	King City	Oregon	97224

May tabulations be published which could indirectly reveal the data reported above?

Value data ☐ (1) Yes ☒ (2) No Other (including quantity) data ☒ (1) Yes ☐ (2) No

Signature	Title	Date
Gerald D Ramnells	owner	3/11/

L. W. SANDSTROM Consulting Fee, SiC Plant Design and Const.

Charges for last client were $100/hour ($800/day), plus expenses such as travel to and from Spain for wife and I, house, housekeeper-cook, car & gas, and two weeks vacation during and after consulting period. Because I have a "vested" interest in this venture, I am willing to donate this initial report, and do further consulting for half the normal charge.

I propose a guarantee of 60 working days with a retainer of $10,000 (ten thousand dollars).

During this period, I will submit weekly reports of time and expense along with progress reports. These will be in addition to more formal reports (budget, construction progress, etc.)

Toward the end of the 60 days (which could span several months), and prior to start of actual construction, I suggest that a letter of intent from you and the other investors, offering me a salary plus some sort of royalty, should be signed. This might be in the form of a contract as Plant Manager, Administrative Consultant, or other, for a minimum tenure. I would expect the royalty agreement to continue for my wife if I should die.

I have mentioned to you the venture in which I am joint owner, with two others, in an Ohio corporation founded for the purpose of manufacturing a rather exotic product which uses Acheson furnaces identical with the ones in this proposed facility. At some atime in the future I would like to explain this venture to you.

As you undoubtedly know, after a retiree earns $9720 (or $400 as a consultant), he must return $1 for every $3 that he earns, back to Soc. Security. Soon after that, the IRS begins to take its share. Of the $24,000 I propose above for consulting, my net would be approx. $17,000, or $28/ hr. I thought I should add this comment just in case you were wincing at the increased cost/ton attributable to me!

LWS
4/11/91

MANUFACTURING COSTS - CRUDE SILICON CARBIDE & GRAIN

Raw Materials:

Petroleum Coke - "Green Delayed", 2% Sulfur, 5% Moisture, 0.5% Ash, 85% Min. Fixed Carbon. Anthracite coal has been used as a carbon source, but high ash content is detrimental to both productivity and quality. As with most materials and methods, technology often improves to the extent that items such as this become more acceptable; therefore coal might be retested at a later date. The economics of this study should not be predicated upon its use, however.

Coke, FOB L.A. Area	$42/ST
Transp. to S. Oregon	12 "
	54/ST

Silica - Residual moisture after washing is desirable, to reduce dusting. 98.5% Min. SiO_2, 0.5% Max. Al_2O_3, 0.25% Max. Fe_2O_3, 0.15% Max. CaO, are important specs. LOI, TiO_2, and trace elements are not critical in most applications (abrasives and refractories). Crushing to ½"& Finer is satisfactory unless reducing further to ¼" & Finer would improve quality by exposing more surface to washing. In quartzite, impurities exist primarily as interlamelar cementing material, but also can be present as interstitial (interatomic) which obviously does not respond to washing. Another method of improving marginal quartzite is to screen out minus 80 or even minus 60 mesh, especially if there is a market for this finer fraction. If not, it is still a good practise for improving not only the chemistry of the silica, but the mix porosity. Better porosity translates to less dependence upon sawdust or other agents. One of my manufacturing recommendations in any case is to include a pelletizing system to utilize not only silica fines, but coke and dust collector fines. These pellets are used in furnace mixes on a spasmodic basis without jeopardizing long production campaigns, or they can be sold as metallurgical additives.

Washed SiO FOB (site) $30/ST

Porosity Agent (Sawdust) - Fine sawdust from furniture and other similar mills can be used, but the optimum is run-of-mill from sawmills, approx. 4 mesh & Finer Softwood is also preferred to harwood. Wet sawdust can contain large amounts of water which constitutes a problem in weighing, since it

isis used as a "space occupier" in the mix. There are a number of adhesive porosity inducers (lignin sulphonate has been used extensively), and I have tested more than 50 others, some of which were promising. Wheat and oat straw are two, but also are difficult to mix uniformly. In combination with an adhesive, these might solve both the field burning problem in the Willamette Valley and our sourcing problem.

Run-of-Mill Fir SD, 4 Mesh & F $30/ Unit or $15/ST

Energy - BPA sales to PUD's, etc., similar to industrial contracts. 18.4 mil/KWH Sept. thru Mar., 14.4 mil/KWH April thru Aug. with average of 22.6 mil/KWH. Demand $3.46. Because of smaller generating plants and/or longer transmission distance, southern Oregon power company would probably place greater contraints upon unbalanced power loads and on power factor than near the Bonneville complex. This might mandate that we rectify to DC or install capacitors. Present day rectification equipment is much improved, and DC not only solves power factor problems but is a more efficient way to apply energy to the SiC furnaces. This item needs thorough study with electrical engineers early in the planning stages of the facility.

Energy $0.0226/KWH

Manpower - For 10,000 TPY plant, the numbers are much like a Ferrosilicon operation. If payroll and other office procedures could be handled outside (or contracted as with First Aid and Medical), the only other addition would be one administrator and perhaps, a chemist.

Local Hourly Wage	$8/hour
Salaried (three)	$15-20/H
Admin. Consultant	(See below)

Maintenance, Shipping, and Other Supplies - Replacement electrodes, concrete heads, copper buswork, electrode and ceramic pastes, firebrick, pallets, bags, Payloader and forklift etc., repair parts, clay spades (for trimming), crusher parts. Electrodes and heads would not be needed for the first 12 to 18 months ($2000 per set). This is a real ballpark figure without doing a lot of research.

Supplies $125,000/ year

MANUFACTURING COSTS - CRUDE SIC & GRAIN (CONT.)

Basis: 9650 Tons Saleable SiC

Raw Materials:

Silica - 15,150 ST @ $30	$ 454,500
Coke - 10,615 ST @ $54	573,000
Sawdust - 4300 ST @ $15	64,500
Energy 77,330,000 KWH @ $0.0226	$1,746,000
Labor - 38 hourly @ $8	2,663,000
Salary - 3 @ $30,000	90,000
Supplies	125,000
Total	$5,716,000

Cost/Ton $592

Manager Salary not included.

Production of 9650 is conservative. An increased amount to 10,200 within a few months after startup should be attainable. This would reduce Cost/Ton to approx. $575.

EST. CONSTRUCTION COST FOR SIC CRUDE AND GRAIN PLANT

This estimate is for a 9000 KW plant consisting of 3 units of 5 furnaces each, plus a modified grain producing facility. Includes a fines pelletizing system.

Major Items:

Land - 5 to 7 acres (not included in cost est.)

Rail siding with track hoppers and in and out sidings. (Discuss rail vs. truck service). (not included in cost est.)

Switch Yard - Line voltage down to 12,800 V or similar.

Control Room or House - with metering, tap-changer switching, rectification or power factor banks.

3 X 3000 KW Oil Cooled XF's and on-load auto tap-changers (minimum 36 positions) circuit breakers

600 foot long furnace bldg. (monitor) with 2 bridge cranes.

Dust Collection - manifolded rolling hoods or on monitor.

15 furnaces, 30 heads, (plus 2 spares), 60 electrodes (plus 4 spares), 150 refractory lined side frames (10 spares),

Copper or Aluminum buswork with switches.

Raw Material and Mix Bldg or Area, with storage bins and surge bins, for coke, qtz., sawdust, revert materials.

Weigh Belt or Metering for 5 "ingredients", with mixing, and distribution to furnaces.

Loading Hoppers for Mix and Graphite core material.

Trimming Area.

Finished Product Processing and Shipping bldg. Includes primary crusher, canary and/or cyclone, and roll crushers, 2,3, and 8 deck sifters w/ screens.

Maintenance Shop and Supply Room

Office and Laboratory.

SIC PLANT CONSTRUCTION COST - CONT.

Several unit operations can be consolidated into the furnace monitor structure if this is a green-field project.

Particulate (dust) control may run 10 to 20% of construction cost, especially if odor control is imposed (iron sponge, misting wet collection, hydroxide absorption, etc.)

Total Est. Const. Cost excl. Land and Rail	$11,000,000

includes 10% contingency

R.L. Jensen & Associates, Inc.

Lawrence W. Sandstrom
Manager of Process Engineering

1818 NE Irving • Portland, OR 97232 • (503) 231-1758

CARBORUNDUM

A Kennecott Company

LAWRENCE W. SANDSTROM
Manager, Process Engineering
The Carborundum Company
Electro Minerals Division
P.O. Box 423
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Phone: 716-278-2459

RESUME

LAWRENCE W. SANDSTROM
3127 S.W. Upper Drive
Lake Oswego, Oregon 97035 USA
Telephone (503) 636 0811
Telex 277331 SMA UR
FAX (503) 641 1629

OBJECTIVE

Management of industrial manufacturing for small-to-medium sized company, or division of large company. Consultation with same, with emphasis on productivity, process and product quality control, and application of new products. Sales engineering and market development are possible areas of interest.

SUMMARY

Broad background in manufacturing, both domestic and international, in cluding management of research and development, product quality and process quality control, materials sourcing, expansion and greenfield (new plant) planning, experimental design, manpower planning, employee training, labor relations. Special skills in quality assurance and control, from incoming raw-material acceptance specifications to outgoing certification (including government contracts).

EMPLOYMENT HISTORY

SOHIO - ENGINEERED MATERIALS COMPANY (ELECTRO MINERALS) 130MM Sales
1980 - 1983 early retirement. MANAGER, PROCESS ENGINEERING, Niagara Falls New York.

KENNECOTT - CARBORUNDUM DIVISION
1975 - 1980 PRINCIPAL ENGINEER, Niagara Falls, New York

CARBORUNDUM COMPANY
1968 - 1975 SENIOR ENGINEER, PRINCIPAL ENGINEER, Niagara Falls N.Y.

1965 - 1968 MANAGER, PROCESS AND PRODUCT CONTROL, Vancouver, WN

1949 - 1965 PROCESS & PRODUCT ENGINEER, SENIOR CHEMIST, Vancouver, WN

ACHIEVEMENT HIGHLIGHTS

Management and Engineering

- Consulted, initiated, managed capital projects for pollution control, equipment and facilities replacement, expansion of facilities - 5K to 10MM - interfacing with all functions (from market development to legal), including presentations to corporate executive board.

Headed up R&D Task Force which successfully retro-fitted pollution control devices to our major manufacturing plant, thus enabling the company to comply with EPA regulations and continue operating. This project included hiring of outside consultants elaborate test programs, design (many of my ideas were incorporated), installation, and start-up.

Initiated and chaired three international company-wide seminars covering a broad spectrum of manufacturing, research, health and safety, and process methods. These seminaars led to significant improvements in interchange of ideas, leading to new business, cost savings and avoidance. (In excess of $125,000/year for one participating plant alone).

As in-house expert, was sent to plants in Brazil, Mexico, and Norway for consulting and problem solving.

Quality Control and Assurance

Complete responsibility for specifications involved in Purchase, Manufacturing, Testing, and Product Sales (Data Sheets). This involved testing, writing, approval, and compliance. Divison responsibilities for quality of incoming raw materials and outgoing products for six plants. Customer complaints and service were a part of this activity.

Direct supervision of seven inspection, testing, and physical test research laboratories. Lab employees were labor union.

Operated small "company within the company" which manufactured and sold test materials, apparatus, and machines for all other compnanies in the same business. In six month, turned this unit into a profit center from a losing business. (-$10,000 to +$30,000 annual)

General

Authored, edited, and published 24 chapter 370 page Operating Manual for world-wide circulation, resulting in greatly reduced training time for new process engineers and supervisors.

Planned, developed, administrated several department budgets. Managed business plans (MBO). Familiar with performance apprais-als, matrix analysis, and various scheduling and decision making techniques.

Personal

Oregon State University - Chemical Engineering 1946 - 1949
Candidate for BPS Empire State College (div. of SNY)
Continuing Education - +350 credit hours of college level study including 40+ hours of post graduate credit.

Patents held and/or applied for - eight

Memberships and Affiliations -

President - Management Assoc. Corporate Board 1974 - 75
Company Chairman - United Fund 1975, (successful campaign)
Vice President of Chapter ASQC (American Society for Quality Control) Senior Member.
Active participant and leader in church, school board committees, art society (president), skiing club (president).

Hobbies

Mountain climbing (guide and instructor), bicycle touring, photography, oil painting, skiing, writing.

RESUME UPDATE

1983 - 1986 Associate with R.L. JENSEN & ASSOCIATES, Portland, Oregon consulting engineers, as Manager of Process Engineering. Inactive at the present time.

1984 - 1987 CONSULTANT with foreign manufacturing company, involving a broad scope, from materials handling, operating methods, to analytical procedures and manpower recommendations.

1987 - Present Associated with NAVARRO, S.A. as MARKETING MANAGER for USA and Canada.

1988 - Present VICE PRESIDENT, OPERATIONS-of WHISKERS, INC., Member, Board of Directors WHISKERS TECHNOLOGY, INC. Hudson, Ohio.