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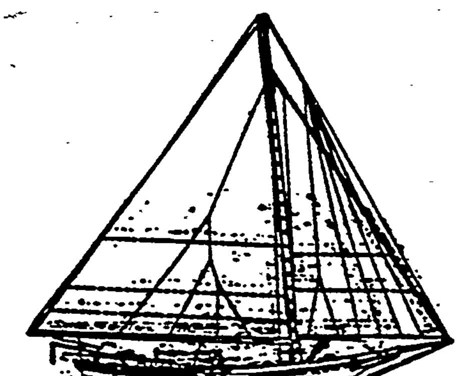

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Thermal Reclamation of Used Blast Grit

No. 10A

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ABSTRACT

Naval shipyards and other domestic port facilities generate thousands of tons of used blast grit annually and dispose of it in landfills. Also, there are thousands of steel bridges in the United States that are on a repaint maintenance schedule that requires grit blasting for surface preparation; this used grit also goes to landfills. However. for environmental reasons it is becoming prohibitively expensive to landfill used blast grit containing paint residues. The Institute of Gas Technology (IGT) has conducted test work to develop a process to clean blast grit to enable its recycling for reuse.

Essentially, IGT applied a transfer/adaptation of fluidized-bed calcination developed for the reclamation of foundry sand. This sloped grid fluidized-bed calciner affords processing advantages that include pneumatic size classification of the reclaimed grit. In addition, the sloped grid reclaimer design facilitates ready removal of any tramp material feed or fusible lumps formed.

Four reclaimer feasibility tests were conducted with used blast grit from the Long Beach Naval Shipyard. The results of these tests revealed that the organic material component of the used grit was fully oxidized to carbon dioxide and water. Some of the metallic oxides of copper, zinc. titanium, and lead from the used grit were largelv elutriated into a cyclonic-collector. The calcined (reclaimable)fraction from this test work amounted to approximately 95% of the used grit charged. The major oxide and organic component analyses conducted revealed no significant general chemical difference between the virgin and reclaimed grit. Based on these results. a commercial plant can be designed to provide a reusable grit yield in excess of 80% within the general size specifications.

SUMMARY

The U.S. **Naval** Shipyards produce **about 100,000 tons** of used blast grit annually and dispose of it in land- In the near future it will become increasingly prohibitive - both environmentally and economically - to landfill used blast grit, which contains paint residue. Therefore. it is desirable for the Navy to develop a simple method to clean and recycle used blast grit.

The Institute of Gas Technology **(IGT)** has developed a fluidized-bed sand calciner for which this application seems suited. The calciner has a patented sloped grid (SG) design that enhances combustion of paint residues and promotes separation of reusable material from the used blast grit. This sloped grid design also facilitates the automatic removal of some tramp material from the calciner without interrupting the operation.

Preliminary calcination tests were conducted by IGT, at its own expense, with used blast grit from the Long Beach Naval Shipyard. **These** tests show that the paint's organic binders can be destroyed thermally, and most of the paint'8 inorganic oxide components, together with off-specification fine grit, can be removed selectively from the reclaimed grit. The data also indicate that about 80% of the used blast grit can be recovered at size and hardness specifications for new blast grit.

Therefore, the application of IGT's fluidized-bed calcining technology can reduce the quantity of new blast grit purchased and used grit disposal by approximately 80%. If the reported costs for the Long Beach Naval Shipyard are typical - **$100** per ton for new blast grit and $150 per ton for used grit disposal - then the potential savings to the Navy ate several millions of dollars per year.

INTRODUCTION

The U.S. Naval Shipyards generate about 100,000 tons per year of-used blast grit from surface preparation of docks while being serviced in dry The blast grit purchased can be slag from coal-fired power plants, copper smelters, or nickel smelters. During blast cleaning of ship hulls, the grit becomes contaminated with organic binders and zinc, titanium, copper, and tin compounds commonly found in marine paints. Currently the used blast grit is land filled, and in some states it is classified as a hazardous waste. As the availability of landfills diminishes the disposal costs for used blast grit will become prohibitive. Therefore, it is desirable to develop an economical process to reclaim blast grit.

BACKGROUND

The Problem

The steel hulls of all U.S. naval vessels are provided with a protective coating to minimize damage from the harsh marine environment. These coatings provide corrosion protection and minimize fouling by marine life, in addition to providing a camouflage. These marine coatings consist of a binder and pigments. The binder is an organic film-forming liquid that converts to a continuous solid film upon drying after application. The pigments are finely dispersed solids that impart color, opacity, and corrosion inhibition. The pigments are oxides of metals such as zinc. titanium, copper, lead. etc. The coating also contains biocidal chemicals such as tri-butyl tin oxide (TBTO) to minimize fouling by the growth of marine organisms.

The effectiveness of the protective coating on the naval vessels is significantly reduced in 2 to 3 years, after which a new coating is necessary. Before the application of a new coating, the vessel's hull has to be completely stripped of the old coating, including the removal of all rust, to attain a white-metal roughened surface profile. Today this is accomplished mainly through pneumatic blasting using crushed and sized slag, called grit, obtained from coal-fired boilers or copper and nickel smelters.

During blast cleaning, the paint and rust removed from the ship's surface accumulates in the used or spent blast grit (slag). Occasionally, material from other vessel servicing operations accumulates as tramp with the used blast grit. Because of this contamination and the generation of grit fines during blasting, the blast grit is not reusable and. therefore, must be disposed of or carefully discarded. Because it contains metals and organics from the paint coatings, the used blast grit is stockpiled on site or landfilled at special hazardous waste sites in certain states. This material is one of the major hazardous wastes generated in the eight Naval shipyards.

Managers of these shipyards, which collectively produce about **100,000** tons per year of used blast grit, have seen tipping fees at hazardous dump sites increase significantly; however. future Environmental

Protection Agency (EPA) regulations may restrict altogether the dumping of such waste. Therefore. naval shipyards are looking for solutions to this hazardous waste problem or at least a means to drastically reduce the quantity of hazardous wastes dumped.

Potential Solution

IGT has developed a versatile fluidized-bed sloped grid calciner (SG calciner) that may be well suited for the reclamation of used blast grit. The sloped grid design has evolved from development work for IGT's U-GAS coal gasification process. The SG calciner system has the following unique features:

A" intensive mixing of the' fluidized bed - all organic contaminants are completely destroyed

The capability to discharge tramp material that would accumulate on the surface of a horizontal grid

The countercurrent cooling of the discharged grit with a portion of the fluidizing air

The ability to separate by air classification the inorganic paint residue, which is liberated by calcining from the discharged grit

The capability of the process to use either natural gas or fuel oil

The capability to operate as a" incinerator for waste materials from other sources in a shipyard (for example, wastewater-oil mixtures, oil- or fuel-contaminated soil, etc.).

An SG calciner pilot unit has been operated to reclaim contaminated clay bonded foundry sand, in which it was able to 1) reduce the organic content of the sand to a very low level (0.2 weight percent measured as loss on ignition) and 2) remove most of the clay from the sand grains. To demonstrate the applicability, IGT processed 50 tons of sand in a pilot unit of 1 ton/h capacity for a major automotive manufacturer. **IGT** also participated in a" American Foundrymen's Society (AFS)-sponsored test work on thermal reclamation. From the IGT system, both of these programs yielded reusable sand.

Figure 1 shows a suggested prototype SG calciner system for blast grit reclamation. As the air enters the preheater. the air will dry the grit, which is then fed into the calciner by a metering screw feeder or drag feeder. The grit will be heated to a temperature of 1200' to 1600°F by burning natural gas or oil directly in the fluidized bed. The organic content of the paint chips will be converted to water vapor and carbon dioxide, and the inorganic and metallic components will be elutriated out of the calciner with the flue gases. Bough particle sizing of the reclaimed media, **free** of paint residue and grit fines, can be achieved through adjustments in air flow to the discharge line from the calciner. Sensible heat from the calcined grit can be used to generate.low-pressure steam and/or provide hot air for drying the spent grit. The cooled, reclaimed grit can then be stored for reuse. The majority of fines and inorganic paint residues can be removed from the calciner flue gases by a cyclone separator. A flue gas heat recovery system downstream of the cyclone can preheat the fluidisation and combustion air supplied for the calciner. The flue gases will then pass through a bag house for final dust removal before venting to the atmosphere.

By recovering energy from the hot grit media and flue gases, this proposed design is aimed at maximizing the overall thermal efficiency of the SG calciner system.

FEASIBILITY TESTS ON USED BLAST GRIT

Preparation

IGT conducted four tests in a laboratory (bench-scale) calciner to investigate the feasibility of using the SG calciner for reclaiming blast grit. The blast grit was obtained from the Lone. Beach Naval Shipyard. The two types of grit used by this shipyard are both from smelter slag produced during the refining of copper and nickel. The copper slag being black in color can be differentiated from the nickel slag, which is green. Virgin (unused) grit samples from both smelters and the used grit from the blast Cleaning operation were collected for these tests. The major chemical components of the grit are iron and magnesium silicate. To be able to evaluate the results of the calcining tests, IGT's analytical laboratory performed analyses (see Tables I and II) on the virgin grit and the used grit for metals content, major oxide components. and sieve size analyses.

The virgin grit contains about 5 weight percent less than **U.S.S.** Size **80** (Navy Spec.), whereas the used grit samples contained 15 to 20 weight percent below SO mesh. The used grit samples contained a volume of about

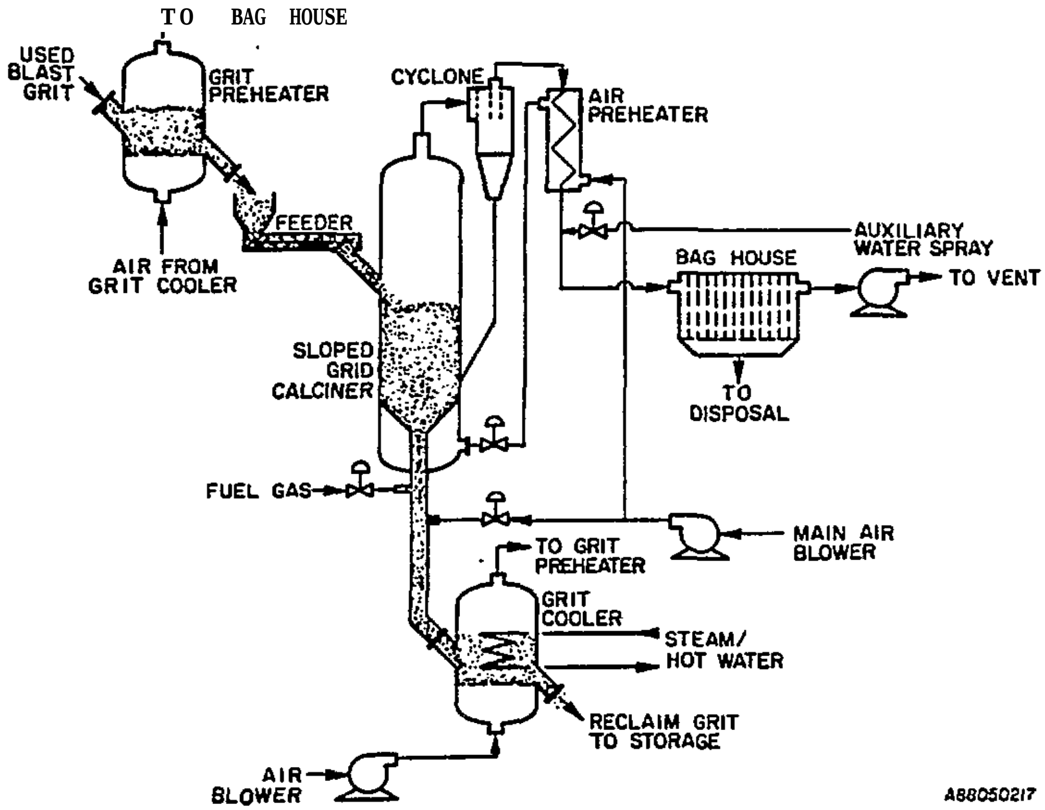

Figure 1. FLUIDIZED-BED CALCINER
FOR BLAST GRIT RECLAIM SYSTEM

Table I. LABORATORY ANALYSES OF VIRGIN GRIT

Metal	Virgin Grit, ppm	Major Oxides	Virgin Grit, wt %	Retained on U.S.S. Sieve No.	Virgin Grit, wt %
copper (CU)	980	Na_2O	0.45	6	0.0
Zinc (Zn)	3400	MgO	15.50	8	0.1
Titanium (Ti)	1900	Al_2O_3	3.23	12	2.7
Barium (Ba)	590	SiO_2	41.90	20	49.0
Chromium (Cr)	2900	P_2O_5	0.12	30	25.9
Nickel (Ni)	2000	SO_3	0.52	40	12.9
Lead (Pb)	840	K_2O	0.54	50	3.5
Tin (Sn)	160	CaO	2.32	80	2.3
Arsenic (As)	210	TiO_2	0.32	100	0.8
Cadmium (Cd)	8	Fe_2O_3	30.20	200	1.8
Organics*	1000	Total	95.10	270	0.4
				325	0.4
				Pan	0.2
				Total	100.0

Bulk Density. 122.5

Moisture, wt % --

* Measured as carbon and hydrogen.

Table II: LABORATORY ANALYSES OF USED GRIT

Metal	Used Grit 1 (ppm)	Used Grit 2 (ppm)	Major Oxide	Used Grit 1 (wt %)	Used Grit 2 (wt %)	Retained on U.S.S. Sieve No.	Used Grit 1 (Wt %)	Used Grit 2 (Wt %)
Copper (Cu)	1000	--	Na_2O	0.35	0.30	6	0.2	0.03
Zinc (Zn)	3700	3700	MgO	20.60	20.70	8	0.1	0.2
Titanium (Ti)	1600	1400	Al_2O_3	2.55	2.49	12	0.8	1.1
Barium (Ba)	790	670	SiO_2	47.80	47.60	20	25.0	30.9
Chromium (Cr)	4000	3900	P_2O_5	0.07	0.05	30	18.6	20.4
Nickel (Ni)	2700	2000	SO_3	0.55	0.47	40	18.5	18.7
Lead (Pb)	320	320	K_2O	0.40	0.39	50	13.2	12.1
Tin (Sn)	120	130	CaO	1.30	1.32	80	12.0	9.8
Arsenic (As).	220	230	TiO_2	0.27	0.23	100	3.1	2.2
Cadmium (Cd)	6	6	Fe_2O_3	24.60	24.40	200	5.9	2.9
Organics*	5800	4900	Total	98.49	97.75	270	1.1	0.6
						325	0.7	0.2
						Pan	0.8	0.6
						Total	100.0	100.0
Bulk Density, lb/ft^2	118.6	123.7						
Moisture. wt %	14.9	14.9						

* Measured as carbon and hydrogen.

1 weight percent paint chips and other tramp material. This contamiation is illustrated by an organic content level 5 to 6 times higher for the used grit. To meet environmental concerns and Navy size specifications, the used blast grit must be dried, the organic materials removed, certain metals reduced in content, and the fines (<80 mesh) separated out.

Description of the Tests

IGT's bench-scale fluidized-bed reactor used for conducting the feasibility tests is show" schematically in Figure 2. The reactor is constructed of 2-inch-diameter stainless steel pipe surrounded by an electric radiant coil furnace. The temperature within the reactor can be closely controlled by a variac over a range from 1000° to 2000°F. This is a batch fluidized-bed reactor having a flat plate gas distribution grid, instead of a conical grid typical of the SG calciner design. Air is forced through the holes in this flat plate to fluidise uniformly the grit charged. The outlet gas from the reactor passes through a cyclone before being vented. There is no provision for the combustion of natural gas and air within the reactor: instead the desired temperature is obtained through radiant heat from the electric furnace. The "air" used in these tests was actually made from the proportional mixture of nitrogen and oxygen. As this unit has other test purposes relative to IGT's energy programs, a means for steam supply is available but was not used in these tests.

A total of four tests were conducted with the used blast grit in the Z-inch fluidised-bed reactor. A charged batch of grit was brought to the desired temperature both by the preheat coil fluidizing air and direct radiation from the furnace. Hot air, CO_2 and water vapor from the paint fine particles leaving the reactor passed through a cyclone where fines were separated and the gas vented.

In a typical test run, approximately 500 grams of the blast grit were charged to the reactor, which gave a fluidized-bed height of 6 inches. The heat-up rate to the preset temperature averaged 10°F/min. During this heat-up period the minimum superficial gas velocity (approximately 1.5 ft/s) was used. Once the fluidized-bed reached the preset temperature, the superficial gas velocity was increased to the desired level, and the test run was continued for 2 hours. The fluidised-bed contents were then cooled, removed, and weighed. The fines collected were also weighed.

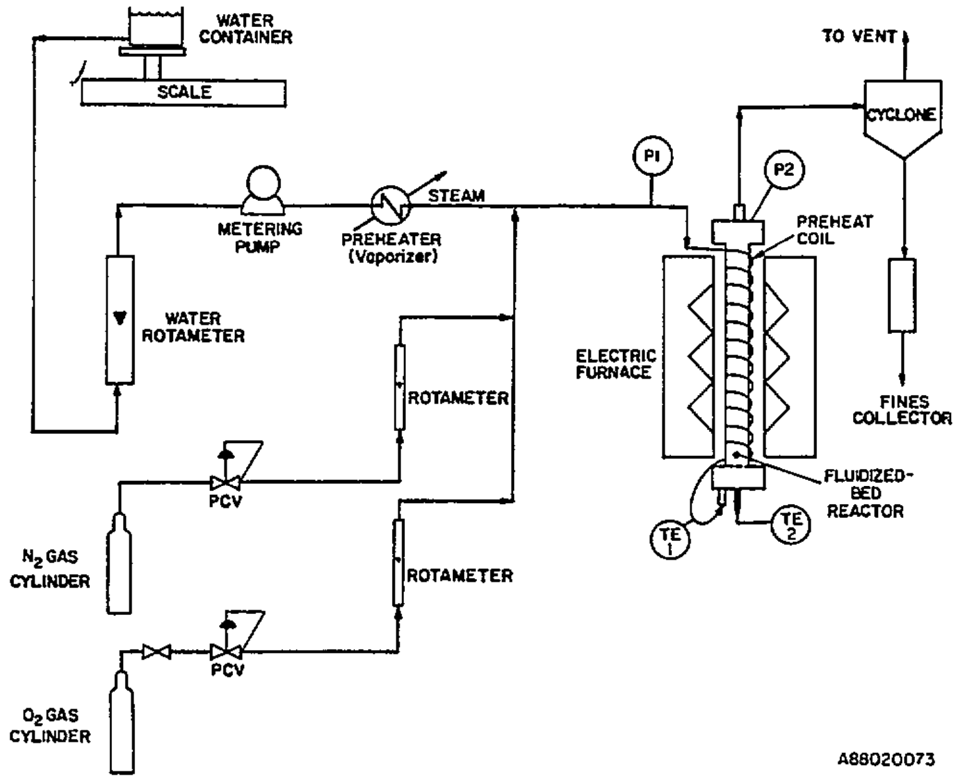

Figure 2. SCHEMATIC DRAWING OF A 2-INCH FLUIDIZED-BED REACTOR

The operating conditions for the four tests are given in Table III. Table IV illustrates the weight fractions of calcined grit retained in the reactor and carried to the cyclone.

Table III. TEST OPERATING CONDITIONS

Run No.	Test Temp, °F	Fluidization Velocity, ft/s	Test Period, h
1	1500	2	2
2	1200	2	2
3	1500	3	2
4	1200	2.3	2

Table IV. MATERIAL DISTRIBUTION

Run No.	Used Grit Wt, grams	Reclaimed Grit Wt, grams	Fines Wt, grams	Percent Reclaimed
1	534.5	493.3	30.8	92.3
2	535.5	513.5	16.4	95.9
3	537.5	512.7	19.0	95.4
4	535.9	504.5	26.9	94.1

Test Results

Visual observations of the calcined grit indicated that the discrete gray paint chips present in the used grit charged were converted to a white material, most of which was present in the cyclone fines fraction. More of the white chips were found in the reclaimed grit from Test Nos. 1 and 2 than in Test No. 3 where the fluidization velocity was increased from 2 to 3 ft/s. The reclaimed grit was almost free of any inorganic paint residue. There was no visual color difference between reclaimed grit from tests at 1500°F and 1200°F.

To evaluate the results of the four calcining test, samples of the calcined grit and the cyclone fines were analyzed for the same criteria as were the virgin and used grit for metals and major oxide content plus sieve size distribution. These analytical results are shown in Tables V, VI. and VII. The same information on fresh grit and used grit is also listed to facilitate a ready **Comparison**

The analyses presented in Table V show that common constituents of paint - organics, zinc. barium. titanium, and copper -were removed from the grit and carried to the cyclone fines collector. The greater concentration of these metals in the fines fraction confirms that fluidized-bed calcining incinerates the paint chips and entrains the inorganic oxides to the fines fraction. The fines fraction also contains size

Table V. BLAST GRIT TEST RESULTS OF METAL CONTENT ANALYSES

Metal	Virgin Grit	Used Grit 1	Used Grit 2	Test No. 1 Reclaimed Grit	Test No. 1 Fines	Test No. 2 Reclaimed Grit	Test No. 2 Fines	Test No. 3 Reclaimed Grit	Test No. 3 Fines	Test No. 4 Reclaimed Grit	Test No. 4 Fines
Copper (Cu)	980	1000	200	1100	5700	2000	6200	600	860	1400	11900
Zinc (Zn)	3400	3700	3700	3700	9000	3400	7200	2800	6800	3100	6400
Titanium (Ti)	1900	1600	1400	1000	4000	1100	5200	1000	4900	1000	4600
Barium (Ba)	590	790	670	360	4100	400	4400	290	4600	320	4300
Chromium VI (Cr)	2900	4000	3900	4000	3300	4000	3100	4400	3300	3800	3200
Nickel (Ni)	2000	2700	2200	1700	1800	2700	1600	2700	660	1400	5600
Lead (Pb)	840	320	320	300	480	310	550	240	440	300	510
Tin (Sn)	160	120	130	60	110	160	80	100	140	100	100
Arsenic (As)	210	220	230	92	170	130	220	160	210	220	170
Cadmium (Cd)	8	6	6	4	12	6	9	6	11	6	11
Organics*	1000	5800	4900	800	35400	900	2900	700	4100	700	42300

* Measured as carbon and hydrogen in the sample.

Table VI. BLAST GRIT TEST RESULTS OF MAJOR OXIDE ANALYSES

Major Oxide	Virgin Grit	Used Grit 1	Used Grit 2	Test No. 1 Reclaimed Grit	Test No. 1 Fines	Test No. 2 Reclaimed Grit	Test No. 2 Fines	Test No. 3 Reclaimed Grit	Test No. 3 Fines	Test No. 4 Reclaimed Grit	Test No. 4 Fines
	wt %										
Na_2O	0.45	0.35	0.30	0.26	0.70	0.28	0.76	0.27	0.69	0.26	0.85
MgO	15.50	20.60	20.70	21.50	18.70	21.50	17.80	21.50	17.90	22.60	18.00
Al_2O_3	3.23	2.55	2.49	2.66	3.27	2.65	3.48	2.72	3.27	2.70	3.19
SiO_2	41.90	47.80	47.60	46.50	41.00	44.40	43.20	48.10	44.70	48.90	43.90
P_2O_5	0.12	0.07	0.05	0.07	0.14	0.07	0.14	--	--	--	--
SO_3	0.52	0.55	0.47	0.62	1.85	0.52	1.22	0.5	1.30	0.50	0.87
K_2O	0.54	0.40	0.39	0.34	0.54	0.35	0.52	0.36	0.51	0.34	0.51
CaO	2.32	1.30	1.32	1.27	3.19	1.40	3.78	1.26	3.37	1.26	3.44
TiO_2	0.32	0.27	0.23	0.17	0.67	0.18	0.87	0.17	0.77	0.17	0.82
Fe_2O_3	30.20	24.60	24.40	24.30	24.80	24.30	24.80	23.70	24.80	23.70	23.50
Total	95.10	98.49	97.75	97.69	94.86	95.65	96.57	98.58	97.26	100.43	95.08

Table VII. BLAST GRIT TEST RESULTS OF PARTICLE SIZE ANALYSIS

U.S. Sieve No. Retained on	Virgin Grit	Used Grit 1	Used Grit 2	Test No. 1 Reclaimed Grit	Test No. 1 Fines	Test No. 2 Reclaimed Grit	Test No. 2 Fines	Test No. 3 Reclaimed Grit	Test No. 3 Fines	Test No. 4 Reclaimed Grit	Test No. 4 Fines
	wt %										
6	0.0	0.2	0.03	0.0	1.3	0.0	1.9	0.0	0.0	0.0	0.0
8	0.1	0.1	0.2	0.1	1.0	0.1	0.6	0.0	0.0	0.10	0.0
12	2.7	0.8	1.1	1.1	1.0	1.2	0.6	2.2	0.5	1.1	0.4
20	49.0	25.0	30.9	28.2	2.7	31.4	0.6	36.9	0.0	28.5	0.4
30	25.9	18.6	20.4	22.2	0.7	23.2	0.0	23.1	0.0	22.2	0.0
40	12.9	18.5	18.7	19.9	0.3	19.3	0.6	16.9	0.5	20.1	0.0
50	3.5	13.2	12.1	14.5	0.7	13.1	0.0	11.5	0.0	14.5	0.4
80	2.3	12.0	9.8	10.9	1.3	8.9	0.6	7.9	4.3	10.4	1.5
100	0.8	3.1	2.2	2.3	6.4	1.5	2.5	1.2	12.9	2.0	5.8
200	1.8	5.9	2.9	0.5	65.7	1.0	57.1	0.3	54.3	0.9	55.8
270	0.6	1.1	0.6	0.1	6.1	0.1	10.8	0.0	8.6	0.0	9.6
325	0.4	0.7	0.2	0.1	4.0	0.1	6.2	0.0	6.5	0.0	6.9
Pan	0.2	0.8	0.6	0.1	8.8	0.1	16.5	0.0	12.4	0.09	19.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Bulk Density, lb/ft^2	122.5	118.6	123.7	123.2	96.0	118.6	89.1	121.8	97.8	122.2	105.5
Moisture, wt %		14.9	14.9			--	--			--	--

degraded grit generated during blasting. The organic content of the reclaimed grit readily meets the low specification level of the virgin grit. The organic content of the fines is high in Test Nos. 1, 2, and 4, but not in Test No. 3 because the higher fluidization velocity of the latter test provided more intensive mixing thereby mote complete combustion of the paint.

Table VI lists the analysis for major oxide components of the blest grit. These data show that there is no significant difference in the general chemical analysis of the virgin, used, and reclaimed grit. The major oxide content of the fines, though, indicates that concentrations of Na_2O, SO_3. CaO, end TiO_2 increased. Some of these compounds are paint components; others may have been volatilized et the calcining temperature.

The Table VII data on size distribution show that the reclaimed grit from all the tests is lower in fines (<80 mesh) than the used grit but does not meet the virgin grit specifications. Operating velocity limitations for the laboratory reactor prevented the use of higher fluidization velocities needed to remove sufficient fines so as to meet virgin grit size specifications.

However, a cursory observation of the data on Table VII reveals that a larger fraction of the fines collected exceeded the 100 mesh sieve size during Test Run No. 3 than in Test Nos. 1, 2. end 4. Test No. 3 operated at a 50% higher fluidization velocity than Nos. 1 and 2, and 33% higher than No. 4. A calciner can be operated at any velocity compatible with elutriation constraints, therefore, if required, a commercial unit can be designed at higher velocities to yield a reclaimed grit more closely approaching the virgin grit sieve size specifications.

There is another factor that relates heavily to the suitability of grit calcining for reclamation end reuse, that is, the hardness of the grit particles Published Military Specifications[1]) list the capability for virgin grit to meet a No. 6 Moh Scale hardness qualification as whether or not it can scratch a glass surface. All evaluated samples met the 6 Moh Scale hardness criteria. Samples of each important size fraction were tested individually for hardness to cover the specification range. Further. within this size range both light and dark particles were tested to ascertain differences in hardness by a major oxide constituent. Table VIII contains a summation of these hardness evaluation tests. A low-power microscope was used to obtain the photos that. in Figure 3. illustrate the scratch surface profiles obtained. Virgin grit. used grit. and calcined samples from this test work were analyzed per the above specification procedure.

Overall. the results of these preliminary fluidized-bed tests are promising in that used grit was calcined, thereby incinerating paint organics while entraining the inorganic residues to a cyclone collector. The laboratory bench-scale fluidized-bed reactor used for the tests is not a scaled-down version of the SG calciner; therefore. it would be quite beneficial to conduct a test in either of IGT's 8-inch-diameter SG fluidized bed or 36-inch-diameter SG fluidized bed. Both of these are continuous feed systems having significant fluidization velocity rangeability.

A test conducted in either of these units would provide not only design data, but also sufficient solids samples suitable for toxic metal and soluble metal components analyses.

Table VIII. GRIT HARDNESS EVALUATION TESTS

Sample	Scratching Microscope Slide Glass*			
	Virgin Grit**	Used Grit**	Calcined Grit Run #1**	Calcined Grit Run #2**
U.S.S. Sieve Size Range				
12 x 20	Yes	Yes	Yes	Yes
20 x 30	Yes	Yes	Yes	Yes
30 x 40	Yes	Yes	Yes	Yes
40 x 50	Yes	Yes	Yes	Yes

* Fisher Catalog No. 12-544-3: Dimensions 3 in. x 1 in. x 1mm.

** Overall, as well as light and dark particles separately.

TECHNICAL AND ECONOMIC CONSIDERATIONS FOR CALCINATION

The economics of reclaiming mineral abrasive blast grit appear very attractive based on these preliminary test results and cost information (1986) obtained from the Long Beach Naval Shipyard. Their cost for virgin grit is approximately $100/ton, and their cost for landfilling the used grit is $150/tan. The annual grit usage at Long Beach is approximately 8000 tons. The total cost of buying and disposing of the blast grit is therefore $2 million.

Extrapolating these preliminary test results based on Table IX, approximately 80% of the used grit

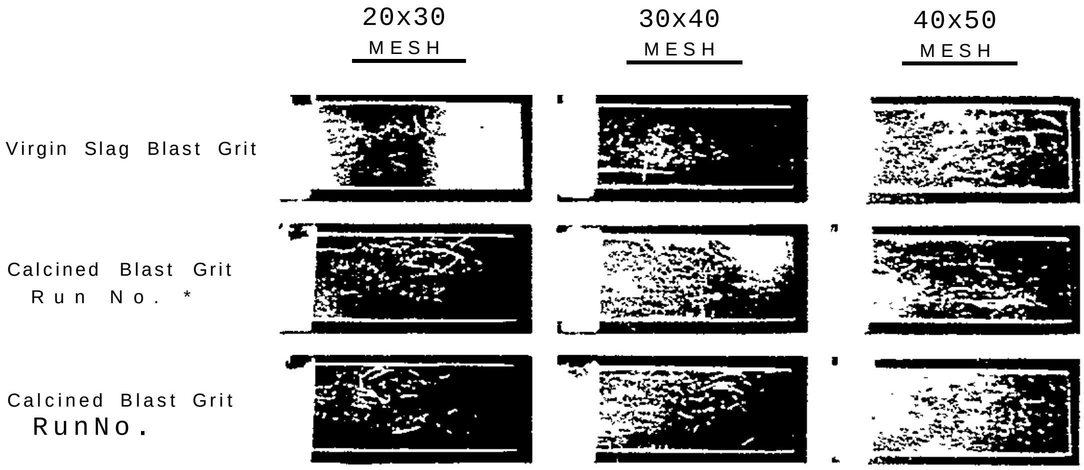

Figure 3. SCRATCH SURFACE 'PROFILES OF THREE SAMPLES

Table IX. ESTIMATE OF RECLAIM GRIT YIELD

	Minus 40 Mesh Fraction in Reclaimed Grit	Minus 40 Mesh Fraction in Virgin Grit wt %	40 Mesh Fraction in Reclaim Grit	Reclaim Grit Meeting size Spec's, grams	Net Spec. Grit Reclaimable,+ wt %
Test No. 1	28.5	9.4	19.1	399.1	74.7
Test No. 2	24.8	9.4	15.4	434.4	81.1
Teet No. 3	20.9	9.4	11.5	453.7	84.4
Test No. 4	27.8	9.4	18.4	411.7	76.8

* Reference Table 7.

** Reference Table 4. Ex. 493.-(100.0-19.1) 399.1

Reference Table 4. Ex. **(399.1/534.5)100- 74.7**

charged to a calciner could be reusable. The balance (20%) less the incinerated organics has to be land-filled. The reclaim potential (R_n), based on this very preliminary data, then is given by -

$$R_P - 1/1-r^{(2)} \text{ where } r - 0.80$$

$$Rp - 5.0$$

The gross savings at n calcinig would then be $2,000,000 - **(8000/5.0) $250 - $1,600,00 less the** operating and amortization costs of an SG caliciner system. Extrapolated on a similar basis to all the naval ship-yards which use a total of SO.000 to **100,000 tons of grit per year the** gross savings available for installing and operating an SG calciner are several millions of dollars per year. Obviously, the above economics are preliminary and based on rough assumptions about costs at various shipyards and the performance of the SG calciner. However, they do indicate a savings potential while simultaneously addressing a serious environmental problem.

So far no mention has been made of the capital and operating cost of an SG calciner grit reclaim system. The cost obviously depends on the details of how such a system would be integrated into a shipyard's normal operation and are very site specific. Several general consider-ations must be addressed before a calciner "size" relative to a yearly shipyard tonnage can be determined.

Those considerations are as follows:

1. Can the calciner be operated 24 hours per day?

2. Should the calciner be a permanent installation reclaiming an existing stockpile and keeping up with the daily blast grit usage rate?

3. Should the calciner be a transportable system reclaiming the stockpile, putting it in storage and moving on to another shipyard site?

4. How much of the overall system is part of grit "reclamation" rather than grit "handling?"

5. Must the reclaimed grit be blended with virgin grit to provide a uniform material for the blast cleaning operators?

6. How much and what type of tramp material is present in the existing stockpile, that is, ate scalping screens and magnets needed?

7. Is storage capacity to be provided for reclaimed grit?

8. Is a covered vs. a" open air facility preferred for stability of system capacity year-round?

CONCLUSIONS

Four reclaimer feasibility tests were conducted with used blast grit from the Long Beach Naval Shipyard. The results of these tests revealed that the organic material component of the used grit was fully oxidized to carbon dioxide and water. The major oxide and organic component analyses conducted revealed no significant general chemical difference between the virgin and reclaimed grit. Based on these results. a commercial plant can be designed to provide a reusable grit yield in excess of 80% within the general size specifications. Therefore, the application of IGT's fluidized-bed calcining technology can reduce the quantity of new blast grit purchased and used grit disposal by approximately 80%. If the reported costs for the Long Beach Naval Shipyard are typical, then the potential savings to the Navy are several millions of dollars per year.

REFERENCES

1. Military Specification MIL-S-22262(SHIPS). Item 4.6.5, Dec. 4, 1959.

2. **J. W. Peart, <u>Prototype Mineral Abrasive Reclaimer: Shipyard Operation</u>, March 1987.**

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