DEPARTMENT OF MINES AND RESOURCES

BUREAU OF MINES

CANADA

Ottawa, January 13, 1947.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 2165.

The Suitability of a Vacuum Pan Salt from Industrial Minerals Limited, Waterways, Alberta, As Feed to Secure a Fused Product in the Reverberatory-type Furnace.

Note:

This report relates essentially to the samples as received. It shall not, nor any correspondence connected therewith, be used in part or in full as publicity or advertising matter for the sale of shares in any promotion.

(Copy No. 6.)

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Bureau of Mines

Mineral Dressing and Metallurgy Division

DEPARTMENT OF MINES AND RESOURCES

Mines and Geology Branch

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Shipments:

Two 300-pound shipments of fine vacuum salt were received, on August 10, and December 8, 1946, respectively from Mr. J. Cochran, Plant Manager, Industrial Minerals Limited, Waterways, Alberta. The shipments were initiated by Mr. W. R. Spence, General Sales Manager, Dominion Salt Company Limited, Terminal Building, Toronto 1, Ontario. Mr. A. O. Ponder, President of the Dominion Tar and Chemical Company Limited, Sun Life Building, Montreal, approved of the shipments.

Location of Property:

The property and plant of Industrial Minerals Limited from which the sample shipments were received is situated at Waterways, Alberta, on the Northern Alberta Railway.

Sampling and Analysis:

Representative samples of the shipments were obtained by the cutting out of 1-inch cores of salt from the bags, using a hollow glass cylinder. These samples assayed as follows:

		Shipment No. 1	Shipment No. 2.
		- Per Cent -	
NaCL	-	99.18	99.08
Fe_2O_3	-	0.0005	0.005
CaO	-	0.17	0.10
MgO	-	Trace	0.03
SO_3	-	0.25	0.18
Insoluble	-	--	0.026

Purpose of Investigation:

In his letter of July 10, 1946, Mr. Spence requested that he would like to have the salt tested "to determine whether or not there would be any residue in fusion in a reverberatory-type furnace, and to what extent any such accumulation of residue is likely to necessitate the closing down of this furnace for cleaning."

Experimental Work:

A series of small-scale fusions were made on these samples of salt. These tests showed that no apparent residues remained in the bottom of the crucibles after fusion, and also that a clean white opalescent product could be obtained with the addition of sodium nitrate. This product was then crushed to -2 +4 mesh.

Details of Test Work:

A screen test on the head sample of salt reported as follows:

Mesh		Weight, per cent
+28	-	4.5
-28 +35	-	35.5
-35 +48	-	39.2
-48 +65	-	14.8
-65+100	-	4.0
-100+150	-	1.3
-150+200	-	0.3
-200	-	0.4
		100.0

(Details of Test Work, cont'd) -

Fusion Tests:

Fusion tests on the samples submitted were made in different types of small crucibles and finally in the larger 5-pound fireclay type. Underfired illuminating gas furnaces were used in all cases.

Vitrosil crucibles of 75-gram capacity were first used for the fusion tests, and a white opalescent product was obtained. No reagents were added to the fusion and no residue was observed.

Porcelain crucibles were next used, of some 330 grams capacity. As in the previous test a white opalescent salt was obtained without the addition of reagents, and no apparent residues remained in the crucibles.

Ordinary fireclay crucibles of 350-gram capacity were next tried out. It was not found possible to procure a white product in using these crucibles, without the use of added reagents (sodium nitrate) to the fusion. In the first instance the melt was quite red in colour. After 4 or 5 fusions the colour was reduced to a pale yellow. On the addition of 4 pounds sodium nitrate per ton to the second melting, a white salt was produced. In all these tests with fireclay crucible, no residue was observed remaining in the crucible after pouring.

Large fireclay crucibles, of 2,500-gram capacity, were next tried out. These fusions acted in much the same way as the smaller fireclay crucibles in the previous tests. The initial fusions gave a salt block ranging in colour from red to a pale yellow, and when the reagent (sodium nitrate) was added in sufficient amount, a white opalescent

(Details of Test Work, cont'd) -

product was obtained. This reagent, sodium nitrate, was added in gradually increasing amounts in the different fusions. In the initial test, one pound per ton of salt was added. This amount was slowly brought up to 4 pounds per ton in the succeeding fusions, when a white block of salt was obtained. Sufficient of these fusions were made to supply about 40 pounds of fused salt. This salt was then crushed and screened to -2 +4 mesh to secure a product of approximate grain refrigeration size. Sixty-nine per cent of the salt reported as the sized product. The remaining 31 per cent was material screening through 4 mesh. Twenty-three pounds of the -2 +4 mesh size fused salt was shipped to Mr. W. R. Spence.

A number of other tests were made in a porcelain crucible. These tests were made to determine the amount of residue, if any, remaining after successive fusions in the same crucible. Some four melts in all were made, a few grains of fused salt being allowed to remain in the bottom of the crucible after each pouring. No accumulated residue or precipitated dregs was apparent after the fourth successive fusion. No added reagent was used in these fusions. In the large-scale (2,500-gram) tests in the fireclay crucibles, some five successive fusions were made in the same crucible. Sodium nitrate was used in these fusions and no accumulated residue was visible.

A series of tests was made to determine the pH value on saturated solutions of the fused and unfused salt. A Beckman 4990E meter was used on this work. On the fused salt with 4 pounds nitre per ton, the pH was 11.2; on the fused salt without any reagent, 10.8; and on the vacuum pan salt as received, 7.0.

Summary and Conclusions:

A series of small- and also comparatively larger-scale fusion tests were made on the submitted samples of vacuum pan salt. The small-scale tests were generally done in vitrosil on porcelain crucibles and gave a clean white product with no appreciable residue. No reagent was added in these tests. A number of other small-scale tests were made in fireclay crucibles of ordinary assay size. In these tests it was found necessary to add the reagent, sodium nitrate, to the melt in order to obtain a white product. No precipitated dregs were observed after pouring. Finally, a series of tests using large-scale, 2,500-gram fireclay crucibles were made in which it was found necessary to add 4 pounds of reagent (sodium nitrate) per ton of salt in order to obtain a white opalescent salt block after pouring. No residue was seen in these crucibles.

In these tests where a fireclay crucible was used, it was apparent that the red-to-pale-yellow colour of the fused salt was the result of soluble iron from the crucible. In practice, the type of lining used in the furnace would determine the amount of reagent that it would be necessary to add to produce a fused white product. In time the iron contamination would be leached out, and henceforth smaller amounts of reagent would be necessary. Some 23 pounds of fused salt was made, crushed, screened to -2 +4 mesh, and shipped.

From the above summary of the results obtained from the test work, it seems reasonable to assume that a white opalescent fused salt can be produced in a reverbera-tory-type furnace from the submitted sample of vacuum pan salt. According to the type of lining used, it may be neces-sary to add reagents to the melt to obtain this result. Also the test work shows that no great accumulation of foreign

(Summary and Conclusions, cont'd) -

material should occur in the bottom of the furnace and, consequently, a considerable period of time should elapse before a shut-down for cleaning would be necessary.

It should be observed that the fusion process increases the pH of a brine made with fused salt. Very little information is available regarding the effect of pH value in industrial use and it is suggested that this factor be fully investigated before any plant is put into operation to treat salt in this manner.

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