Sampling and sizing of Las Cuevas fluorspar in the logistical supply chain

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Abstract

Cía. Minera Las Cuevas, S.A. de C.V. exports its products through the Tampico and Altamira Ports in Mexico to several destinations around the world. The case study that we are presenting in this paper is focused in the Tampico – Rotterdam shipments of bulk metallurgical grade fluorspar (20 - 60 mm). For these shipments, there were significant differences in sizing results obtained at port of loading in comparison with such obtained at port of destination.

The report includes aspects of and consideration about the handling and sampling operations, the generation of fines, and sample preparation for the screen test at Tampico and Rotterdam Ports. The report also considers suggestions for standardizing sampling methods at both locations and the results of the implementation of more standardized sampling methods.

Resumen

Cía. Minera Las Cuevas, S.A. de C.V. exporta sus productos a través de los puertos de Tampico y Altamira en México a varios destinos alrededor del mundo. El caso de estudio que estamos presentando en este documento esta enfocado a los embarques Tampico – Rótterdam de fluorita grado metalúrgico a granel (20-60mm). Para estos embarques, existían diferencias significativas en los resultados de granulometría obtenidos en el puerto de carga en comparación con aquellos obtenidos en el puerto de destino.

El reporte incluye aspectos de las operaciones de manejo, los métodos de muestreo y consideraciones acerca de los mismos, generación de finos así como preparación de las muestras para las pruebas de granulometría en los puertos de Tampico y Rótterdam. El reporte también considera sugerencias para la estandarización de los métodos de muestreo en ambas localidades y los resultados de la implementación de los mismos.

The following report is of observations made at Tampico and at Rotterdam of the fluorspar shipments of Cía. Minera Las Cuevas, S.A. de C.V., which have been attended at both locations by SGS Minerals Services, and the subsequent actions performed upon those samples.

1.0 Operations at Tampico Port

Compañía Minera Las Cuevas (MLC) ships its fluorspar to Rotterdam. The fluorspar is shipped by rail car from the MLC yard in San Luis Potosi to the yard at Tampico Port.

Once rail cars arrive at Tampico Port, they are discharged using a port grab, which places the mineral onto the cement ground. When the material surface in the rail car is not sufficient to allow the grab to collect the mineral, an excavator is placed into the car and is used to accumulate the material.

The small piles produced by the discharge of each rail car are piled up to form a bigger stockpile using the same grab and end loaders. Sometimes, a mobile conveyor belt is used to form the stockpile.

4.0 Sampling at Rotterdam Port

Sampling at Rotterdam is performed in the vessel holds. ISO 8868 "Fluorspar – Sampling and sample preparation" and ISO 8876 "Fluorspar – Determination of particle size distribution by sieving" are documented in our accredited Quality Assurance System and followed during discharge operations.

The total number of increments required by these standards is collected manually by our own experienced SGS staff on a random time basis using an appropriate ISO shovel at different points and levels of the exposed surface of the fluorspar in the vessel hold.

Samples for quality and sizing are kept separately.

5.0 Sample preparation and sizing at Tampico Port

The increments collected by each sampling procedure are screened manually through metallic round-hole screens.

Each fraction retained and fines passed are weighed in order to obtain their percentage in the cargo.

6.0 Sample preparation and sizing at Rotterdam Port

The increments collected at each stage of sampling are sieved mechanically through metallic square-hole screens.

Each fraction is retained and weighed individually. The following formula is used to calculate the size results for the total cargo.

$$\frac{\text{Mass of size fraction}}{\text{Mass of gross sample}} \times 100 = \text{Size fraction content, \%}$$

Results from each stage of sampling are compiled to yield the size distribution of the total cargo.

7.0 Generation of fines

Bulk fluorspar is very friable, easily susceptible to degradation. This situation has a greater effect on larger particles.

SGS has visited the yard of MLC in San Luis Potosi (SLP) several times and checked the preparation of the shipments to be exported. Although the material looks to be free of fines before being loaded into the rail cars, there are a lot of maneuvers from the plant in SLP to the warehouse in Rotterdam, which indubitably produce additional abrasion/degradation of the fluorspar. The maneuvers mentioned include the following:

8.2 Sampling from fresh exposed surface in the end loader's bucket

1. As in the case of sampling of the freshly exposed surface of stockpiles being moved, sampling from buckets has the potential risk of drawing nonrepresentative samples due to the fact that only a part of the material is easily accessible. Segregation of different size/density particles may occur.
2. It was found that, while it was not possible to see the size segregation in the loading stockpiles, once an end loader scooped up a bucketful of fluorspar, the layered segregation could be observed in the end loader bucket.
3. Increments have been collected from the bottom and in the middle of the end loader's bucketful.
4. This option results in the collection of a sample that contains more fines than sampling the coarse outer surface of the stockpile.
5. The correlation between the amount of fines thus collected and that which was really in the pile/bucket still could not be known with any degree of certainty.
6. Invariably, sizing results of samples collected from the end loader's bucketful have shown more fines than samples collected from the exposed surface of the stockpile. In some cases, results have been very close to the final figures obtained during discharge at Rotterdam.

9.0 Considerations about sampling at Rotterdam Port

9.1 Sampling into the vessel's holds

1. In our opinion, sampling from ship's holds is not recommended and all necessary precautions must be taken to minimize the risk caused by moving machinery and shifting cargo. Preference should always be given to sampling from the grab or conveyor belt. However, hold-sampling is an acceptable sampling method according to the relevant ISO standard.
2. Also, sampling of coarse product out of the grab is not recommended. At the beginning of sampling at Rotterdam Port, placing machinery into the vessel hold does not influence the sampling significantly. However, there are some spots of fine material segregated over the fluorspar surface that are sampled.
3. Machinery is working all over the fluorspar surface in order to pile material up to allow the grab to get the material. All these maneuvers invariably generate more fines than the fines that were in the vessel holds at arrival. Additional fines (both newly produced and segregated) can get into the gross sample as increments are collected throughout discharge operations.
4. Sampling during discharge could produce portions of the lot that are not being sampled and such portions may be over- or under-represented in the gross sample.
5. Presently, sampling out of the sea vessel holds at Rotterdam Port is the only available and practical option to collect samples. Hold-sampling is conducted adequately with regard to the number and size of the increments and to the equipment used. However, as in the case of Tampico, it is not possible to determine with any accuracy or predictability the overall precision of the fines.
6. Also, it is difficult to define the increase of fines after sampling from the ship's holds caused by additional handling during discharge.

11.0 Conclusions

After performing this exercise, we obtained more information which allowed us to establish a more representative sampling method for sizing. The results obtained are now (as closely as possible) more comparable between both ports.

Although the differences in sizing have been reduced dramatically and the results are more representative, implementation of mechanical sieving apparatus at Tampico and stopped-belt sampling or mechanical sampling system at Rotterdam would help us to know more about the representativeness of the ship's hold sampling and to gain a better understanding of the increase in fines generated during handling.

Doing this, we can define or confirm the representativeness of the modified sampling methods and help to improve them.

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ABSTRACT
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Cía. Minera Las Cuevas S.A. de C.V. exports its products through the Tampico and Altamira ports in Mexico to several destinations around the world. The case study that we are presenting in this paper is focused on the Tampico – Rotterdam shipments of metallurgical grade fluorspar in bulk (20-60mm). For these shipments, there were significant differences in sizing results obtained at port of loading in comparison with those obtained at the desintation port.

The report includes aspects of the handling operations, sampling methods and considerations about them, generation of fines as well as sample preparation for the screen test at Tampico and Rotterdam ports. The report also considers suggestions for standardising sampling methods at both locations and the results of their implementation.

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BIOGRAPHY

Hugo Mujica
SGS Minerals Services

Hugo joined SGS in 1993. He graduated with a degree in geology in 1993 and then completed a postgraduate degree in administration and finance in 1999. Hugo began his career in SGS as minerals assistant manager, after which he held the position of branch manager of the SGS Tampico office. He was appointed manager of SGS Minerals Services in Mexico in 2002 with responsibility for operations and sales for this sector in the country.

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Facing Forwards

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