



Sustainable utilisation of quarry by-products

Context

The seeker operates one of the largest limestone quarries in the world: approximately 6 million tons of limestone aggregates are produced each year. The use of a wet processing technology for aggregate production generates as a by-product about 300 000 t/year of quarry fines¹ (0/100 µm, D50 = 12 µm). During the production process, these fines are concentrated, flocculated and pumped in slurry form (varying from 380 ÷ to 530 g/L) to settling ponds that occupy a large part of the quarry site. The amount of already deposited material is estimated to be 10 million tons:

- Approx. 7 million tons of « plastic » settled material with a moisture content of 25 to 30%
- Approx. 3 million tons of « liquid » material with concentration of 500 g/L.

The mineralogical composition of these fines is mainly concentrated of 3 components: limestone, clay, and silica in the form of quartz.

• Limestone, which constitutes the largest share (more than 60% of the composition of these fines), allows the production of diverse types of product:

- o Component (filler / addition) for plaster, concrete, mortar
- o Paint filler
- o Filler for glue, adhesive, putty
- o Filler for plastic

¹ Fines obtained from the washing of a crushed stone aggregate as it is processed into a product are called pond fines, pond screenings, pond slimes, washing fines or pond tailings

- o Filler for asphalt, bituminous membrane
- o Animal Feed Component

- Clay that represents 19% (Illite + Kaolinite), may allow the production of diverse types of product:
 - o Sealing material for landfill and pond (based on the waterproof characteristic of the clay)
 - o Ceramic
 - o Cement
 - o Paint filler
 - o Filler for rubber
 - o Filler for plastic
 - o Cosmetics (thalassotherapy)
 - o Vinification product (high level of cleanliness required)

- Quartz that represents 11% of these fines, allows the production of diverse types of product:
 - o Component (filler / addition) for epoxy concrete and other building materials
 - o Abrasive component
 - o Glass (subject to iron content reduction)

These fines also contain goethite which can have a negative / penalizing impact on some uses (colouring impact).

Today, these fines are not being used and if no solution is found by 2025, the storage of these by-products will require significant investments through the opening of a third settling pond.

Before being able to use these fines, the Seeker is seeking an economically viable solution for the evacuation, processing and sale of the quarry fines as they are or for a partner interested in utilisation of these fines for a minimum volume of 20,000t / year.

The objective of the challenge today is to find a solution or a partner interested in the utilisation of these fines (as they are) for a minimum volume of 20,000 t/year.

For information, the estimated cost of the extraction of fines deposited in the settling basin is in the range of a few euros per ton.

Existing

Among the many ways investigated, several proved to be interesting but without necessarily leading to sale of the sufficient volume of the quarry fines or simply were not economically viable. The studied applications for the quarry fines (raw, pre-dried or dried and deagglomerated) were:

- Raw material for ceramic (pre-dried)
- Raw material for facing bricks or tiles
- Raw material for structure bricks (pre-dried)
- Raw material for portland cement, for belite cement, for sulphoaluminous cement (raw)
- Raw material for road binder (pre-dried)
- Calcined reactive filler (metakaolin-limestone) / road binder (pre-dried)
- Expanded or lightweight aggregates using heat treatment (raw and pre-dried)
- Grout for the creation of waterproof screens, filling of caves (pre-dried)
- Flowable fill mix (controlled low strength materials) (pre-dried)
- Stabilized pathways (pre-dried)
- Hydraulically bound mixtures (pre-dried)
- Core of dikes
- "Mattresses" to isolate brownfields
- Retention basin, bottoms and covers of landfill cells (raw and pre-dried)
- Use of quarry fines in methanation processes (pre-dried)
- Amendments for agricultural land (pre-dried or dried and deagglomerated)
- Manufactured topsoil
- Animal shelter absorbent, bedding (pre-dried)
- Pellets for agriculture
- Animal products, blocks and lick buckets for animals (dried and deagglomerated)
- Modified clay binder and earth plasters (dried and deagglomerated)
- Straw/hemp and clay blocks/ panels (dried and deagglomerated)
- Unfired compressed earth bricks (pre-dried or dried and deagglomerated)
- Environmental clay concrete (dried and deagglomerated)
- Foam clay panels (dried and deagglomerated)

- Foam concrete (dried and deagglomerated)
- Cellular concrete (pre-dried)
- Pigments for blocks (dried and deagglomerated)
- Filler for paint, plasters, mortars, mineral ceiling, soft or rigid PVC, carpet backing, tires, bituminous waterproofing membranes, flexible plastic films, compounds, polymers, floor coverings, rubber / elastomers, cladding, insulation, roof covering and facade cover (dried and deagglomerated)
- Filler for shooting targets (dried and deagglomerated)
- Filler for detergents and cleaning agents, putty, wood pulp, coatings (dried and deagglomerated)
- Liquid desiccants / absorbers (dried and deagglomerated)
- Filler for abrasive (dried and deagglomerated)

Constraints

The solution sought must respect several constraints:

- Economic constraints:

- Sales price - Extraction cost + processing + shipment: total cost zero minimum

- Geographic Constraints:

- Stock of quarry fines located in the north of France.
- Accessibility of markets: road, rail (only pre-dried material compulsory covered) or river transport (only pre-dried material compulsory covered)

- Technical constraints:

- % moisture varies depending on weather conditions
- Complex transport: fines have inherently high moisture contents, resulting in problem associated with handling (sticky material in original “plastic” form or slurry).
- Status of inert waste
- Mixed product (limestone, clay, quartz, dolomite, goethite, traces of other minerals)

- Ecological and environmental constraints:
 - o The industrial process must respect the HSE (Health Safety Environment) constraints.

Given these requirements, the Seeker is seeking an economically viable solution for the evacuation, processing or sales of the quarry fines as they are or for a partner interested in utilisation of these fines for a minimum volume of 20,000t / year.

Price

A bonus of 15 000 € will be paid for the purchase of a solution or the identification of a partner who proposes a solution meeting the expected criteria and respecting all the stated requirements.