

# Management of pyritic material in landfills of great construction works.

AVE Madrid-Galicia. Tunnel of Espiño.  
Orense, Galicia.

In the material from the excavation of Espiño-right road tunnel of 8 km long, has been planned the presence of pyritic materials ( $\text{FeS}_2$ ) and heavy metals. These type of materials have a very specific problematic derived from oxidative processes, and that basically consist in a hyper acidification of the waters and the releasing of heavy metals into the environment.

The original solution consisted in the intersperse of limestone material ( $\text{CaCO}_3$ ) between excavated material to buffer the foreseeable environment acidification.

Considering the last advances, studies and technologies applied globally in the management of affected areas by the presence of sulphur compounds and heavy metals (pyrites principally), Ferrovial Agroman has proposed in collaboration with the Environmental Technology laboratory of the Santiago de Compostela University (LTA-USC) and the participation of the Centro de Valorización del Noroeste company (CVAN), the utilization of specific Tecnosols with particular functions for the treatment of pyritic material, as well as an analytic control program, for both the materials which are being extracted from the tunnel and the leachate waters for each of the stocking areas, which it is pretended to prolong until 5 years once the works have finalized to guarantee treatment ability until the definitive stabilization of the areas to treat.

Tecnosols are artificial soils, created from different materials, lands and wastes which converge with natural soils simulating them and that are fabricated with the purpose of confer them very specific materials, being able to act as a biosphere protector, contaminant control, filter and water purifier, carbon sink and genetic reserve.

In the particular case of the Espiño tunnel, it has confirmed in laboratory evidences, that effectively, excavated material reaches pH oxidation levels around 3 (hyperacid), with elevate liberation of certain heavy metals in some cases. Therefore, it is required a complex Tecnosol design, because it must act as:

- Reducing agents, to avoid pyritic material oxidation.
- Neutralizing agents of acidity with high buffer capacity.
- Adsorbents of specific adsorption anions (arsenates, phosphates, sulphates, fluorides, etc.) and heavy metals.
- Eutrophying capacity (on the top layers) to enhance plant growth and to reduce oxidizing power of filtration waters).

Highlight that Tecnosol has a very low solubility in water, decreasing enormously its lixiviation with rain, and not being "passivated" in presence of iron (Fe) losing its efficiency as occur with limestone amendments. It acts on the source of the problem avoiding sulphides oxidation (in fact, the use of these specific Tecnosols avoids the production of 4 moles of protons per mole of oxidized pyrite, while the other method would multiply enormously the neutralized capacity requirements or buffer of the amendment to use).

These Tecnosols are being fabricated in Galicia, employing in a 70% of the times non-hazardous wastes. To date, more than 4.500  $\text{m}^3$  of Tecnosols have been applied, of the 17.000  $\text{m}^3$  planned.

The analytic monitoring of leachate waters from landfills treated with Tecnosols is probing the effectiveness of the treatment since the beginning, registering values of pH within normality and with presence of metalloids and heavy metals similar to the natural water of the environment, guarantying therefore an optimum sustainability in the landfill management of the Espiño tunnel.



## Environmental advantages:

The use of Tecnosols instead of employing limestone for the treatment of excavated material implies:

- Avoiding extraction and transport of more than 32.000 $\text{m}^3$  of limestone (in the region in which there are not quarries of this material).
- Reusing non-hazardous wastes in the fabrication of Tecnosols.
- Reducing the volume of soil landfills.
- More effectiveness and efficiency than limestone to control leachates .
- Guarantee of chemical stability of the landfills in a short, medium and long term, avoiding acid water drainage.
- Reduction of carbon emissions to the atmosphere.
- Creation of new niches for the biodiversity maintenance in an environmental and landscape integration framework.
- Development of new technologies applied to prevent contamination.



Fabrication plant of Tecnosols in Touro.  
Santiago de Compostela



Landfill and Tecnosols' extension

