SUBACUATIC REPAIRS OF A HDPE LINER SYSTEM BY USING AN ASPAHLTIC BASE GEOSYNTHETIC MATERIAL AT "EL VALLE –BOINAS" MINE, ASTURIAS, SPAIN

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Abstract

As part of restart operations at "El Valle-Boinás" gold mine in Asturias, Spain, the Tailing Management Facility (TMF) associated to the treatment plant which presented various defects on its liner system were requested by the authorities to be fixed in order to obtain the necessary authorizations to operate and manage the installation; the mine owner held this engineering group to find a technical solution to fix the liner system..

The TMF was used during a previous closure time to manage the water runoff from the open pit and rainfall water, such volume of water prevented to use traditional methods for fixing the HDPE system. HDPE.

As a technical solution for the defects found, it was proposed to use an asphaltic base geosynthetic material with a density higher than 1 g/cm^3 and adhesive, which allow each different surface to be glue underwater by a process named vulcanization an also seal the joins.

The solution apply had fixed the defects and had achieved the authorities request to obtain the authorization to operate and manage the TMF.

The article will also describe the results obtain after 5 weeks of installing the solution proposed.

To finalize the article will comment other specific jobs related at Reunion Island.

1. INTRODUCTION

“El Valle-Boinás” gold mine is located in the north of Spain, in Asturias province on its Occidental side. The mine Project has a benefit plant and the produce tailings, will be storage on a TMF built for this purpose.

Previously to initiate the mining activities, the owner of the project carried out various tasks to adequate the storage area in order to obtain the authorization to operate and manage the facility. At the time start the permitting process, the storage facility was exclusive fill with runoff water from the open pit were the facility is located and rainfall water.

During the permitting process, the authorities carried out various site visit and requested that additional works were developed to ensure that the facility accomplish all the environmental requirements, which included the correct impermeabilization of the facility.

Previous episodes indicated the existences of defects on the liner, at the moment those were located below the water level. The owner request to an engineering group to search for a viable solution which will fix the defects found.

2. SOLUTION APPLIED

Due the fact that the defects were located below water level, it was impossible to use the custom techniques to fix a HDPE system, this issue lead the search to new solutions and defined the searching parameters, which are describe below:

- The material chosen needs to be glue to an existing HDPE material, taking into account that the join could not be done using heat;
- the proposed material should present the same properties, in terms of chemical and physic-mechanical resistances, as the existing material and;
- material and installation methodologies should granted the impermeabilization of the TMF.

After the searching process concluded a company with experience of using an asphaltic base geosynthetic material was approached.

The solution presented to the owner consisted in, using an asphaltic base geosynthetic material and its chemical union to the HDPE by a process named vulcanization using an adhesive capable to work under water and ensuring the sealing between surfaces.

This solution covered the prior requirements and allowed to fix the defects founded.

3. METHODOLOGY FOLLOWED.

To install and fix the defect founded it was prepared a worked methodology between the engineering, the manufacturer and the owner which is describe in the following sections:

3.1 Initial review

Previously to initiate the fixing activities it was carried out an inspection of the areas where was considered the existence of defects in the impermeabilization system.

This task was performed by a scuba diver team which located the defect underwater, indicating the deep and the approximate size. While on surface the defect were topographic marked, in this way the defect were precisely marked.

This review was done in sections of 2-3 meters and was defined two types of defects depending on size and geometry. It was named “breaches” those defects bigger than 20 cm with a longitudinal geometry, including those with a L setting; in the other hand were named “leakage” those defects no higher than 10 cm with a circular or semicircular geometry.

During the initial review were found 13 “breaches” and 19 “leakage” in two areas of 130 and 250 linear meters.

3.2 Repairing

To repair the defects founded during the initial review, it was proposed the following methodology:

1) The scuba driver will relocated the defects according with available data from the initial review.
2) Will delimiting the area leaving 1 m on each side of the axis in where the defect is located by using two master ropes.
3) The scuba driver will reconfirm the deep of the defects located during the previous review and will left a distance of 0.5 m (min) below defect location; this will be use to define the length of the geosynthetic piece of material up to it final position, which will be located a minimum distance of 0.5 m from the head of the slope.
4) On surface a point mark will be done at the define length and a central axis will be trace to center the piece of material.
5) While the material it is cut and prepare (see following points) a scuba driver will clean the slope face to ensure the correct vulcanization process of the product.
6) Material preparation: Once the defect is located, the measurement will be transfer to the piece of material already cut.
7) Surrounding the defect will place a thick and abundant cord of adhesive, attending to site engineer criteria to ensure the maximum seal of the defect (see figure 1 and 2).
8) On the perimeter of the piece and up to the water level will be place a finer cord which purpose is to avoid possible undesired movements of the piece (see figure 1and 2).
9) Once the piece is ready, it will be center on the sign already made, the area should be clean and the adhesive applied. The piece will be fixing to the berm mechanically by using a thread bar (30 x 30 x 30 on a U form).

10) The scuba dive will clean the area once again while step 9 is occurring.

11) The piece mechanically fix will be slide down the slope and the scuba dive will be place it properly.

12) Finally the operative on surface along with the scuba dive will place a certain amount of sandbags on the axis of the defect, one of the sandbag have to be on top of the defect, and on the perimeter of the piece.

13) The sandbag schemes propose will remain in place at least 4 weeks, to ensure the chemical vulcanization process between the different products.

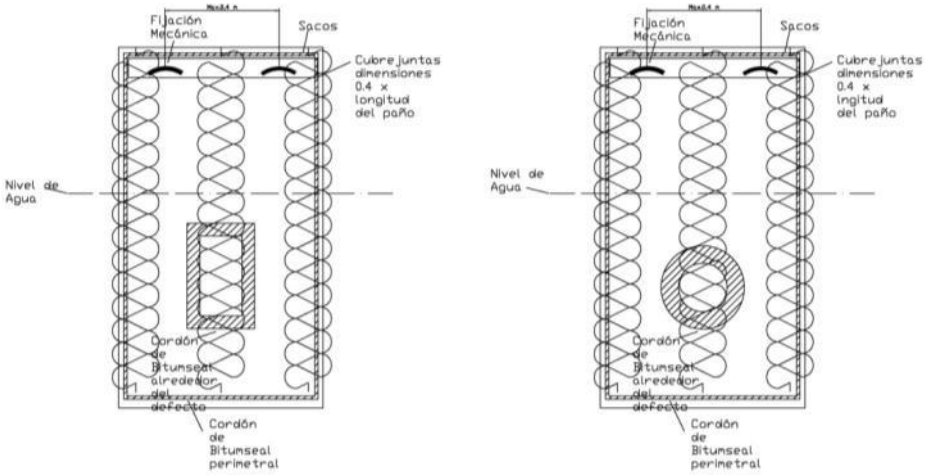

Figura1: Material piece configuration

14) The mechanical fixes will be seal by welding a piece of geosynthetic material on top of the thread bar, by using this will be ensure that no infiltration will pass through this point. The dimension of the fixes and the sandbags lines can be modify according with the dimension of the piece and are left to the site engineer criteria.

According with the methodology describe above, was fixed 100% of the defects detected.

Following a serial of pictures showing the reparation process are presented:

Figura2: Geosynthetic cloth ready to be place

Figura3: Axis of the defect marked on the Berm

Figura4: Mechanical fixation of the geosynthetic colth

Figura5: Final result of a repaired defect

3.3 Further actions

Once the Works were done after 6 weeks an inspection was carried out to verify the status of the repairs.

The objective of the inspection was to verify that the sealing and the joins between the materials were produced as was expected, and also to ensure that the defects repaired did not presented any failure that will lead to a poor sea of the defect.

A scuba team performed an inspection of the repairs according with the following criteria already establish:

- The sandbags maintain the same position.
- There are not roughnesses on the cloth surface placed.
- The cloth was seal, there were no miss joins between materials.
- There were not lateral displacements.

The inspection carried out showed that 100% of the defects were without any roughness, seal and without lateral displacement. Only to mention that a line of sandbags were out of place due the welding of the mechanical fixation.

4. CONCLUSIONS

After all the work developed can be conclude the following:

- It is possible to repair defects on a PEAD liner under water.
- The joins between geosynthetic material from different origins it possible throughout chemical process (vulcanization).
- The. Durability and guarantees of the material are maintained along the time.
- Hydrostatics pressures generated by the water help to fix the cloth to the slope face.

5. OTHER WORKS

Job: Reunion Island

The geomembrene was place on slopes below a rock wall to separate the sea water from the phreatic water level. It was decisive for the Project the fact that was possible to weld underneath the water, adding that density higher than 1 the geomembrene to submerge under water. (Job Antiquity 14 years).

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