

Summary of the official report about the Sgurigrad (Bulgaria) failure of 1st May 1966

Tailings Dam: " Sgurigrad"

Location: Western Balkan Mountain, Western Bulgaria

Ore: Multyore - Lead, zinc, copper, silver

Tailings: Mean Grain Diameter 0.11 mm

Dam Height (m) : 45, Dam Type: US , cross-valley

Fill Material: Tailings

Downstream Slope : v:h = 1: 3 to 1: 3.5

Volume (cu. m): 1 520 000

Incident Information:

Date: 1st May 1966 Incident Type: 1A

Cause: Flooded beach, total saturation of the tailings, loose of stability and liquefaction

Quantity of Released Tailings-Water mixture (cu. m): 220 000

Tailings Travel Distance: 6 km (the valley is very steep - 6 to 7 %)

Incident description:

The failure occurred after 3 days heavy rains. The beach was flooded and all the tailings have been saturated. The decant towers have been with low spillway capacity and the pond water level rized dangerously. To avoid overtopping of the dam, the operation staff has digged two trenches on both side of the dam on the banks through the last secondary dykes, but this desperately action could not help. The dam failed suddenly and the mass went down like a steep wave. The dam was not overtopped, according to all witnesses. This was registered also by photo by a plain. The cause was sudden loose of stability and liquefaction of the saturated tailings. For this reason the mass went down like a wall. If it has been overtopped, then the erosion would take some time and the failure wave would not be so large and steep.

The wave destroyed half of the village Sgurigrad that was 1 km beneath the dam and caused 107 victims. About 220 000 cu. m traveled down and reached the town Vratza (50 000 inhabitants), 6 km downstream of the dam and flooded its streets without damages.

After the disaster a significant water spring has been seen under the tailings level, high on the left bank. The heavy rain has activated this spring. The area is karstic and according to local habitants this spring is activated only after heavy reins. The spring has not been considered in the dam design, because it has not been seen at this time, but it has contributed to the failure.

The dam has been designed by mining engineers in 1956 and commissioned in 1958. At this time the civil engineers have not been involved in the tailings dams design. This dam was abandoned and an other has been built on an other valley far from the town Vratza.

Lessons from the failure:

1. The spillways of the decant structures must be with sufficient capacity, to avoid the submersion of the beach.
2. The hydrogeological investigations of the tailings dams area must be very thoroughly, especially in carstic regions. Then the adverse surprise with this spring could be avoided.
3. After this disaster the tailings dams in Bulgaria are designed only by civil engineers, specialized in dam engineering.
4. All other tailings dams have been revised.
5. The hydrology of all tailings dams has been revised.