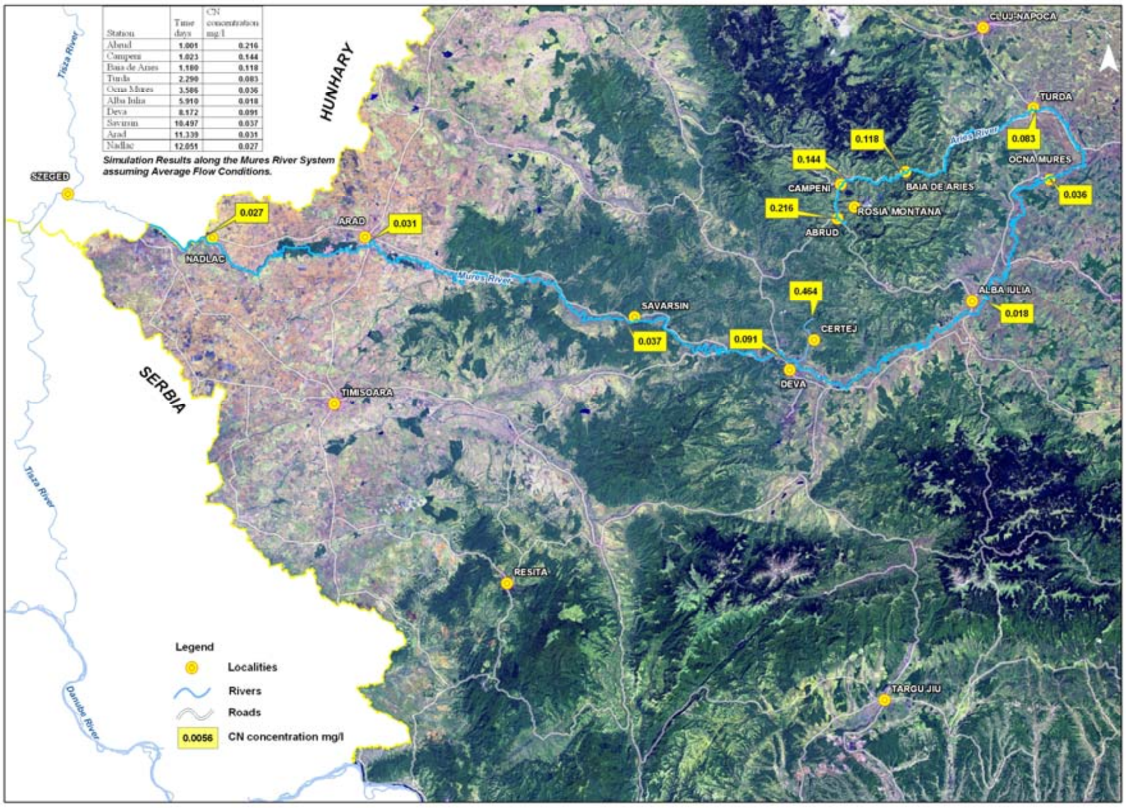
THE ASSESSMENT OF THE CUMULATED IMPACT FOR ROSIA MONTANA AND CERTEJ PROJECTS, AND THE CONSEQUENCES OF A SIMULTANEOUS ACCIDENT HAVING LIKELY TRANSBOUNDARY EFFECTS



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2. **Potential impact on the quality of water from Mures River System in case of accidental discharges from Rosia Montana and Certej mining projects**

1. Overview

The hereby Report assesses and presents the potential of generating a tranboundary impact resulted due to cumulated effects of Rosia Montana and Certej Projects from Romania.

In order to assess the cumulated impact, there were observed the potential pollution ways and these are, through the river system tributary to the water courses which flow from the assessed sites, as well as by air, through the contribution of additional concentrations of substances to the existing ones. Therefore, the assessment of cumulated effects generated by Rosia Montana and Certej Projects, within tranboundary context, concluded into the following:

- „The potential impact on the quality of water from Mures River System in case of discharges from Rosia Montana and Certej mining projects" compiled by Prof. Paul Whitehead from Oxford University, UK and Prof. Steven Chapra from Tufts University of Boston, USA, following the modelling studies for the river flows and pollutants' dispersion within Mures river basin;
- „Report regarding the cumulated impact and transboundary impact on the air quality generated by Rosia Montana and Certej Projects" compiled" by SC WESTAGEM SRL, following the air pollutants modelling studies released from the operations related to these two Projects and quantification of the concentrations at local level as well as at regional level.

1.1 Brief description of the Projects

1.1.1 Rosia Montana mine

Rosia Montana Project involves the open cut pit mining and processing of an average quantity of 13 Mt/year of gold ore, for 16 years, along with the storage and management of mining and processing waste. During the first 14 years of operations, the low gold content ore will be stored in a waste dump, and later on, will be recovered and processed during year 14 to 16 of operations. According to the existing plans, the open cut put ore mining will last for 14 years.

Corna tailings management facility – the dam and the pond of the dam will be built in phases and will be located on Corna Valley, at South-South-East from the site of the processing plant site. The height of the rock starter dam will be, at first stage, and at last phase will be 185 meters. The processing tailings will be stored in the dam neutralised and partially dewatered.

The last raising of the dam will reach the final level of approx. 840meters above the sea level and it is designed to confine a volume of 250 Mt processed tailings. In the first years of mining, the dam will have to impound a volume of 1-1.5 million cubic meters of industrial water, needed to commence the flowsheet, therefore the starter dam will be built on a clay layer (like the water storage dams). Until the tailings beach is formed, they will be stored under water.

1.1.2 Certej mine

Certej Project involves the mining and concentration through means of flotation of an average quantity of 3Mt gold ore, followed by the processing of 315 thousands tone/year of gold concentrate for 11 years, along with the storage and management of wastes generated by mining and processing.

The main pond of the flotation dam is located on Măcriş creek, right upstream from its confluence with the right hand side affluent – Avram Brook. The dam was sized to be able to impound upstream the entire quantity of flotation tailings which is 25 Mt, generated by the ore processing plant, over the entire ore mining period.

The main pond of the CIL leaching dam will be located on Măcriş creek, at approx 1.8km upstream from its confluence with the right hand side affluent – Avram brook. For the peak over-raising level, it was estimated that the leaching tailings quantity of to be deposited in the pond is 4.5 Mt. The processing tailings will be stored in the dam after neutralisation and partial dewatering.

1.2. The scope of the assessment

1.2.1 The scope of assessing the cumulated impact

The assessment of the cumulated impact was conducted due to the location of both sites in the same river basin- Mures system – and the vicinity in straight line of approx. 35km of Rosia Montana Project and Certej gold-silver ore mining site, as well as due to the concerns issued by the stakeholders.

The scope of the cumulated impact assessment for the prevention/mitigation of the transboundary impact is the same as it is for other forms of significant potential impact identified within these two projects. The implemented measures involve a hierarchy of approaches, as follows:

- Alternatives for the processes, location of the Project's industrial objectives etc, assessed for the purpose of avoiding the occurrence of the impact;
- Design measures for removing or mitigating the potential risks related to the selected options for the Project;
- Implementation of specific control and/or management systems for impact mitigation.

This approach was applied during the entire process of developing projects, in order to make sure that the risks related to the potential impact forms were minimised.

1.2.2 Legal provisions

Both projects which are subject of the hereby study are governed by the provisions of the Helsinki Convention regarding the transboundary impact caused by industrial accidents (Convention on the Transboundary Effects of Industrial Accidents) because they both are industrial objectives which:

- develop operations where one or several hazardous substances may be present in quantities equal or higher than the standard quantities included in Annex I to the Convention
- are located within the river systems of some transboundary water courses, thus have the potential to generate transboundary effects.

According to the guidelines to facilitate the identification of hazardous activities for the purposes of the Convention", **PARAGRAPH 5 "Location criteria",** The following two location criteria shall apply for the purpose of identifying hazardous activities capable of causing transboundary effects under the Convention:

- (a) Within 15 kilometres from the border, for activities involving substances that may
- cause a fire or explosion or involving toxic substances that may be released into the air in the event of an accident;
- (b) Along or within catchment areas 2/ of transboundary and border rivers, transboundary or international lakes, or within the catchment areas of transboundary groundwaters, for activities involving substances that fall under category 3, 4, 5 or 8 of part I of annex I to Convention and that may be released into watercourses in the event of an accident. Whether or not such an activity is capable of causing a transboundary effect in such an event should be decided by the competent authority of the Party of origin, preferably in consultation with joint bodies. 3/ The decision should depend, among other things, on the existence of river warning and alarm systems and the distance 4/ between the location of the hazardous activity and the border.

Notes

- 2/ A catchment area of a transboundary river or lake is defined as the whole drainage
- area of this river or lake with a common outlet.
- 3/ Joint body means any bilateral or multilateral commission or other appropriate
- institutional arrangements for cooperation between Riparian Parties.
- 4/ The joint ad hoc expert group on water and industrial accidents recommended that this distance should correspond to approximately a flowing period of two days of average flow velocity."

Having regard to the fact that the distance to the closest border is over 130km, it shouldn't cause any transboundary effects on airways.
Also, the distance on water course corresponds to flow duration of average flow conditions of approx. 12 days for Rosia Project and approx. 4 days for Certej Project. So, none of these two projects should generate transboundary effects on water ways either.

2. The assessment of the cumulative effects

2.1 Natural environment of the impact area

Roşia Montană Project is located within Apuseni Mountains, part of the Carpathians of Transylvania, Romania. The water sub-systems related to Roşia Montană area belong to the sub-system of Aries River which, at its turn, is affluent of Mures River, which flows towards Hungary, reaching the border with this country at approx. 595 km downstream from Roşia Montană (measured on water bodies: Corna Valley, Abrud, Arieș and Mureş).

Certej mining project is located at South-East of Metaliferi Mountains, which are part of the so-called gold quadrilateral Săcărâmb – Brad - Roșia Montană -Baia de Arieş and it is located at approx. 20km NE from Deva town. The site proposed for this investment is located on the brook's valleys of Măcrişului, Corănzii, and Băiegii Valley with their related effluents. All these brooks are affluents of Hondol creek. Certejului Valley, which is the main river from the area, is tributary of Mures River and its main effluents are – at the right hand side - Făerag creek and Mireşului creek, and – at the left hand side – Hondol creek, Ciongani creek and Nojagului Valley. Mureş River flows towards Hungary, reaching the border with this country at approx. 230 km downstream from Certej.

2.2 Brief presentation of the scenarios

The study considered the worst case scenarios for both Projects, as well as the assumption of a scenario regarding several sequences of events, in order to have the possibility to assess and quantify the maximum impact, even though the occurrence probability is extremely low.

The scenarios took into consideration the following data:

- the distance between these two sites is only 35 km in straight line, and 366 km along the river basins;
- hypothetic relation of the emissions specific to the construction and operations phases;
- the worst scenario for both projects;
- for air, it was considered the existing pollution overlapped by the modelling of the pollutants' dispersion released from the sites of both mining projects.

2.3 Cumulated impact on the air quality and terrestrial eco-systems

2.3.1 Approach and methodology

In terms of air quality, the assessment of cumulated and transboundary impact generated by the two Projects involves preparation of a pollutant dispersion model for the pollutants generated by the activities associated with the two Projects in order to quantify the concentration fields both at local as well as regional level. For this, a complex dispersion model should be applied capable of describing dispersion at various scales (starting from distances of max 50 – 80 km to simulate the cumulated effect in the area of the two Projects and going up to distances of hundreds of km in order to simulate pollutant spread at regional scale). Therefore, a numeric Eulerian model will be used which will take into consideration the topographical – climatic and land-use conditions in running at various scales by using successive calculation grids (telescopic or nest run). The results will be extracted from 2 different calculation grids, as follows:

- The results required to assess the cumulated impact on the lowest resolution grid
- The results for assessing trans-boundary impact on a grid with intermediary resolution but which includes the boundary area.

2.3.2 Assessed emission scenarios

The following notes should be made regarding the reviewed emission scenarios:

Although the activity and production capacity graphs for each Project are properly described and thoroughly phased by years there is the uncertainty related to the date when the construction of the facilities associated with the two Projects commences. To this effect, the way in which the activities overlap cannot be precisely known at this time and hence a conservative approach is required to assess the cumulated impact by assessing the maximum cumulated impact generated by the two Projects (the worst case scenario).

Such approach implies the assumption that the activities associated with phases involving maximum emissions for each Project will be conducted simultaneously therefore the years with maximum impact on air quality that were identified in the impact assessment reports for each project will be addressed as follows:

- Emissions associated to year 9 for the Rosia Montana Project
- Emissions associated to year 6 for the Certej Project

This scenario which will indicate the maximum impact of the two Projects will be conservative enough for any combination of emissions generated by simultaneous activities during the operating stages of the two Projects. Thus, any change in the mining plan for any of the two Projects will not generate total cumulated emissions higher than those assessed in the proposed scenario.

A scenario which considers that the maximum annual emissions associated with each project occur simultaneously was done in order to assess the impact during the construction phase. Moreover, given that the procedures to secure construction permits are presently being carried out simultaneously, it is very likely that the construction of the facilities associated with the two Projects will overlap.

There also is the obvious possibility of having a situation whereby the construction phases of one Project overlap with the operating phases of the other Project however the cumulated emissions will generally be lower or comparable with the cumulated emissions associated with simultaneous construction of the two Projects.

During the closure phase, the pollutant emission inventories indicated lower values compared to the construction or operating phase therefore the impact on air quality will be lower. Consequently, impact quantification is required only if the impact is significant during construction or operation.

2.3.3 The results of the study

The outputs show that the maximum pollutant concentrations is case of cumulated effect of the construction phase or operations phase in the localities included on the model grid are generally significantly below the limit or target values set forth by the legislation in force (less than 16% of these values during the construction phase and less than 11% during the operations phase).

The outputs show that the maximum pollutant concentrations in case of cumulated effect of the construction phase or operations phase forecasted at the level of protected areas (reservations and national parks) and NATURA 2000 sites included on the model grid are significantly below the limit or target values set forth by the legislation in force (less than 9 % of these values during the constructions phase and below 10% during the operations phase).

2.4 Cumulated impact on water quality and aquatic ecosystems

2.4.1 Approach and methodology

The model accounts for the main dispersion processes operating in rivers as well as the dilution from incoming tributaries and first order kinetic decay processes. The model is dynamic and simulates the hourly behaviour of river flow and pollutant transport along river systems. The model has been applied to the Aries and Mures River System in Romania and has been used to assess the impacts of potential dam releases from the RoşiaMontană Mine in Transylvania, Romania (Chapra and Whitehead, 2009) in case of a dam failure. In addition to investigating the effects of upstream discharge, it is necessary to consider the effects of simultaneous releases from downstream sources. This is possible using a modified version of the dispersion software in which a second discharge pulse can be specified and timed to coincide with the upstream pulse. The combined effects of both upstream and downstream pulses can then be assessed.

The model has been used to assess the effect of the potential loss of cyanide (CN) from the tailings dam of Certeju de Sus mining project, located at 18km away from Mures River and Deva town, some 366 km downstream of the Rosia Montana mining Project. For the upstream discharge, we assume an upstream total discharge of 26,000 m^3 of water for a discharge time of 24 hours, a flow of 0.3 m^3/s, with the cyanide tailings concentrations of 5 mg/l. The trigger for the above mentioned release was associated with earthquake shaking of the main dam causing instability of the dam slope and liquefaction, static liquefaction of the tailings, and internal erosion of the Dam.

The second downstream discharge results from a similar event causing successive failures of the ponds of the two tailings dams at Certej mining Project. The triggering event for such a scenario is a flood occurring in the local watershed due to another PMP(probable maxim precipitation). This would result in a discharge of 350,000 m^3 of water over a 6 hour period which gives a discharge flow of 16.2 m^3/s. The cyanide concentration would be 0.46mg/l and this concentration represents the value generated after the dilution of the ponds by the water volume resulting from the flood.

It is assumed that the second pulse is discharged into Mures river at exactly the same time as the peak of the first pulse (from Rosia Montana) arrives at Deva.

The simulation also assumes a worst case situation in the river system when there is no decay or loss of CN due to chemical transformation.

2.4.2 Scenarios assessed

2.4.3 Results of the modelling

The results of the dispersion model simulations represent the pollution events occurring under high, average and low flow conditions in the river system. Under high flow conditions the pulses move downstream rapidly but there is a large quantity of water which dilutes the discharges. The low flow conditions represent the other extreme in that reduced water volumes do not dilute the discharge so much but the travel time along the river system is much longer, giving more time for mixing and dispersion.

The simulations show that for all the low, average and high flow conditions in the river system the second pulse increases the CN concentrations in the Mures River below Deva. This is to be expected as the pulses coincide and their effects will be cumulative. Under the high flow conditions there is very high dilution occurring in the river system and although the CN is transported down the river system quickly, the CN concentrations are very low and well below the CN river water standards.

Under the average flow conditions, the pulse has a significant effect on the concentrations in the river within Deva section, and immediately downstream, but again the CN concentrations are well below 0.1 mg/l. In addition, further dilution and dispersion down the river system, because the CN concentrations fall to much lower levels by the time the pulse reaches the border.

Under the low flow conditions, the pulse increases the concentrations in the river within Deva section. However, dilution and dispersion reduce the concentrations significantly downstream so that CN concentrations are well below 0.1 mg/l by by the time the pulse reaches the border.

3. Conclusions

3.1 Cumulated impact and transboundary impact on the quality of the air and terrestrial ecosystems

The outcomes of the „Report regarding the cumulated impact and transboundary impact on the quality of air and terrestrial ecosystems generated by Rosia Montana and Certej Projects" show that the „the concentration values obtained from mathematical modelling, within towns and protected areas, induced by simultaneous operation of the objectives of these two projects, have very low values in comparison to the threshold values or target values imposed by the legislation in force (overall, below 16%, in the majority of cases being below by 10%)" which emphasise the lack of any significant impact on the terrestrial ecosystems.

3.2 Cumulated impact and transboundary impact on the surface waters and aquatic ecosystems

The simulations show that the effects of the second discharge are to increase concentrations close to the discharge point at Deva section but the levels fall fairly rapidly to concentrations below 0.1 mg/l by far before the time the pulse reach the Hungarian border. It should be emphasised the probability one PMP in the upstream river basin in the same time with low flow conditions downstream from the river basin is very low of the order of 10^{-11}. Moreover, the probability of the sequence of events described in this worst case scenario for both Projects and for these to occur under low flow conditions is extremely low. It should be emphasised that some conservative assumptions have been made here, namely that there is no chemical cyanide decay along the river system, that the pulses take place simultaneously, that two major events and dam failures occur at two different locations simultaneously and that the low river flow condition coincides with a maximum rainfall event. All these conditions mean that we have considered the worst case scenario.

Discussion regarding the toxicity of the cyanide

The cyanide toxicity depends on several factors which can't be directly established by measuring the "total cyanide". Only the compounds of "free cyanide" and those compounds which are able to release free cyanide (WAD cyanide) may determine the toxicity for any life forms. Other conditions such as pH values, temperature, light and those factors which affect the evaporation and oxidation, also affect the level of this toxic element.

Even so, the highest cyanide levels (established considering the worst case scenarios and which occur at the most inappropriate location, which is near the site), following the discharge of the tailings/water at the magnitude and duration caused by accident conditions assessed are:

Much below the concentration level and/or exposure duration which could affect human population, birds and other species of terrestrial animals.

Considered safe for mammals and birds at cyanide concentrations much over the level of concentration found within fenced tailings dams – species which won't be affected even at higher levels, in worst case scenarios, when an accidental spillage occurs and discharges in the water course;

- Safe for the aquatic flora which has the capacity to cope with concentrations and duration much higher that the cyanide levels stipulated by river waters, even in the situation when a model to assume the worst discharge is conducted;

- Below those concentrations which may influence even the most invertebrates from the aquatic environment; the exposure duration will be that small that if any impact would exist, this would be much less significant than anticipated; and

- Having a meaning much different than in the case of fish – which are the most vulnerable vertebrates in case of pollution, due to the acute sensibility of some species and duration of their exposure to contaminated waters due to the fact that they live in the potential impacted rivers. Thus, even the most vulnerable species of fish, such as the river trout, need a minim level of cyanide concentration and a minimum exposure duration before that the most vulnerable samples from the populations of these sensitive species lose their life.

The conditions after the assumed accident, in a worst case scenario, may threat the most vulnerable fish belonging to the most sensitive species – but the low concentration and the temporary short exposure are of such nature that only the weakest samples will suffer. Certainly, there won't be about a full extinction of species not even in the case of the most sensitive ones; thus, they will continue to be present along the affected water courses even after the passing of the pollution pulse – their populations will recover.