



Agency for Environment Protection Hunedoara

**ENVIRONMENTAL PERMIT
No. 8 of 05.07.2012 reviewed on 28.11.2013**

Further to the request of **S.C. DEVA GOLD S.A.**, with the headquarter in Certeju de Sus locality, 89, Principala str., Hunedoara county, notifying the occurrence of new elements about the project, registered at the Agency for Environment Protection of Hunedoara under the number 8125/07.10.2013, further to the revision of the documentation submitted, of the verification as well as of the completion of the procedure stipulated at art 22, paragraph (3) letter b) of GD 445/2009 about the assessment of the impact of certain public and private projects on the environment respectively the partial resuming of the environmental impact assessment for the "Gold- silver ore exploitation of Certej perimeter " Project ,Hunedoara county

Based on:

- GUO 195/2005 about the environment protection with further amendments and completions approved through the Law 265/2006, with further amendments and modifications,
- GD no. 1000/2012, about the reorganization and functioning of the National Agency for Environment Protection and of public institution reporting to it;

Whereas :

- G.D no. 445/2009 about the impact assessment of certain public and private projects on the environment respectively the partial resuming of the environmental impact assessment;
- Order no. 135/2010 about the approval of the Method for the application of the environmental impact assessment for public and private projects;
- Convention about the environmental impact assessment under trans- boundary context (Espoo Convention) ratified through the Law 22/2001, annex 1 points 14 and 17;
- G.U.O no. 57/2007 about the regime of protected natural areas, preservation of natural habitats, wild fauna and flora, with further amendments and completions approved through the Law 49/2011;
- Order no. 19/2010 about the approval of the Methodologic Guidelines about the suitable assessment of the potential impacts of plans or projects on protected natural areas of community interests;
- And provisions of the Order 864/2002 for the approval of the Procedure for the environmental impact assessment under trans-boundary context and public participation at the decision making process for projects with trans-boundary impact,



There has been issued :

REVISED ENVIRONMENTAL PERMIT

In order to establish the requirements and measures for environment protection which should be observed for the completion of "**GOLD-SILVER ORE EXPLOITATION OF CERTEJ PERIMETER**", Hunedoara county.

Which stipulates:

The continuation and development of the mining activity in Certeju de Sus commune, Hunedoara county, involving the exploitation and development of the existing open pit , gold and silver precious metals of ore, controlled storage of the tailings and of waste rocks as well as other objectives of the economic development of the zone (access ways, utility network, environment protection etc).

On the date of the issue of the environmental permit no. 8/05.07.2012, the project included, in accordance with the provisions of the Government Decisión no. 1213/2006 about the establishment of the procedure – frame assessment of the environmental impact for certain public and private projects in the **Annex I.1, activity with significant environmental impact** at:

- - point 4.2 of the annex to the GD 1213/2006, at plants obtaining the non-ferrous raw ores , concentrates or secondary products further to the metallurgical, chemical or electrolytical processes;
- - point of 5.2 of the annex to the GD 1213/2006- open pit and surface mining exploitation when the site surface area is bigger than 25 ha;
- - point 9.7 of the annex 1 of the GD 1213/2006- storage facilities for dangerous waste or installations for the removal of the waste by incineration or chemical treatment;

The project is listed in the Annex 1 to the Convention about the assessment of the environmental impact under trans- boundary context adopted at Espoo on 25th February 1991, ratified by the Law 22/2001.

The Project makes the object of the provisions of the GD no. 804/2007 about the control of major accident risks involving dangerous substances (which transposes the SEVESO II Directive), of amounts that determined its inclusion „*in the major risk*” category of the project site.

The Project provides the production and storage of *extractive waste* making the object of the GD no. 856/2008 about the management of extractive waste (which transposes the Mining Directive 2006/21/EC).

The new elements notified by S.C. DEVA GOLD S.A , referring to the change of the processing plant site – against the original data of the project and on which basis the Environmental Permit no. 8 of 05.07.2012, was issued . is included in:

- Point 13.a) Annexe II of GD 445/2009 , respectively – any modifications or extensions , others than those stipulated at point 22 of the annexe no.1 , of the projects stipulated in the



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annexe no.1 or in the present annexe, that have been already permitted or are in progress, and could result in significant environmental impact;

Futher to the framing stage developed based on the notification according to the provisions of art.22 paragraph (1) letter b) of the GD 445/2009, decision of the Agency for Environment Protection Hunedoara and consultations of the commission of technical analysis reunited on 08.10.2013 was to partly resume the environmental impact assessment and the revision of the environmental permit originally issued. There were requested additional data about the elaboration of the adequate assessment study, Seveso notification and review of the new elements notified by the holder

I. DESCRIPTION OF THE PROJECT, WORKS PROVIDED BY THE DESIGN, INCLUDING THE INSTALLATIONS AND EQUIPMENTS USED

Project site

1. Geographic location

Certej mining perimeter, Hunedoara county is located to the South –East of Metaliferous Mountains which are part of the so called Gold Quadrilater Săcărâmb – Brad - Roșia Montană -Baia de Arieș and is situated close to Hondol locality, to the central –South part of the Neogene Brad – Săcărâmb basin, at about 20 km NE of Deva municipal.

According to the perimeter sheet the ore deposit of Certej perimeter is located on the administrative territory of Certeju de Sus commune, Bocșa Mică locality.

The perimeter proposed has the following coordinates in STEREO '70 system:

COORDINATE INVENTORY					
Stereographic projection system 1970					
Point	E (m)	N (m)	Point	E (m)	N (m)
1	346103.16	503214.3	30	347231.34	501114.21
2	345936.49	502443.36	31	347148.31	501137.81
3	345820.34	502260.79	32	347094.68	501204.76
4	345771.55	502166.7	33	347098.21	501454.61
5	345825.56	502107.63	34	347038.75	501538.19
6	345462.54	501744.2	35	346905.66	501669.56
7	345416.91	501672.29	36	346907.91	501758.16
8	345120.12	501532.05	37	346872.41	501848.38
9	345056.18	501431.76	38	346783.48	501896.53
10	345016.18	501323.29	39	346851.63	502179.09
11	345014.66	501071.96	40	346777.81	502363.48
12	345032.69	500925.36	41	346781.16	502507.62
13	344987.42	500786.85	33	347098.21	501454.61
14	345224.35	500633.45	34	347038.75	501538.19
15	345620.96	500475.17	35	346905.66	501669.56
16	345934.66	500281.27	36	346907.91	501758.16
17	346028.42	500268.73	42	346872.6	502680.94
18	346224.86	500312.31	43	346934.92	502867.21
19	346240.76	500523.21	44	346665.17	503165.68



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20	346352.50	500691.80	45	346614.3	503592.75
21	346493.46	500693.74	46	345991.3	503580.21
22	346641.76	500693.46	47	346006.36	503646.33
23	346733.76	500781.2	48	346388.03	503851.56
24	346854.02	500727.35	49	346324.02	504062.4
25	346950.43	500740.15	50	345705.88	504082.27
26	346991.55	500843.17	51	345311.61	504063.76
27	347048.84	500814.07	52	345272.01	503822.19
28	347128.58	501044.2	53	345246.30	503587.86
29	347226.94	501055.42	54	345607.34	503392.01

2. Hydrology classification of the site.

The proposed perimeter for the ore exploitation, waste dumping, ore processing plant and tailings management facilities is situated along the following streams:

- Valea Măcrişului stream and tributaries (non - cadaster);
- Valea Coranda (non – cadaster) with tributaries;
- Valea Băiegii (non –cadaster) with tributaries.

All these waters are tributaries of Hondol stream; Valea Certejului cadaster code IV-1.120.00.00.00.00 is the main collector of the zone and is tributary to Mures River and its right hand tributaries are Făerag and Mireşului streams and the left hand tributaries are Hondol, Ciongani and Valea Nojagului streams, The water courses are short with steep slopes and the annual average flow-rates are not significant.

The coding of the surface water body “Certej and its tributaries”: RW4.1.120-B1 – water body significantly modified due to the old mining operations and indicate risks because of the dangerous and organic matters , the bad chemical condition, moderate ecologic potential;

3. Geological classification of the site.

The mining perimeter of Certej Ore Deposit – Hondol Hondol – Băiaga – Coranda – Dl. Grozii structure is situated to the Southern part of the tectonic – magmatic “Brad-Săcărâmb” basin between the localities of Hondol, Bocşa Mare and Bocşa Mică. The geology formation includes basic volcanogene formations and Cretacious deposits – Mezozoic basement as well as Neogene volcanic sediments.

In Coranda Certej open pit zone, the Cretacious flysh deposits, the detritus Neogene sedimentary and Hondol type amphibole andesites are located in a dome or around the Băiaga sub-volcanic body of andesite composition. Locally, the whole structure indicate in sequences, aspects of tectonic melange.

The gold-silver mineralization of Certej generally shows a simple composition, but the presentation of the metal minerals is extremely diversified, the structural and texture types alternating over several meter distance. The pyrite type occurrence is prevailing, there are also centimeter or decimeter size veins as well as ore nests with high content of lead and zinc sulphides.

The primary metal minerals are pyrite, low iron sphalerite and galena, mineral components macroscopically visible. The minerals that were microscopically identified: pyrothine, arsenopyrite in pyrite , chalkopyrite in tetraedrite sphalerite, bornite, tellurides and quite frequently there occur native gold. To the West zone of the structure, the gold mineralizations form vein systems. Within



this type of mineralization, the native gold occur as spangles and dendrites and it is associated to the quartz.

In the location area of the two TMF's and their dams (flotation and CIL TMF's), a number of 43 open shafts (manual, geotechnical holes) and 20 drill holes have been performed. All shafts, with no exceptions, after crossing the soil, diluvium or talus material, stopped in the base rock, represented by andesites, generally fresh. Only close to the surface, on depths varying between 0.10m and 1.00m, the andesites are fissured and oxidized.

According to the tests and determinations made on samples taken from drill holes and open shafts, the values obtained for the physical-mechanical characteristics of rocks from the TMF's location area indicate rocks (andesites) that constitute a good foundation ground. The andesite layers situated between 1m and 19m depth have a RQD ranging between 26% and 100%, with an average value of 79%. The monomictic breccia situated between 19m and 21m shows a very low value with a RQD equal with 16% at average. The second andesite layer, situated between 21m and 24m depth has a high resistance and a 96% RQD.

4. Hydrogeological classification of the site.

A) Certej mine exploitation zone

In this zone no significant aquiferous occur in the zone; the depth circulation of the underground water takes place at the fracture system level. The level of the underground water resulted at the infiltrations of the meteoric waters is about 80m below the 410 m level (Hondol pit). The water flow-rate of Nicodim gallery which collect the infiltrated meteoric waters of the open pit is small, below 2l/s and the water is strongly mineralized and a pH of 2,2 – 3.

The underground aquiferous which are to be impacted of the open pit, waste dump and tailings facility zones are small and do not constitute drinking water sources.

B) Tailings management facility location site In this zone, the hydrostatic level of underground water was not intercepted to the drilling depth. *The underground aquiferous* of the location site zone of the tailings facilities are small size and do not constitute drinking water sources.

The hydrogeological tests conducted in the field in 2008 and 2009 show that the rock mass is not very fractured and its permeability is below 10^{-9} m/s. The results correspond with the visual inspection of the sampled cores and RQD values.

5. Site classification from tectonics and seismic activity point of view

Certeju de Sus commune area is situated in a region which seismic intensities are probably 6. Certej zone is located in an area where the ground peak acceleration is 0.08 which is the lowest value of Romanian territory.

6. Site classification from the point of view of soils

The soils (protisoils, cambisoils, luvisols, hydrosols, antrisoils categories) of the mining site shows degradation events, processes which behave differently and on different surfaces as well as the surface erosion, depth erosion, land slides, excess of humidity resulted further to precipitations and lateral spillage. Also, the soils investigated show metal pollution, but occurring at certain



locations, and the soil pH indicate an acid or moderate acid reaction.

7. Site classification from climate point of view

Certej mining perimeter zone is characterized by a continental moderate climate. The average multi – annual value of the air temperature is 9.7 °C.

The multi annual average value of the atmospheric quietness is 60.5 %. The average speed of the wind along directions indicate values between 2.2 and 3.7 m/s.

The annual amounts of precipitations of the last 15 years ranged between 263,6 mm and 830,7 mm at Certeju de Sus. The heaviest snow fall in January – February at Certeju de Sus when the average monthly thickness of the snow layer may range , from one year to another , between 1 and 20 cm.

8. Site classification from protected areas point of view

The mining project footprint in the current alternative overlaps 108.7 hectares of the ROSPA 0132 Metaliferrous Mountains site surface area, on Măcrișului Valley. This surface area represents approximately 0.4% of the site surface area. The site covers a surface area of 26 671 hectares. The **Natura 2000 ROSPA 0132 Metaliferrous Mountains** site was designated in 2011.

The Project perimeter is at about 7.5 km East from Natura 2000 ROSCI0029 site Cheile Glodului, Cibului and Măzii and water is supplied there by a different hydrographic micro basin.

The distances between the project zone and the national reservations are:

- Limestones of Dealu Măgura 8,5 km
- Boholt reservation 6,8 km
- Măgurile Săcărâmbului 3,1 km
- Cheile Măzii 7,5 km
- Cheile Glodului 9,6 km
- Cheile Cibului 12,4 km

9. Project zoning

The project surface area is 456,2 and from architecture and urabnism point of view, it is organzied as per the territorial balance-sheet below:

- Surface used for works afferent to the project 300.5ha, respectively 65.87 %;
- Surface used for the perimetral protection area 155.7ha, respectively 34.13 % (the current use of land will not be changed for this surface).

The current use of land afferent to the project is shown in *tables below*.

Current Use of Land

USE OF LAND	SURFACE (ha)
FOREST	187.0
HAY LANDS	30.7
FARMING LANDS	5.3
RESIDENTIAL ZONES	18.7
COMMUNICATION WAYS	3.2
INDUSTRIAL ZONES	55.6
TOTAL SURFACE	300.5



Proposed Use of Land

Crt.No.	LOCATION	SURFACE (ha)
MAIN INDUSTRIAL AREA (YARD)		
1.	Certej Open Pit	62.8
2.	North Waste Dump	32.6
3.	South Waste Dump	40.2
4.	Processing Plant – yard	20.9
5.	Access roads (outside the Plant)	6.9
6.	Municipal constructions (outside the Plant)	0.2
7.	Vegetal soil dumps	7.7
8.	Protection zones (green spaces)	65.3
TOTAL Main industrial area (yard)		236.8
SECONDARY INDUSTRIAL AREA (YARD)		
9.	Flotation and CIL tailings management facilities	63.6
TOTAL INDUSTRIAL AREA		300.5
Perimetral protection area		155.7
TOTAL INVESTIGATED AREA		456.2

Project objectives are: Certej open pit, andesite quarry, waste dumps, topsoil dumps, tailings management facility dams, tailings management facilities, oxygen plant and processing plant Works for the completion of these objectives

- Opening and exploitation of open pit/borrow quarry from Macrisului Valley for construction materials (for roads, construction of the TMF dams, concrete making etc);
- Opening and exploitation of open pit Certej
- Connection to the national high voltage grid;
- Restoring of the existing industrial water supply pipeline from Mures River;
- Construction of the Processing Plant;
- Construction of the flotation and cyanidation tailings management facility dams
- Infrastructure construction (Construction of access roads to the Processing Plant and tailings management facilities)
- Construction of the other water administration facilities.

The works associated to the project objectives will be carried out in stages

- Works during the construction stage
- Works during the exploitation stage.
- Works during the closure stage
- Works during the post closure stage

For the commencement of the construction works there will be set up two main locations of the site organization:

I) Main location: platform on +605m elevation yard (as work site organization)

II) TMF main location – flotation and CIL tailings management facilities

Work site organization operations will be developed on the +540m, +575m, +577m, +590m, +605m, +625m platforms.



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Objectives of the site works will be as follows:

- Access roads to the working and storage ramps
- Ramp with the central warehouse for materials:

The central warehouse on the +605 ramp is provided with open spaces for storage:

- Ramp for the storage of metal works and ramp for the assembling of metal works
- Ramp for the closure panels;
- Ramp for bulk materials;
- Ramp for equipment storage;

There was designed a light metal hall , which can be dismantled , two containers for the storage of materials requiring special conditions of storage or for tools. All the warehouses will be provided with access for trucks.

- Metal booth for warehouse
- Locker room for workers and technical administrative staff –office type booths
- Temporary fencing
- platform for material storage (reinforcement, concrete...)
- equipment storage ramp
- PSI equipment
- ecological toilets

The works that will be performed at the work site organisation are:

- Site clearance (land clearing, etc),
- Removal and stockpiling of the vegetal soil layer,
- Land levelling according to the project requirements;
- Construction of rainfall drain ditch and collecting tanks (inverse filters) where necessary and installation of pumps for dewatering;
- Tracing and marking-out of the site in accordance with the tracing plan;
- The quantities and quality of materials and pieces will be supplied as requested in the design so to assure the commencement and continuity of works;
- Construction of access roads and material storage platform.

The drinking water supplied to the site will be bottled water. In an early stage, the power is supplied by a power generator.

Works to be carried out during the construction and exploitation stages

A. Land clearing

It will be carried out by objectives and execution stages and there will be applied for and obtained the regulating deeds for the temporary take out of use of the surface areas which will be impacted by the project implementation. The surface proposed to be deforested , its statute and the deforestation stages by years and objectives are given in the table below:



**CLEARING STRATEGY THAT WILL BE APPLIED IN THE “GOLD-SILVER ORE MINING PROJECT OF CERTEJ PERIMETER,
HUNEDOARA COUNTY”**

Crt. No.	SITE	Total surface to be cleared	Property		Clearing status		Clearing stage	
			State-owned	Private	Definitive removal from the NFF (National Forest Fund)	Temporarily occupied of the NFF	Construction	Operating stage 11 years
			(ha)	(ha)	(ha)	(ha)	(ha)	(ha)
1	Certej Open Pit	28,34	-	28,34		28,34	5,20	23,14
2	North waste dump and annexed constructions	9,20	-	9,20	-	9,20	7,55	1,65
3	South waste dump and annexed constructions	11,01	-	11,01	-	11,01	0,58	10,43
4	Processing plant	1,55	-	1,55	-	1,55	1,55	-
5	Flotation TMF and annexed constructions	62,90	37,73	25,17	-	62,90	12,23	50,67
6	CIL TMF and annexed constructions	36,00	36,00	-	36,00	-	8,82	27,18
7	Communication ways – roads	5,25	2,40	2,85	5,25	-	5,25	-
8	Urbanistic constructions	-	-	-	-	-	-	-
9	Vegetal soil dumps	-	-	-	-	-	-	-
10	“Valea Măcrișului” andesite quarry	10,86	10,86	-	10,86	-	4,13	6,73
TOTAL		165,11	86,99	78,12	52,11	113	45,31	119,80



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FOREST CLEARING STAGES OF THE “GOLD-SILVER ORE MINING PROJECT OF CERTEJ PERIMETER, HUNEDOARA COUNTY”

SITE	TOTAL SURFACE TO BE CLEARED	CLEARING STAGES												
		Constr uction	Operating Stage (11 years)											
			11 YEARS	Year 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10	Yr 11
(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	
Certej Open Pit	28,34	5,20	23,14	0,82	-	3,83	-	-	2,43	3,0	8,06	5,00	-	-
North waste dump and annexed constructions	9,20	7,55	1,65	1,65	-	-	-	-	-	-	-	-	-	-
South waste dump and annexed constructions	11,01	0,58	10,43	0,17	-	3,34	1,58	1,0	2,34	1,0	1,0	-	-	-
Processing plant	1,55	1,55	-	-	-	-	-	-	-	-	-	-	-	-
Flotation TMF and annexed constructions	62,90	12,23	50,67	7,67	7,50	5,50	5,50	5,50	4,50	4,00	4,00	3,50	3,00	-
CIL TMF and annexed constructions	36,00	8,82	27,18	3,18	3,50	3,50	2,50	2,50	2,50	2,50	2,50	2,50	2,00	-
Communication ways – roads	5,25	5,25	-	-	-	-	-	-	-	-	-	-	-	-
Urbanistic constructions	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vegetal soil dumps	-	-	-	-	-	-	-	-	-	-	-	-	-	-
“Valea Măcrișului” andesite quarry	10,86	4,13	6,73	-	0,92	1,47	3,38	0,96	-	-	-	-	-	-
Total	165,11	45,31	119,80	13,49	11,92	17,64	12,96	9,96	11,77	10,50	15,56	11,00	5,00	-



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Work stages for the deforestation works

A) Preparation of the felling area (well defined surface area) consisting of:

- division of the felling area in plots where the works will be developed for a determined period of time for a good work organization and also for the mitigation of the impact on the forestry ecosystem elements;
- clearing of the hanging trees, sick trees or dry rot trees;
- selection of the tree cutting direction, the land clearing around them and preparation of the place of the tree falling to ensure the work safety;
- selection and arrangement of the ways for taking out the wood and getting it closer to the road;
- establishment and arrangement of the primary temporary deposit.

B) Wood collection including the cutting of the trees, branch clearing, and partial finishing works (cutting the tree crown or part of the crown).

C) The wood collection including the take out of trees, (collection of stubs by dragging the trunks collection of trees with partly broken branches) and their bringing close to the forest boundary (transport by semi-dragging to the temporary storage area).

D) Clearing the felling area of branches and remaining pieces of wood.

E) Wood processing, sorting and stockpiling in primary temporary stockpiles and these works will be developed on surfaces meant for this purpose and situated close to the traffic ways.

F) The processed wood transport by vehicles from the temporary primary stockpiles to the final stockpiles arranged to this purpose.

B. Works at the topsoil dumps

The topsoils dumps will be located near the processing plant yard for the soil resulted at the open pit, North waste dump, South waste dump and yards and downstream the flotation tailings management facility.

The soil dumping and dump construction will be carried out in strict compliance with the classic technology to ensure the dump stability , and to this aim there were designed benches, slopes and there will be ensured the natural angle of the ground.

The soil volume estimated to be removed, considering that the soil thickness varies depending on the location, is 1.408.000 c.m.

C. Works prior to the execution of the tailings management facility dams:

In order to build the dams there will be previously constructed the followings:

- The gallery of Macris stream was sized for a flow rate of $Q_c = Q_{0,1\%}$ and checked for $Q_v = Q_{0,01\%}$. The gallery opening will be 1.8 – 2.1m, will be 2400 m long on the Macris valley. Macris creek water collecting gallery under the main dam. In order to avoid the penetration of floats or big-sized materials into the gallery, a bottom grate will be mounted at the upstream end of the gallery, with 10cm spaces between bars. The gallery is built on the stream riverbed with a section semi – buried in the rock. The stream waters flowing in the gallery , flow through the still basins: 2 still basins at the cyanidation TMF and 1 basin at flotation TMF .



Work stages:

The gallery will be built within the flotation TMF area and it will be also used for the diversion of the water courses during the dam construction.

To ensure the dryness of the area , there will be built a coffer dam on each branch of Macris stream upstream the dam area.

The gallery construction along the entire route is completed. The water enter the gallery through the loading chambers which have been sized using the checking flow-rates of the gallery.

The remaining tributaries are piped to the gallery and the pipeline is extended as the deposition level rise.

At the mine closure, the pluvial water from the valley sides , collected by the water network and piped to the collecting gallery ,will be taken over by the guard channels and directed to the loading chambers (stilling basins) mentioned above.

The gallery will be 2400m long on the Macrisului valley .

The main gallery will be built in two stages:

- In the first stage there will be built gallery sectors beneath the flotation TMF dam and CIL TMF dam and it is extended at the base of each embankment up to the end of the flooding zone;
- In the second stage the gallery sectors will be extended up to the final footprint boundary of the flooding zone of the two tailings facilities.

The galleries to be excavated in the fresh rock of the valley floor will have a rectangular shape .

All the works for taking over the water streams will have variable profiles.

Take over the water of streams, torrents and waters flowing on the hillsides

Lateral pipes, for piping the water resulted at the torrents

In the main gallery, during the construction there will be connected the lateral steel concrete encased pipes with diameters of 0,3 – 0,6m.

After the tailings facility rise and its reaching the final level these pipes are decommissioned and the pluvial waters will be collected by the perimeter guard channels.

The lateral pipes will follow the valley floor and will have the following sizes:

No	Site/denomination	Pipe diameter (m)
1	pipe – flotation tailings facility	0,5
2	Pipe –CIL flotation tailings facility	0,6

Stilling basin – gallery entrances

The stilling basins take over the water of the stream along which the guard channels are placed in the upstream area , of the guard channels and have the following sizes:

No	Location site/ denomination	Basin sizes (b x h x l)
1	Stilling basin no.1 flotation TMF	3 x 2 x 10
2	Stilling basin no.2 CIL TMF	2,5 x 2 x 10



3	Stilling basin no.3 CIL TMF	2 x 2 x 10
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Stilling basins – drain entrance

The lateral pipes will be built during the exploitation stage as the tailings facility rises. The stilling basins for taking over the water in the lateral pipes will be excavated in the rock as they are temporary.

No	Location site /denomination	Basin sizes (m) (b x h x l)
1	Stilling basin for pipe – flotation TMF	2 x 1,2 x 3
2	Stilling basin for pipe – CIL TMF	2 x 1,2 x 3

Guard channels at the flotation tailings management facility and cyanidation tailings management facility

The guard channels that were designed at the flotation and CIL TMF have rectangular shape and depending on the water to be taken over and then discharged are calculated from hydraulic point of view over several zones and sectors with different profiles and lengths as followsL

Sector	Length of channel (m)	Channel profile Bxh (m)
T1.1	200	0,5 x 0,4
T1.2	500	0,85 x 0,75
T2.1	300	0,80 x 0,75
T2.2	180	1 x 0,75
T2.3	120	1,0 x 0,95
T3.1	160	0,6 x 0,45
T3.2	240	0,85 x 0,8
T4.1	640	0,9 x 0,75
T4.2	205	1,15 x 1
T4.3	455	1,3 x 1,2
T4.4	600	1,5 x 1,2
T5.1	230	0,5 x 0,45
T5.2	190	0,8 x 0,6
T5.3	180	1,0 x 0,9
T6	519	0,5 x 0,5

The channels will be provided with concrete slabs. The 15 cm thick concrete slab will be placed on a levelling 5 cm concrete layer. The concrete slab of the channe is reinforced with welded net.

Two intake dams on the two branches of the Macris creek, will be made of local clayish material. The intake flotation dams will be located approximately 10m upstream the upstream limit of the starter dam and will have the following characteristics:

- Height H = 5.00m + 3.00m (foundation) = 8.00m
- Crest width = 3.00 m
- Upstream and downstream slopes 1: m = 1:2
- Intake dam length on the left branch of the valley = 28 m



- Intake dam length on the right branch of the valley = 20 m

The intake CIL dams will be located approximately 30m, 40m respectively, upstream the upstream limit of the starter dam and will have the following characteristics:

- Height $H = 5.00\text{m} + 3.00\text{m (foundation)} = 8.00\text{m}$
- Crest width = 3.00m
- Upstream and downstream slopes 1: m = 1:2
- Intake dam length on the left branch of the valley = 30m
- Intake dam length on the right branch of the valley = 40m

D) Construction of the main flotation TMF rockfill dam

The main dam will be constructed in stages, as follows:

- **The starter dam**
- **Successive dam rises.**

The main dam will be made of rockfill and has the following geometrical characteristics:

- Maximum height = 169 m
- Crest length = 480m
- Crest width = 8.00m
- Berm width: 6.00m upstream and 8.00m downstream
- Upstream and downstream slope dipping 1: m = 1:1.4 (the general slope, considering the designed berms, too, is 1:1.9)
- setting: average $h = 3.00\text{m}$ in the streambed and 1.00m on slopes

The flotation TMF starter dam will be located on the Macris stream, with axis at approx. 550m upstream the confluence between Macris stream and the right affluent, Pârâul lui Avram.

The cross section of the starter dam has the following constructive elements:

- Crest level 625.0 mdM
- Thalweg level in the dam axis 547.0 mdM
- Dam height 78 m (81m with foundation)
- Fixing in the base rock, in the streambed: 3.0 m
- Fixing in the base rock, on slopes: 1.0 m
- Maximum dam height: 48.0 m
- Crest length: 243.0 m
- Crest width 6.0 m
- Upstream slope gradient 1: m = 1:1.4
- Downstream slope gradient 1: m = 1:1.4
- Berm width - *upstream:* 6.0 m
- *downstream:* 8.0 m
- Number of berms: - *upstream:* 3
- *downstream:* 4
- Height between berms- *upstream:* 15.0 m
- *downstream:* 20.0 m



- Berm levels:
 - *upstream:* 580.0; 595.0; 610.0 mdM
 - *downstream:* 545.0; 565.0; 585.0; 605.0 mdM

The dam will be made of rockfill (non-degradable andesites) in successive layers of 0.50 – 0.75m, compacted by a vibrating compactor to the parameters resulted from the experimental track.

The upstream slope is protected by 3 filtering layers, namely:

- Coarse filter of 1.50 m thickness, made of crushed stone
- Fine filter, 1.50 m thick, made of gravel and sand
- Over the fine filter, there will be laid a geotextile and a PEHD geomembrane for water proofing the dam.

In order to fix the dam, it is necessary to clear the territory by removing the bushes, trees and vegetal material as well as part of the altered rock or which is not fixed well.

Twinning benches will be made in the slope, 1.50 – 2.0 m wide and 2.0 – 3.0 m high.

Main rockfill dam of the CIL TMF will be built in several stages as follows:

- **Starter dam,**
- **Successive rises completed during the operational mine life .**

The geometry features of the dam are given below:

- Maximum height = 70m
- Crest of wave length = 480m
- Crest of wave width = 8.00m
- Berm width: 6.00m upstream and 8.00 downstream
- Inclination of the upstream and downstream slopes 1: m = 1:1.4 (general slope considering the designed berms is 1:1.9)
- Foundation: average h = 3.00m in the river bed and 1.00 m on the hillsides

The starter dam of the CIL TMF is located at the confluence between the first two streams forming Măcriș stream on the 741.00mdM elevation.

The cross section through the main dam includes the following constructive elements:

- | | |
|---|--|
| - Cres of wave level | 780.0 mdM |
| - Valley floor level in the dam axis | 741.0 mdM |
| - Dam height | 39,0 m |
| - Base rock embankment in the riverbed: | 3.0 m |
| - Base rock embankment on the slopes: | 1.0 m |
| - Maximum dam height (with foundation): | 42.0 m |
| - Crest of wave length: | 162.0 m |
| - Crest of wave width | 6.0 m |
| - Upstream slope inclination | 1: m = 1:1.4 |
| - Downstream slope inclination | 1: m = 1:1.4 |
| - Berm width | - upstream: 6.0 m
- downstream: 8.0 m |
| - Berms number: | - upstream: 3
- downstream : 3 |
| - Height between the berms | - upstream: 10.0, 15,0 m |



- downstream: 20.0 m
- Berm level:
 - downstream: 755.0; 770.0 mdM
 - downstream: 740.0; 760.0 mdM

The dam is built of rockfill (non –weathering andesites) in successive layers (0.50 – 0.75) m which are consolidated using a smooth vibrating compactor up to reaching the parameters resulted at the experimental track. The rockfills are purchased from the quarry located on the future flotation TMF site.

The upstream slope is protected with 3 filtering layers and namely:

- Coarse filter of 1.50 m made of broken stones
- Fine filter of 1.5 m thick made of gravel and sands
- Over the fine filter there is a geotextile and a PEHD geomembrane for the dam impermeabilization.

In order to enclose the dam it is necessary to clear the dam area by removing the bushes and trees and the vegetation as well as a part of the weathered rock.

On the slope there will be built benches of (1.50 – 2.0) m wide and (2.0 – 3.0) m high.

Dam rise of the flotation TMF to the final elevation

The dam rise to the final elevation is carried out in stages by means of successive rise of the starter dam.

The rise stages of the dam are:

- Stage I – downstream rise to the 640.0 mdM level
- Stage II – downstream rise to the 655.0 mdM level
- Stage III – downstream rise to the level 670.0 mdM
- Stage IV – vertical rise to the 675.0 mdM level
- Stage V – vertical rise to the 680.0 mdM level
- Stage VI – vertical rise to the 685.0 mdM level
- Stage VII – vertical rise to the 690.0 mdM level
- Stage VIII – vertical rise to the 695.0 mdM level
- Stage IX – vertical rise to the 700.0 mdM level
- Stage X – vertical rise to the 707.0 mdM level

The cross section through the dam to the final level includes the following constructive elements:

- Crest of wave level 707.0 mdM
- Level of the valley floor in the dam axis 538.0 mdM
- Dam elevation 169.0 m
- Embedding in the host rock in the riverbed: 3.0 m
- Embedding in the host rock on the valley sides: 1,0 m
- Maximum dam elevation 172.0 m
- Crest of wave length 480.0 m
- Crest of wave width 8.0 m
- Upstream slope inclination 1: m = 1:1,4
- Downstream slope inclination 1: m = 1:1,4
- Berm width
 - upstream: 6.0 m
 - downstream: 8.0 m



- Number of rise downstream 3
- Elevation between the downstream rise 15.0 m
- Downstream rise level: 640.0; 655.0; 670.0 mdM
- number of vertical rises (maintaining the dam centreline)
- elevation between downstream rises: 6 rises of 5.0 m
1 rise of 7.0 m
- vertical rise elevations: 675.0; 680.0; 685.0; 690.0; 695.0; 700.0; 707.0 mdM
- elevation between the downstream berms at each rise: 20.0 m
- level of the downstream berms for the final rise to the 707,0 mdM level: 547.0; 567.0; 587.0; 607.0; 627.0; 647.0; 667.0; 687.0 mdM

The rises of the main dam for the construction of the facility for the flotation tailings storage are made of rockfill (non weathering andesites) in successive layers of (0.50 – 0.75) m consolidated with vibrating compactor, up to the achievement of the parameters resulted at the experimental works.

The upstream slope is protected with 3 filtering layers and namely:

- coarse filter of 1.50m thick made of broken stone with particle sizes of up to 70 mm
- fine filter of 1.5 m thick made of gravels and sand
- erosion proof filter of 1.5 m thick

For the vertical rise (670 – 707.0 m levels) a geotextile of separation between the rise stges will be provided. In order to embed the dam it is necessary to clean the area by taking out the bushes and trees and the vegetation as well as a part of the altered rock or weakly fissured rock. There will be built twinning benches with width of (1.50 – 2.0) m and elevations of (2.0 – 3.0) m.

Header embankment of the flotation TMF

The header embankment of a zone with levels beneath the flotation TMF level (between the 670 and 707m levels) will be placed on the left valley side at the source of the first tributary, namely, Măcriș stream situated upstream the main dam.

The side closure dam consists of:

- Starter dam with H = 10m
- 4 rises of 5m each and a rise of 7m of the dam with successive rise of the crest of wave to the levels: 685.00m, 690.00m, 695.00m, 700.00m, and 707.00m.

The cross section of the starter dam show the following constructive elements:

- Crest of wave 680.0 mdM
- Valley floor level in the dam axis 670.0 mdM
- Dam height 10 m
- Embedding in the host rock: 1.0 m
- Maximum dam height: 13.0 m
- Crest of wave length: 54.0 m
- Crest of wave width 8.0 m
- Inclination of the upstream slopes 1: m = 1:1.4
- Inclination of the downstream slopes 1: m = 1:1.4

The dam is built of rockfill (non-weathering andesites) in successive layers of (0.50 – 0.75) m which are consolidated with a vibrating smooth compactor up to reaching the parameters resulted at



the experimental track.

The central body of the dam is made of clay ensuring the dam sealing.. The clay is protected by 2 filtering layers downstream and namely:

- Coarse filter of 1.50 m thick made of broken stone
- Fine filter of 1.5 m thick made of gravel and sands

In order to build the dam foundation it is necessary to clear the area by taking out the bushes and trees and vegetal material as well as a part of the weathered rock. There will be twinning benches of (1.50 – 2.0) m wide and (2.0 – 3.0) m high.

The header embankment rise will be in stages with successive rises of the starter dam.

The dam rise stages are:

- Stage I – vertical rise to the level 685,0 mdM
- Stage II – vertical rise to the level 690. mdM
- Stage III – vertical rise to the level 695.0mdM
- Stage IV – vertical rise to the level 700.0mdM
- Stage V – vertical rise to the level 707.0mdM

The cross section of the dam to the final level include the following constructive elements:

- Crest of wave 707,0 mdM
- Valley floor level in the dam axis 670.0 mdM
- Dam height \ 37.0 m
- Embedding in the host rock 1.0 m
- Maximum dam height: 40.0 m
- Crest of wave length: 171.0 m
- Crest of wave width 8.0 m
- Inclination of upstream slopes 1: m = 1:1.4
- Inclination of downstream slopes 1: m = 1:1.4
- Berm width - upstream: 8.0 m
- Number of vertical rises (maintaining the dam axis) 5
- Height between the downstream rises: 4 rises of 5.0 m each
1 rise of 7.0 m
- Vertical rise levels: 685.0; 690.0; 695.0; 700.0; 707.0 mdM
- Elevation between the downstream berms at each rise: 20.0 m
- The downstream levels for the rises to the final level 707.0 mdM: 667.0; 687.0 mdM

At the vertical rises , upstream (685.0 – 707.0 m levels) a geotextile will be provided for separation.

Header embankment upstream the flotation TMF

The header embankment upstream the flotation TMF is located along Macris stream at about 950m from the main dam, the distance being measured along the water course.

The cross section of the dam include the following constructive elements:

- crest of wave level 720.0 mdM
- valley floor level in the dam axis 695.0 mdM
- dam height 25.0 m
- host rock embeddement on the valley sides: 1.0 m
- host rock embedding on the riverbed 3.0m



- maximum dam height: 28.0 m
- crest of wave length: 85.0 m
- crest of wave width 6.0 m
- downstream berm width 8.0m
- inclination of upstream slopes 1: m = 1:1.4
- inclination of downstream slopes 1: m = 1:1.4

The dam is built of rockfill (non-weathering andesites) in successive layers of (0.50 – 0.75) m which are consolidated with a vibrating smooth compactor up to achieving the parameters resulted at the experimental track. The downstream slope is protected with a erosion proof filter of 1.5m thick. Over the erosion proof filter there will be placed a geotextile and geo –membrane made of PEHD in order to ensure the dam imperviousness. To build the dam foundation it is necessary to clear the area by taking out the bushes and trees and the vegetal material as well as a part of the altered rock. There will be built twinning benches of (1,50 – 2,0) m wide and (2,0 – 3,0) m high on the valley side.

Dam rise to the final level – CIL TMF

The dam rise to the final level of the CIL TMF is carried out in stages by successive rises of the starter dam.

The stages of the dam axis rise are:

- Stage I – downstream rise to the 785.0 mdM level
- Stage II – vertical rise to the 790.0 mdM level
- Stage III – vertical rise to the 795.0 mdM level
- Stage IV – vertical rise to the 800.0 mdM level
- Stage V – vertical rise to the 805.0 mdM level
- Stage VI – vertical rise to the 810.0 mdM level

The dam cross section after this stage include the following constructive elements:

- Crest of wave level 810.0 mdM
- Valley floor level in the dam axis 740.0 mdM
- Dam height 70 m
- Host rock embedding in the river bed: 3,0 m
- Host rock embedding on the slopes: 1.0 m
- Maximum dam height: 70.0 m
- Crest of wave length: 305.0 m
- Crest of wave width 8.0 m
- Inclination of upstream slopes 1: m = 1:1.4
- Inclination of downstream slopes 1: m = 1:1.4
- Downstream berm width 8.0 m
- Number of downstream rises 1
- Elevation between downstream rises: 5.0 m
- Downstream rise levels: 785.0 mdM
- Number of vertical rises (maintaining the dam axis) 5
- Elevation between the downstream rises: 5.0 m



- Vertical rise level: 790.0; 795.0; 800.0; 805.0; 810.0 mdMN
- Elevation between the downstream berms at each rise: 20.0 m
- Levels of the downstream berms for the final rise to the level 810.0 mdM: 730.0; 750.0; 770.0; 790.0 mdM

The final rise stages to the upstream side of the dam are:

- Stage VII – upstream rise to the 812.50 mdM
- Stage VIII – upstream rise to the 815.00 mdM level
- Stage IX – upstream rise to the 817.50 mdM level
- Stage X – upstream rise to the 820.00 mdM level
- Stage XI – upstream rise to the 822.50 mdM level
- Stage XII – upstream rise to the 825.50 mdM level
- Stage XIII – upstream rise to the 827.50 mdM level

The dam rises are built of rockfill (non-weathering andesites) in successive layers of (0.80 – 1.00) m consolidated using a smooth vibrating compactor up to the achievement of the parameters obtained at the experimental track. The rockfill are supplied from the quarry located in the basin of the future flotation tailings management facility.

The upstream slope is protected by 3 filtering layers and namely:

- Coarse filter of 1.50m thick made of broken stones;
- Fine filter of 1.5m thick made of gravel and sands
- Erosion proof filter of 1.5m thick

In case of vertical rises, (790 – 810.0 m levels) a separation geotextile will be provided.

In order to perform the dam fixing it is necessary to clear the bushes and trees and vegetal material as well as some of the altered rock. In the valley side there will be built twinning benches of (1.50 – 2.0) m wide and (2.0 – 3.0) m high.

E) Channel for the collection and discharge of seepage from tailings management facilities

The TMF seepage will be collected by a channel at the base of the dam and discharged to a downstream storage tank. Subsequently, the waters will be pumped from the storage tank back to the TMF, from where, they will be recycled in the processing plant together with the TMF water.

The TMF seepage will be caught by channel C1, with the mention that on the upstream section of the channel (upstream of the dam), at each dam rise, the channel bottom will be lowered to the dam foundation base (to ~3.0mm) to ensure the complete catchment of the dam seepage. That will be repeated for each dam rise.

- The depth of the channels must correspond with the depth of the dam foundation: ~3.0m in the streambed
- The channel slope from the dam side will be permeable, made of rubble dry wall
- The bottom and the other slopes will be waterproof: cut in rock or made of rubble dry wall with cement mortar, based on the depth of the base rock.

The channel has the following characteristics:

- depth = 1.00 – 3.00 m
- base = 1.00m
- 1: m = 1:1



The channel is protected by waterproof rubble dry wall with cement mortar, 25cm thick. The dry wall will be placed on a draining layer of ballast or sand with a thickness of 10-20 cm.

F) Flotation TMF rainfall catchment and discharge channels

The pluvial waters from the slopes will be caught and discharged by channel on the left slope and channel on the right slope. The pluvial waters will be discharged straight into the Macris stream.

The rainfall discharge channel section has the following characteristics:

- The V-shaped section
- Depth $h = 1.00$ m
- Base $b = 0.50$ m
- $1: m = 1:1$

The section will be protected by a rubble dry wall with a 25cm thickness, placed on a ballast (sand) layer with a 20cm thickness. When delluvium surfaces will be stripped, the protection of such surfaces was designed providing geogrid surfaces with topsoil to prevent the surface erosion which could impact the channel construction. The following table gives the lengths of the seepage and rainfall discharge channels, based on the main dam rise:

Dam elevation	Channel C1 (m)	Channel C2 Left bank (m)	Channel C3 Right bank (m)
625,00	340	560	560
640,00	290	540	560
655,00	230	520	550
670,00	140	480	550
707,00	40	480	600

Channels for the collection and discharge of pluvial waters at the cyanidation tailings management facility

The rainfall water from the dam sides flows will be collected on the channels C2 on from the left hand valley side and C3 on the right hand valley side. The rainfall waters will be discharged directly in the flotation TMF. The standard profile of the rainfall discharge channels indicate the following characteristic features:

- Trapezoidal shape profile
- depth = 1,00 m
- base $b = 0,50$ m
- $1: m = 1:1$

Protection of the profile is made with sloping walls of coarse stone of 25 cm thick placed on a ballast layer (sand) of 20 cm thick. When delluvium surfaces will be stripped, the protection of such surfaces was designed providing geogrid surfaces with topsoil to prevent the surface erosion which could impact the channel construction.

The table below gives the lengths of the discharge channels of seepage and rainfallw aters depending on the main dam rise

Dam elevation	Channel C1 (m)	Channel C2 Left bank	Channel C3 Right bank
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		(m)	(m)
780	160	360	380
785	140	360	380
810	50	350	420
827,5	50	460	510

G) Stripping work – Certej open pit

The preparation of the Certej deposit for the open-pit mining is done by digging the existing mining workings, namely the opening trenches and preparation trenches.

There will be more types of trenches in the Certej open pit, namely:

- The main trench (main access road) which allows the access from the surface to the working levels of the open pit, serving for the whole period of the mining operations
- The preparation trench, which creates the initial face for the open-pit bench mining (it will be cut from the main trench)
- The special trench, which is a connecting trench with auxiliary role, allows the shifting of the rolling stock and open-pit equipment

The open pit design includes two main access ramps, with 1:10 slope, one of them serving the West zone and the other one serving the Central, Intermediate and East zones. Each of the main ramps will be 24m wide for the safe working of the dump trucks on two directions. On the deeper sectors of the open pit, the ramps will be 12m wide, taking the shape of a one way road. The opening works were planned in such a manner, from both technical execution and time grading points of view, so to enable the normal progress of the open-pit technological process without interruptions.

The mining preparation works will involve in the first stage the removal of the altered material from the existing benches, concurrently with the construction of the access road to the designed upper benches. The stripping works will be conducted gradually, the vegetal soil and sedimentary material produced by deluge will be removed by means of bulldozers or front end loaders. The mining opening and preparation works will be carried out prior to the mining works in order to ensure the working face. Depending on the nature of the above-ground, of the roof rocks respectively, this will be dumped in the waste dump and/or partly or totally used for beneficiation.

H) North and South Waste Dump Arrangement Works

Basement arrangement

The land will be cleared of vegetation and the waters will be discharged from the site territory.

The delluvial layer sliding on the host rock is removed. The sedimentary material produced by deluge will be removed from the base rock layer. The zones with $>10^0$ gradient will be arranged with twinning benches for the dumped waste to be adequately wedged. The twinning benches will be created by building reverse slopes, opposite the gradient of the basement. Delluvial clayish deposits will be removed and transported to the soil waste dump, before starting the depositions, in order to allow an efficacious natural drainage and to avoid differential settling caused by waste depositions, inhomogeneous as petrographic composition. The dump base will be scarified to create a wedge between the dumped material and host rock and to create the dump stability. The



resistance of the basement – waste dump contact can be improved by partly scarifying the basement rocks. The procedure is based on the reduction of the surface of minimum resistance by digging trenches, steps in the basement, transversely on the slope dipping direction.

Drains on the North and South waste dumps basements

The drains will be made of coarse rock from the unaltered stripping material, before starting storing the waste. The coarse rock will be laid down on the line of the torrents and springs existing on the waste dump territory and will have a variable grading, ranging from 20-200mm (cobbles) to 2-20mm (gravel).

The length and section of the drains that will be constructed for the North Waste Dump are given in the table below:

Crt. No.	Drain	Surface mp	Length, m	h (height), m	b (width), m
1	A	22.500	170	0,74	0,61
2	B	60.000	350	0,76	0,63
3	C	78.750	450	0,80	0,66

The length and section of the drains that will be constructed for the South Waste Dump are indicated in the table below:

Crt. No.	Drain	Surface mp	Length, m	h (height), m	b (width), m
1.	A	0,418	280	0,478	0,395
2.	B	0,332	350	0,426	0,352
3.	C	0,522	450	0,534	0,442
4.	D	0,503	280	0,524	0,434
5.	E	0,343	260	0,433	0,358
6.	F	0,585	260	0,458	0,379

Abutment walls to the two waste dumps

The North waste dump will be protected by an abutment wall with a total length of 600 m and the abutment wall that will be built at the foot of the South waste dump will be 100m long.

The abutment walls will be built at the foot of the waste dumps using 5m sections, with settlement joints between them. For the construction of joints, it will be used an asphalt board sheet or the alternative placement of sections in successive stages. The wall setting will be done in base rock, which is overlain by the delluvial layer with variable thickness. Also, the crest of the wall sections will be made of approx. 0.50m steps, following the natural slope of the existing ground. The foundations and elevations will be made of concrete.

Behind the wall, a drain will be made of stone non-resistant to frost/thaw, sealed at the upper part with a clay plug and placed on a concrete water-collecting culvert at the lower part. From the culvert, the water will flow through ø15 cm weepers, made of prefabricated concrete or PVC tubes, outside the wall, being subsequently collected by a ditch. These waters will be collected by the acid water catchment basins corresponding to each waste dump, which will be described below. The weepers will be 2.50m distanced. The inside face of each wall will be coated with an insulating bitumen layer.



Water catchment and discharge from the North waste dump territory

It aims at channelling the Coranda creek on the North waste dump territory in order to control the discharge of the flow rates of Floroiaia and Toader streams, which form the Coranda creek.

a. Discharge gallery beneath the North Waste Dump

Maximum flow-rate 1% = 8,65 c.m/s , corresponding to the II category of importance according to the STANDARD 4273 – 83, will be discharged beneath North waste dump through a gallery which follows the current riverbed of Coranda stream.

It is noticed that the designed gallery may discharge also the maximum flow rate corresponding to the probability of excess rate of 0.1%, $Q_{max} 0,1\% = 14.88$ c.m/s.

The canalization of Coranda stream in North waste dump zone includes the following works:

Discharge gallery of water beneath North waste dump of $L = 1,050$ m and a unique section made of reinforced concrete – the base plate and the walls – of rectangular shape with arched roof made of prefabricated concrete

b. Constructions upstream the gallery

Along Coranda stream, (Floroiaia), upstream the water input in the gallery there were designed the following works:

-The arrangement of the riverbed over $L = 20$ m, with rough stone cement mortar pitching and 2 drops of $h = 1,50$ m

-Reinforced concrete basin (3.40 x 5.85)m and 2.6 m deep.

-Reinforced concrete portal upstream gallery, $h = 2.5$ m, $b = 3.9$ m

c. Constructions downstream gallery

For connecting the discharge gallery to the natural riverbed of Coranda stream the following works were performed:

- Portal downstream the gallery, of reinforced concrete with $h = 2.5$ m, $b = 3.9$ m

- Energy dissipator made of reinforced concrete (12.5 x 3.2)m and $h = 2,5$ m

Energy dissipator situated along Coranda stream riverbed, at the water outflowing the gallery and made of reinforced welded wire concrete and consisting of two sectors:

- Zone connecting the gallery and the basin $L = 3.0$ m

- Dissipator itself $L = 9.5$ m

Downstream the basin:

- there is a rockfill rough stone spillway of 5.0m long, the spillway sector being Vee shaped.

- arrangement of Coranda stream riverbed along $L = 125$ m, consisting of the cross section calibration and connecting the riverbed floor between the gallery exit level at 434.50mdMN (situated at -5,50m, against the natural floor 440,00mdMN), and the natural floor 430,00 mdMN, **situated 125m downstream.**

Guard channels

The guard channels designed at North have been designed and calculated from hydrotechnical point of view, with different profiles and length as follows:

Sector	Channel length (m)	Channel profile bxh (m)
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T _{1,2} (Coranda stream gallery – discharge of precipitation water flowing out the hillsides)	375	0,7 x 1
T _{1,1} (Coranda stream gallery – discharge of precipitation water flowing out the hillsides)	165	0,5 x 0,85
T ₂ (Valea Macrisului stream –discharge of water from precipitations flowing out the hillsides)	309	0,5 x 0,5
T ₃ (storage basin no.2– infiltration water possibly acid flowing out the hillsides)	328	0,5 x 0,9
T ₄ (discharge in Coranda stream gallery –precipitation waters)	321	0,5 x 0,7
T _{5,1} (sedimentation basin – storage basin no.1 –discharge of acid water – infiltration water possibly acid flowing out the dump)	320	0,4 x 0,6
T _{5,2} (sedimentation basin – storage basin no.1 discharge of acid waters and water from infiltration possibly acid flowing out the waste dump)	200	0,5 x 0,9
T _{5,3} (sedimentation basin – storage basin no.1 discharge of acid waters and water from infiltration possibly acid flowing out the waste dump)	228	0,7 x 0,9

The guard channels will be made of concrete with walls of 15cm thick and it will be palced on a concrete levelling layer of 5cm thick.

Acid water sedimentation basin

Sector	Basin sizes (L x B x H)	Total elevation (m)
T _{5,1} , T _{5,2} și T _{5,3} (discharge in sedimentation basin -infiltration waters possibly acid)	12 x 6 x 3,5	4

The basin is an underground open structure made of monolith reinforced concrete.

Acid water storage basin no. 1 and no. 2

According to the STANDARD 4273, the acid drainage storage basins are water constructions of the IV importance category and according to STANDARD 4068/2 they are calculated for maximum flow rate of 5%.

These basins will be located downstream North waste dump according to the layout plan and wered esigned to collect the rain water flows with 5% excess . The flowing water resulted at North waste dump will be directed through the guard channels to a sedimentation basin and the water flow rate reduces and allows the suspension sedimentation. The sedimentation basin sizes are 12m x 6m x 4,1m. The sedimentation basin overflow will be collected through the discharge channel in the water storage basin no.1 . The sedimentation basin will be made of concrete and periodically there will be carrie out maintenance works to remove the sediments, which will be delivered to the flotation TMF. The acid water storage basins no.1 and no.2 are underground open structures made of acid proof protection reinforced concrete.

Storage basin no.1 of the North waste dump will have a usefl capacity of 3,000 c.m and sizes of L x B x H = 81m x 18,5m x 2m.

The capacity of the Storage basin no.2 of the North waste dump will be 1,200m³ and sizes of L x B x H = 30m x 20m x 2 m.



Water catchment and discharge from the South waste dump territory

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It represents the assembly of hydrotechnical workings that aim at clearing the Coranda-Certej open pit and South waste dump by diverting the Ciongani creek and its affluents (Groazei creek, Borzii creek, Valley 1 and Valley 2) into the neighbouring Paraul Mare hydrographic basin.

The surface water diversion system will include the following main workings:

1) **Guard channel on the eastern side of the Coranda open pit**, ($L = 250\text{m}$) sized for $Q_{\max 1\%} = 0.70 \text{ mc/s}$, with V-shaped section with $b = 0.50 \text{ m}$, $h = 1.00 \text{ m}$, $1:m = 1:1$. The channel will be made of dry rubble walling and cement mortar pitching at the inner surface of the channel, at the contact with water. The guard channel will discharge the taken-over flow-rate into the Groazei creek, upstream the intake dam

2) **The common catchment of the Ciongani and Groazei stream waters** situated to the East part of the open pit are built with concrete weirs of $H = 0,50\text{m}$ connected to the hillsides situated at 30m respectively 20m from their confluence.

The catchment of 2 streams together with the guard channel for the proposed open pit are connected and form the Diversion channel of water and for the discharge in Pârâu Mare stream.

The caught flow-rates will be discharged through a channel crossing the dam and which was sized for the $Q_{\max 1\%} = 18.52 \text{ c.m/s}$

3) **Discharge channel of the caught flow-rates into the Paraul Mare creek.**

The diversion channel has been divided into the following five sections:

- **Section I**, $L = 40 \text{ m}$, V-shaped section, $b = 2.00\text{m}$, $h = 2.30 \text{ m}$, $1:m = 1:0.5$ with a rectangular-shaped basin at the bottom with $b = 1.00 \text{ m}$, $h = 0.50 \text{ m}$, $Q_{1\%} = 18.52 \text{ c.m/s}$, $h_{1\%} = 1.07 \text{ m}$, $Q_{0.1\%} = 31.85 \text{ c.m/s}$, $h_{0.1\%} = 1.47 \text{ m}$

- **Section II**, $L = 110 \text{ m}$, V-shaped section with $b = 2 \text{ m}$, $h = 2.3 \text{ m}$, $1:m = 1:0.5$ with a rectangular-shaped basin at the bottom with $b = 1.00 \text{ m}$, $h = 0.50 \text{ m}$, $Q_{1\%} = 22.11 \text{ c.m/s}$, $h_{1\%} = 2.11$

- **Section III**, $L = 760\text{m}$, V-shaped section $b = 2 \text{ m}$, $h = 2.3 \text{ m}$, $1:m = 1:0.5$ with rectangular-shaped basin at the bottom with $b = 1.00 \text{ m}$, $h = 0.50 \text{ m}$, $Q_{1\%} = 23.25 \text{ c.m/s}$, $h_{1\%} = 2.17\text{m}$

- **Section IV**, $L = 490 \text{ m}$, V-shaped section $b = 2 \text{ m}$, $h = 2.3 \text{ m}$, $1:m = 1:0.5$ with rectangular-shaped basin at the bottom with $b = 1.00 \text{ m}$, $h = 0.50 \text{ m}$, $Q_{1\%} = 24.88 \text{ c.m/s}$, $h_{1\%} = 2.25\text{m}$

- **Section V**, $L = 100 \text{ m}$, V-shaped section $b = 2 \text{ m}$, $h = 2.3 \text{ m}$, $1:m = 1:0.5$ with rectangular-shaped basin at the bottom with $b = 1.00 \text{ m}$, $h = 0.50 \text{ m}$, $Q_{1\%} = 24.88 \text{ c.m/s}$, $h_{1\%} = 2.25\text{m}$

4) **Works on the diversion channel**: 3 affluent catching (Borzei stream, Valley 1, Valley 2), 3 water chutes - 0.50m high, 5 water chutes - 0.75m high, 1 culvert at the crossing point of the channel with a local road

5) **Regularization of the Pârâu Mare stream**, for discharging the stream maximum flow rate, $Q_{\max 1\%} = 5.80 \text{ c.m/s}$ and the maximum flow rate diverted from the Ciongani hydrographic basin, $Q_{\max 1\%} = 24.88 \text{ c.m/s}$. Considering that Paraul Mare stream crosses the Bocsă Mica village and that the discharged flow rates will increase approximately 5 times, it has been proposed to resize and consolidate the current streambed in concordance with the new circumstances. It has been designed the decrease of the streambed slope from approximately 0.10 to 0.05% , in concordance with the admissible maximum water speeds. The slope decrease has been done with the help of 70 chutes of 1.50m height.

6) **Culverts made of prefabricated concrete tubes – Premo tubes**, located at the intersection of the regularized Paraul Mare stream with the roads from inside the built up area of Bocsă Mica village. These are placed at water crossing points, over streams with low flow-rates of $0-2 \text{ c.m/s}$, for



the execution of some emergency works, therefore they are temporary works executed in special cases only and for limited use. The execution consists of placing Premo tubes with 1m diameter and 6m length.

d. Guard channels

The guard channels that have been designed for the South waste dump will be V-shaped and depending on the water quantity they will take over and then discharge, they have been hydrotechnically calculated by segments with different sections and lengths

Sector	Channel length (m)	Channel profile bxh (m)
T _{1.1} (discharge in the settling pond – acid water storage basin no 3 South waste dump – possibly acid water flowing on the dump)	443	0,5 x 0,9
T _{1.2} (discharge in the settling pond – acid water storage basin no 3 South waste dump – possibly acid water flowing on the dump)	416	0,7 x 0,9
T _{1.3} (discharge in the settling pond – acid water storage basin no 3 South waste dump – possibly acid water flowing on the dump)	365	0,7 x 1,1
T ₂ (discharge in the settling pond – acid water storage basin no 3 South waste dump – possibly acid water flowing on the dump)	309	0,5 x 0,75

The guard channels will be built of concrete with 15 cm thick walls and will be palced on a levelling 5 cm concrete layer. The slope of the channel base considered for the profile calculation is 1%.

Acid drainage settling pond

Sector	Basin size (L x B x H _{util})	Total height (m)
T _{1.1} , T _{1.2} , T _{1.3} și T ₂ (discharge in the settling pond – acid water storage basin no 3 South waste dump – possibly acid water flowing on the dump)	30 x 6 x 3,5	4

From the acid drainage settling basin its overflow is taken over by a rectangular channel directing the acid drainage to the acid drainage storage basin no.3 South waste dump.

Storage basin South Dump

According to the STANDARD 4273, the acid drainage storage basins are water constructions of the IV importance category and according to STANDARD 4068/2 they are calculated for maximum flow rate of 5%.

Based on the dimensioning calculations, two acid water collecting basins have been designed. The basin will have a capacity of 3,000mc. This basin will be located downstream the South waste dump according to the layout plans and was designed to collect the pluvial waters wit an excess rate of 5%. The water flown on the South waste dump will be directed through the guard channels in a settling basin where the water flowing rate is reduced and allow the suspension sedimentation. The settling basin will be 25m x 6m x 4m. The settling basin overflow will be collected through the dicscharge channel to the acid drainage storage basin. The settling basin will be made of concrete requiring peridoical maintenance to remove the accumulated sediments which will be taken to the flotation TMF.



The acid drainage storage basin of South waste dump is an open underground construction made of reinforced concrete with acid proof material.

The storage basin of South waste dump will have capacity of 3.000m³ and sizes of L x B x H = 50m x 30m x 2m.

I) Pipeline corridor

At the determination of the pipeline route the following issues have been considered:

- Construction of continuous , increasing slope from the processing plant to the tailings management facility
- Construction of a slope which does not exceed 10% so that to build the road allowing the access for the pipeline execution, exploitation and intervention

The pipeline routes grade is more than 10% only within the upward zones towards the tailings management facilities (dam zones).

On the dam crest of wave, at different stages of the rises there will be erected pipelines for the tailings discharge in the tailings management facilities. Within this zone, (dam crest of wave) the pipeline will be on the same level.

After the dam rise completion, the discharge pipe located on the crest of wave of the lower bench is recovered and mounted on the risen dam crest of wave.

The pipes are placed above the ground , on concrete supports ensuring the necessary grades.

The crossing of ravines is carried out by means of reinforced concrete pillars for the passing over.

The flotation tailings piping to the flotation TMF shows the following features:

- **Section 1** – section within the processing plant ramp:
Dn = 250 mm; length = 336 m,
- **Section 2** – Dn = 250 mm; length = 1648 m,
- Zone of the discharge pipe on the dam crest of wave on the 625.00 mdM level includes:
 - Junction leg Dn = 200 mm; L = 50 m,
 - Discharge pipe Dn = 200 mm; L = 200 m;
- **Section 3** – Dn = 200 mm; L = 85 m;
- Zone of the discharge pipe on the dam crest of wave on the 670.00 mdM level consisting of:
 - Junction leg Dn = 200 mm; L = 80 m,
 - Discharge pipe Dn = 200 mm; L = 330 m;
- **Section 4** – Dn = 200 mm; L = 90 m; I = 0,411
- Zone of the discharge pipe on the dam crest of wave on the 707.00 mdM level consisting of:
 - Discharge pipe Dn = 200 mm; L = 475 m;

Cyanidation tailings pipe to the CIL tailings facility has the following features:

- **Section 1** – section of the processing plant ramp: Dn = 200 mm; length = 150 m,
- **Section 2** – Dn = 150 mm; length= 253 m,
- **Section 3** – Dn = 150 mm; length = 592 m,
- **Section 4** – Dn = 150 mm; length= 174 m,
- **Section 5** – Dn = 150 mm; length = 72 m,
- **Section 6** – Dn = 150 mm; length = 160 m,
- **Section 7** – Dn = 150 mm; length = 156 m,
- **Section 8** – Dn = 150 mm; length = 78 m,



- **Section 9** – Dn = 150 mm; length = 54 m,
- **Section 10** – Dn = 200 mm; length = 2350 m,
- **Section 11** – Dn = 150 mm; length = 63 m,
- The discharge pipe zone on the dam crest of wave on the 780.00 mdM level consists of:
 - Junction arm Dn = 150 mm; L = 88 m,
 - Discharge pipe Dn = 150 mm; L = 157 m;
 - **Section 12** – Dn = 150 mm; length = 88 m,
 - Zone of the discharge pipe on the dam crest of wave on the 810.00 mdM level consisting of:
 - Junction arm Dn = 150 mm; L = 295 m,
 - **Section 13** – Dn = 150 mm; length = 60 m,
 - The zone of the discharge pipe on the dam crest of wave on the 825.00 mdM level consists of:
 - Junction arm Dn = 150 mm; L = 430 m

Clarified water recycling system

Flotation Tailings Management Facility

The technological pipes used for the clarified water recycling to the flotation TMF with diameter of Dn 150 and Pn 25 bars. The entire pipeline consists of metal pipes.

Along the sector of the buried pipeline the pipe will be sealed against corrosion. Along the route, the recycled water pipe passes through 4 depression zones because of some streams where the pipe will be above the ground. Along the above ground sectors the pipeline will be mounted on supports and thermally insulated against the freezing. Along the route where the pipe passes under the road traffic zones it is encased in a metal tube. At the highest level in the pipe is mounted in a concrete manhole provided with ventilation valve to eliminate the air pockets.

In case of damage, a part of the pipe remains filled with water and there is provided a discharge installation of the pipe consisting of a concrete manhole with two compartments communicating between them, in one of the compartments there is the discharge line provided with a slide valve, and the second compartment is a buffer basin for a submerged electric pump which delivers the water from the basin to the recycling tank through a hose.

CIL Tailings facility

The pipes used for the recycling of the clarified water from the flotation tailings management facility have a diameter of Dn 150 and Pn 16 bars. The entire pipeline consists of metal pipes.

Along the buried pipe sector the pipe will be sealed against corrosion. Along the route, the recycled water pipeline passes through 7 depression zones, created by the streams, where the route will be above the ground. Along the above the ground sector the pipe will be mounted on supports being thermally insulated against freezing. Along the route where the pipe crosses beneath the car traffic zones, it is placed in a metal tube for protection purposes. At the highest level, the pipe is mounted in a concrete manhole provided with an air release valve to remove the air pockets.

In case of failure, a part of the pipe remains filled with water, and there is provided, for such cases, a discharge pipe installation consisting of a concrete manhole with two compartments connected in between, one compartment there is the discharge route provided with a slide valve and the second compartment is the buffer basin for a submerged electric pump delivering the water from the basin to the recycling tank through a hose.



J. Construction of roads

The following aspects were considered for the designing of the Certej site main roads:

- Designing of the geometrical elements in accordance with STAS 863/85.
- The designed minimum speed at which the route was calculated is 25 km/h (to ensure the visibility in plan and longitudinal profile in windings and small radius curves).
- The alignments will be joined by circular curves with radii ranging between 32m and 400m.
- Designing of the longitudinal profile followed the line of the existing ground as possible. The designed maximum longitudinal slope is 12 %.

- According to the technical specifications in force, the slope changers have been provided with vertical transitions with radii ranging between 500m and 4000m.

In transverse profile, the geometric elements of roads will be the following:

- width of the carriage way – up to 7.00 m
- width of the consolidated road verges, left and right, up to 2 x 0.50 m
- spaces on the right and left sides, as the case stands, for trenches (wall along the road) or ditches for collecting and discharging the pluvial waters.

The road structure of the designed platforms will consist of:

- compacted filling material for reaching the designed elevation, of variable thicknesses
- ballast layer for foundation
- crushed stone

The road verges will be made of crushed stone and ballast.

Seven culverts of prefabricated concrete tubes – Premo tubes will be located at the intersection of the regularized Paraul Mare stream with the roads inside the built-up area of Bocsa Mica village.

The main roads of the site, necessary for the transportation of the useful substance, waste, materials and personnel:

A. Main access road to the processing plant (it ensures the access from Certej to the plant site):

- *Certej-crushing plant Road (asphalted road)*
- *crushing plant-processing plant yard Road (causeway)*

B. Access road from the open pit to the processing plant and waste dumps (it assures the transportation of ore to the processing plant and of waste to the waste dumps)

C. Access road to the flotation TMF, +720 m Level (it ensures the connection between the processing plant and the flotation TMF)

D. Access road to the CIL TMF, +745 m Level (it ensures the connection between the processing plant and the CIL TMF, it comes of the access road to the flotation TMF)

E. Rehabilitation of the existing road in order to start the works on the starter dams.

K) Arrangement works for the industrial yards – pluvial water collection

The platforms on the +540; +577; +575; +593; +605; +625 elevations have been designed with a minimum water-flowing slope of 0.5% (according to the details) so that the rainfall will flow from these sites into the ditches built at the edge of the platforms for carrying them further to the existing watercourse (Floroaia creek). In the cut sections, for the discharge of the meteoric water, reinforced concrete ditches will be built (jointed each 5m), covered with metallic grates and with carriageways over the ones that will be crossed by trucks and cars, their discharge being done longitudinally compared to the designed platform.



Industrial buildings and constructions

Close to the open pit, where the following constructions will be located:

+ 575 m level platform	
<i>Open pit yard</i>	
1	<i>Open pit equipment maintenance shop</i> – construction of hall type, developed on the ground floor with sizes of 38.6 x 15.2 = 586.72 sq.m and annexes (lubricant storeroom, spare parts storeroom and vulcanization workshop) with sizes of 22 x 10 = 220 sq.m Built area = 850.0 sq.m; Area built on ground = 850.0sq.m; From functional point of view, the maintenance shop will have the following spaces: - Maintenance hall S = 626.4 sq.m - Annexes formed of: - lubricant storeroom S = 61.98 sq.m - spare parts storeroom S = 57.6 sq.m - vulcanization workshop S = 25.30 sq.m
2	<i>Technical-social annexe</i> – with sizes of 39.55 x 12.55 = 496.35sq
3	<i>Open pit equipment washing platform</i> with sizes of 9 x 28 m
4	<i>Distribution pump platform</i> – covered metallic construction with sizes of 25 x 20 m
5	<i>Fuel warehouse</i> – reinforced concrete construction with sizes of 12 x 14 m and capacity of 180 mc. The warehouse contains three buried metallic tanks, each of them equipped with aperture and air passages.
6	<i>Used oil tanks</i> – metallic tank with a volume of 40c.m located in a reinforced concrete construction with sizes of 10 x 5.6 m
Open pit yard sewage treatment plant	
1	BIO CLEANER 75 - type sewage treatment plant
+ 540 m level platform	
<i>Crushing plant and raw ore storage platform</i>	
1	<i>Raw ore storage platform</i> – sizes 20m x 30m
2	<i>Primary crushing section</i>
3	<i>Belt conveyor</i> – 1000 mm wide, approx. 20 m wide, with height of lift of 3.1m; the second conveyor: capacity of 520 t/h, 1000 mm wide, approx. 170 m long and lifting height of 40,7 m Both belt conveyors are mounted on suspended bridges, supported by metallic poles fixed in reinforced concrete foundations, provided with passage way on one side
<i>Crushed ore stockpile + 577m level platform</i>	
1	<i>Crushed ore stockpile</i> - Under the stockpile, there is a tunnel made of prefabricated concrete elements with internal sizes of L = 78 m, H = 5.2 m, B = 3.5 m, provided at the upper part with 2 holes of 5.5 m x 1.5 m sizes, through which the two plate feeders are fed.
<i>Yard substations +540m level platform</i>	
1	<i>Primary crushing monitor and control chamber (MCC 001)</i> – metallic construction with sizes of 5.4m x 12.60m
+ 605 m level platform:	
<i>Trafo Station ST 110/6kV</i>	
1	<i>Electric substation</i> – construction of metallic hall type with basement and ground floor, sizes 29.6 x 10.6 = 313.76sq.m, built area on the ground = 627.52sq.m From functional point of view, the trafo station will encompass the following spaces: - Basement at the -2,60 m level with power cables mounted on metallic racks - Ground floor of the building (Level ±0.00) where electric cells will be located on two rows
<i>Processing plant (grinding, classing, flotation, thickening, concentrating) +575 m level</i>	
1	<i>Concentrate thickener</i> – thickener foundation of circular type with radius of 4.83m, foundation of overflow basin of octangle shape with side of 1.574m, retention tank with sizes of 18.8 x 15.9m with tank parapet 1.6m above level ±0.000, EUROPROFILE metallic platform
2	<i>Grinding section</i> – ground-floor industrial hall on metallic structure with sizes of: 35m x54 m, with surface built on ground of 2,116.96 sq.m. <i>Monitor and control chamber</i>



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3	<i>Flotation building</i> – is a ground-floor industrial hall on metallic structure with sizes of: 36mx 48m and a surface built on ground of 1,788.40 sq.m. <i>Monitor and control chamber and the reagent section.</i>
4	<i>Reagent preparation for flotation</i> – is a ground-floor industrial hall with two openings nearby the flotation, on metallic structure with sizes of: 20,70 m x 48m and a surface built on ground of: 365.62 + 677.93= 1,043.55 sq.m
5	<i>Tailings thickener</i> – concrete retention tank with sizes of 44.6 x 29.15m with protection fence of 1.80m height above the 0.000 level of the setting ground, circular thickener foundation with radius of 20.6m, water recycling basin foundation – hexagonal with 4.37m side, EUROPROFILE metallic platform
6	Emergency pond – section 16.6 x 7.6 x 1.8m, made of waterproof monolith concrete, designed to take over the discharge of the flotation TMF tailings hydrotransport pipes, in case of emergency (220 c.m).
Grinding ball storage platform	
1	<i>Grinding ball storage platform</i> – concrete platform with sizes of 50m x 20m, fenced
Reagent warehouse	
1	<i>Reagent warehouse</i> – metallic construction with sizes of 45m length x 18m width x 4.5m height
Substations	
1	<i>Processing plant monitor and control chamber (MCC 002+MCC 003+ MCC 004+MCC 005)</i> - made of metallic structure being located nearby flotation and across the reagent hall. The built surface is 717.90 sq.m
2	<i>Thickener monitor and control chamber (MCC 006)</i> – metallic construction with sizes of 5.4m x 12.60m
Flotation TMF water treatment plant +605m platform	
1	<i>Flotation TMF water treatment plant</i> – monoblock foundation pe care sunt amplasate echipamentele specific stației de epurare
Open pit + waste dump acid water treatment plant +605m platform	
1	<i>Open pit + waste dump acid water treatment plant</i> – monoblock foundation pe care sunt amplasate echipamentele specific stației de epurare
Oxygen plant +605m platform	
1	<i>Oxygen plant</i> – it has sizes of 40 x 85m cu echipamentele aferente
Processing plant maintenance shop +605m platform	
1	<i>Maintenance shop</i> – the proposed building has sizes of 70.10 x 19.24 m
Chemical assay laboratory +575m platform	
1	<i>Chemical assay laboratory</i> with the following characteristics: height regime: ground floor and one storey; sizes: 18.55 m x 12.55 m; built surface = 232.80 sq.m room useful height = 3.3m
Appurtenance	
1	<i>Appurtenance</i> – height regime: ground floor; sizes: 18.55 m x 10.55 m;
Administrative building	
1	<i>Administrative building</i> surface built on ground = 454.37 sq.m;
+ 575m level platform	
Albion plant	
1	<p><i>Albion tanks</i></p> <p>The construction works for the installation of the leaching tanks and confinement of the yard to protect the area in case of failure consist of:</p> <ul style="list-style-type: none"> - Bases of the leaching tanks; they are insulated bases of block type, made of monolith reinforced concrete with: <ul style="list-style-type: none"> • Built area $A_c = 135.77 \text{sq.m}$; - The confining walls are located on the outline of the leaching installation area, at level +2.3m; They are elastic walls made of monolith reinforced concrete; <p>Floor with 1% slope on transverse direction composed of:</p> <ul style="list-style-type: none"> • A slope concrete layer: - of variable thickness = 30cm - 2cm. <p>Floor: - 20cm thick.</p> <p>Polyethylene sheet of 0.8cm thickness for water proofing;</p> <p>A 10cm layer of simple equalizing concrete.</p> <ul style="list-style-type: none"> - Sump pump Pv-028: located nearby the wall, in the FT4 tank base axle, has a rectangular shape and sizes of 1.20m x 1.20m



	- Access stairs to the yard
2	<p><i>Albion Thickener</i></p> <p>The construction works for the installation of equipment and confinement of the yard to protect the area in case of failure consist of:</p> <ul style="list-style-type: none"> - The neutralizing tank base of block type made of monolith reinforced concrete, with built area $A_c = 15.35\text{sq.m}$; - thickener overflow pump bases (2 pieces); neutralizing tank feeding pumps (2pieces); thickened pump bases (2pieces), have rectangular shape; width $A= 1.00\text{m}$; length $B =1.40\text{m}$; - Thichener overflow tank platform - Square form with interax side of 3.00m; The bases are insulated with sizes of $0.70\text{m} \times 0.70\text{m}$; - The confining walls are located on the outline of the leaching installation area. They are elastic walls made of monolith reinforced concrete; Upper elevation level = $+2.20\text{m}$; - Floor with 1% slope on transverse direction towards rectangular-shaped with sizes of $1.10\text{m} \times 1.20\text{m}$, 20cm thick walls - Access stairs to the yard
3	<p><i>Albion cooling tower</i></p> <p>The construction works for the installation of equipment and confinement of the yard to protect the area in case of failure consist of:</p> <ul style="list-style-type: none"> - The hall with resistance structure made of two transverse metallic frames and nrastructure formed of insulated monolith concrete bases of block - Platform for access around the screen, level $+2.30\text{m}$ - The confining walls are located on the outline of the Albion cooling yard area; The vertical wall has a constant thickness on a height of $b = 0.20\text{m}$; - Floor, with 1% slope oriented towards the collecting tank . The collecting tank: located nearby the longitudinal right confining wall, with rectangular shape and sizes of $1.00\text{m} \times 1.10\text{m}$ - Access staircase from the Albion cooling tower yard to the Albion thickener yard
CIL Plant	
1	<i>Compressor station</i> – one-level building with sizes of $15 \times 10\text{m}$
2	<i>CIL tanks</i> – monoblock foundation on which the tanks (4) will be placed in open air, with sizes of $39 \times 9.9\text{m}$; the surface is surrounded by confining walls located on the outline of the CIL tanks area; the vertical wall has a constant thickness on the height of $h=1.5\text{m}$; floor with 1% slope, oriented towards the collecting tank , located nearby the longitudinal confining wall provided with a sump; the leakage is pumped from the sump into the CIL tank feeding basin.
3	<i>Cyanide preparation and storage</i> – security building with a single level and sizes of $18 \times 15 \text{ m}$, with internal concrete fencing, 0.4 m high, and floor with slope towards a sump to collect the leakage
4	<i>Compressor cooling tower</i> – metallic construction located outside the compressor station building
Lime milk preparation plant	
1	<i>Lime milk preparation plant</i> – lime silo, located on a metallic structure where the lime is taken over from, by a spiral conveyor to a mixing tank and then further to a storage tank. All equipment are placed on concrete foundations, inside a concrete-confined area with a height of 0.8m and a surface of $17.5 \times 13.15\text{m}$, with floor sloping towards the plant sump.
Substations	
1	<i>Monitor and control chamber (MCC 007+MCC 009)</i> – metallic hall with sizes of $20.84 \times 8.83\text{m}$, P+1
2	<i>Power generating set</i> – $1600 \text{ kVA}/400 \text{ V}$
Limestone storage facility	
1	<p><i>Limestone storage facility</i> - Built surface: $A_c = 211.72\text{sq.m}$</p> <p>The construction works for the installation of the limestone storage facility and pumps and confinement of the yard to protect the area in case of failure consist of:</p> <ul style="list-style-type: none"> - Limestone storage tank base - it is an insulated base of block type made of monolith reinforced concrete, with octongle shape; built surface $A_c = 75.94\text{sq.m}$; - Centrifugal pump bases with rectangular shape, width $A= 0.90\text{m}$; length $B =1.30\text{m}$; - The confining walls are located on the outline of the limestone storage facility area; they are elastic walls, - Floor with 1% slope on transverse direction – towards the collecting ditch ; The collecting ditch is



	located at the base of the wall and has a section of 30cmx30cm. - The collecting tank has a rectangular shape and sizes of 1.2mx1.2mx1.2m - The access staircase to the yard is metallic staircase with a 45° slope
+ 625 m level platform	
Limestone preparation plant	
1	<i>Limestone preparation plant</i> – the total surface of the limestone grinding building will be approx. 19x18m. The building will be equipped with an overhead crane of 15.
+ 575 m level platform	
CIL Plant	
1	<i>Gold room electrolysis</i> The construction is developed on two levels – partly on one level, with modular axle sizes of 20.0 x 25.0 m, S = 500 sq.m, with bay opening of 11.70 and 8.30 m, 5m-distanced.
2	<i>Elution</i> – the building will have a total surface of 28m length x 10m width
3	<i>Hydrochloric acid preparation/storage, discharge ramp</i> – the construction necessary for the preparation and storage of the hydrochloric acid will be located in open air. The construction is developed at the ground level and includes the construction of a concrete platform with sizes of 9.00 x 9.00, thus forming a yard surrounded by a reinforced concrete wall of 1.25m height; the base of the hydrochloric acid reservoir will be located on this platform – the reservoir has a circular shape with diameter of 4.50m and height of 5.50m. The base of this reservoir has a circular shape and is made of reinforced concrete and is lifted 15cm above the floor level. The yard is accessed by reinforced concrete stairs, which allows the passing over the surrounding wall. The floor is sloped towards a collecting channel discharging into a sump equipped with a discharge pump for rainfall waters or solutions from the plant in case of emergency. The possible leakages are recycled in the storage tank or sent to neutralization – acid washing. Adjacent to this yard, on the south-east side, there will be made another concrete discharge platform (ramp) of 2.0 x 5.50m, with a 30m thick planking on outline, made of reinforced concrete. The floor is sloped towards a collecting sump. This platform will be the location of the discharge and recycling pumps for the possible hydrochloric acid leakages as well as of a cleaning and washing (shower) facility for the working personnel. In order to unload the hydrochloric acid from the cistern, an unloading ramp will be made, north-east to the main yard in the axle base of the road. The unloading ramp will be made of concrete for roads, B300, of 30cm thickness, provided with safety reinforcement and placed on ballast layer of 20cm thickness for which there will be made slopes towards a sump. There will be special anti-acid protection measures, made of bituminous mixtures, especially in the area of the hydrochloric acid tank and the others (platform, ramp).
4	<i>Elution reagent preparation/storage Preparation / storage of reagents for elution (metabisulphite, flocculant and caustic soda)</i> - construction is a metal hall for industrial use. The construction has been developed on a single level The dimensions to the modular axis are 12.0 x 26.0 m, S = 312 sq.m. The isolated type foundations made of reinforced concrete with base and shoes Structura pardoselilor se realizează din beton de 15cm grosime prevăzut cu armătură de siguranță. The structure of the floors is made of 15cm thick concrete layer with safety reinforcement.
5	<i>CIL Thickener</i> – the construction is developed at the ground level and will include the construction of a concrete platform with sizes of 9.00 x 9.00, thus forming a yard surrounded by a reinforced concrete wall with a height of 1.25m, inside which there will be located the foundation of the CIL TMF recycled water tank (volume 216 c.m) and the thickener overflow tank (volume 70 c.m) – these equipments have circular shape, with diameter of 4.50m and height of 5.50m. The base of this tank is ring-shaped, made of reinforced concrete and will be lifted 15cm above the floor level.
DETOX 1 treatment plant	
1	<i>DETOX 1 treatment plant</i> – the platform for the treatment plant is surrounded by a reinforced concrete wall, 2.20m high, and the access inside the platform will be enabled by concrete stairs with higher elevation than the surrounding wall. There will be collecting channels and sump with pumps for cases of emergencies and for meteoric waters. The DETOX 1 neutralizing tank will be located on this platform, on a ring-shaped reinforced concrete base, 15cm above the floor, inside a concrete fencing with H = 2.2m, which can take over the whole capacity of the tank. The technological platforms will be accessed by metallic stairs. The plant platform will be located in open air without perimetral enclosures.



2	<i>DETOX 1 pump station</i> – the pump station platform is located nearby the treatment plant and is surrounded by reinforced concrete walls with height of 0.50m; the access is enabled by reinforced concrete stairs higher than the surrounding wall. The floors of both platforms will be made of reinforced concrete raft with a thickness of 15cm, with safety reinforcement □ 10/15cm and a slope of 10% towards a marginal collecting channel provided with a sump. The station platform will be located in open air without perimetral enclosures.
CIL TMF clarified water treatment plant – DETOX 2	
1	<i>CIL TMF clarified water treatment plant – DETOX 2</i> – the construction will be developed at the ground level and will include the construction of a concrete platform with sizes of 23.50 x 16.50 m, thus forming a yard surrounded by a reinforced concrete wall with a height of 1.50m. The 1.5m high surrounding wall. The yard will be accessed by two staircases passing over the surrounding wall . The foundations and supports of these equipments will be made of reinforced concrete For the Detox 2 tank, there will be made a trestle of reinforced concrete with 30cm thickness, with a shape of octagon included in a square with a 5.90m side. Inside the surrounded yard with sides of 23.50 m and 16.50 m, there will be constructed a reinforced concrete floor of 15 cm thickness, starting from level 0.00 with slope towards a collecting channel discharging in a sump. There will be access metallic stairs to the upper part of the Detox 2 tank and for passing from this platform to the platform above the thickener.
2	<i>Reagent preparation for DETOX 2</i> - Industrial metallic hall ; The construction is developed on a single level – the ground floor, with S = 120.0 sq.m and cornice height of 4.50 m. The structure is made of steel metallic frameworks with modular opening of 10.0 m, 4.0m-distanced in the modular axles.
Substations	
1	<i>CIL monitor and control chamber (MCC 008+MCC 010)</i> – metallic hall with sizes of 20.84 x 8.83m, P+1
2	Power generating set –1600 kVA/400 V power
Emergency pond	
1	<i>Emergency pond</i> - section 16.6 x 7.6 x 1.8m, of monolith concrete
LOG Storage facility	
1	Liquefied oil gas tank – mounted on a concrete platform
Sewage treatment plant	
1	Sewage treatment plant of ECO CLEANER VFL AT 100
Platform on +593m elevation:	
	Soil dump

L) Explosive Warehouse

It is located in Bocșa Mică locality and the access to the explosive warehouse is provided by a stone paved road. The warehouse is accessed by a gallery which is located at level +630m and is 180m long. The access gallery is also provided with damping offsets, 2 and 3m long, totalling 37m of gallery. The access gallery was dug at a slope of 7%.

The profiles of the explosive handling and storage rooms are built so that after furnishing with storage shelves and handling tables, the legal distances between the shelves can be kept.

Corner gallery and main air head (gallery)

These galleries have 16.5 m together, of which:

- the corner gallery 7.5m
- the ventilation gallery 9m

The ventilation gallery comes out to surface at level +670m.

The ventilation raise

For the airing of the warehouse, there is a ventilation raise located in the extension of the access gallery, having a total length of 40m.



Warehouse yard platform

The waters are carried away by V-shaped trenches from the slopes and by a 3% slope from the platform.

The waters are carried away by V-shaped trenches from the slopes and by a 3% slope from the platform with barbed wire at the top and “No Access Allowed” warning signs, which delimits a protection area 3m away from the surrounding fence. The water for fire extinguishing is provided by an underground hydrant with a nominal diameter of 100mm, installed at the entrance into the warehouse yard.

M) The andesite quarry

The andesite quarry is located on the right hillside of Macris valley outside the tailings management facility territory between the 850 and 790 mdM.

The quarry opening and preparation works will consist of the construction of 15m working benches designed at the +850m, +835m, +820m, +805m and +790m levels.

The andesite extraction will be carried out using blasting, classic bucket shovel loading and andesite trucking to the dam.

The quarry will be opened from the existing road of Valea Măcrișului by a slope semi-trench.

The pluvial waters from the hillside will be collected and directed through 2 contour guard channels which will discharge in Avram stream

The exploitation operations will be developed in compliance with the proposed technology, and its scheduling by operations is given below:

- access road construction (face branching);
- drilling and blasting of boreholes;
- andesite loading and trucking.

The branching of the main access road will ensure the traffic to and from the open pit, of the equipment as well as of transport vehicles.

N) Mures pump station

It is located on the right bank of Mures River near Balata locality, Soimus commune.

The pump station will be equipped with four pumps with the following characteristics: $Q = 150 \text{ m}^3/\text{h}$, $H = 256 \text{ mCA}$, $P = 250 \text{ KW}$ and $U = 380 \text{ V}$.

The pump delivery will be carried out through a pipe of $D_n = 350 \text{ mm}$, mounted underground, to pipe the industrial water to the existing tanks, $2 \times 2500 \text{ m}^3$, of Certej nlocality and which in the past were the property of the former mine.

O) Certej repumping station

It is located near the industrial water tanks of Certej locality.

The pump station will be equipped with three pumps with the following characteristics: $Q = 170 \text{ m}^3/\text{h}$, $H = 395 \text{ mCA}$, $P = 315 \text{ KW}$ and $U = 380 \text{ V}$.

The pump delivery is carried out through a $D_n = 350 \text{ mm}$, pipe through which industrial water is piped to the tank ($3,300 \text{ m}^3$ capacity) from the designed processing plant yard.

P) Drinking water supply plant

The drinking water necessary for the staff hygiene and for the technological process will be supplied from a source with a flow rate of 2.5 l/s, situated in Bocșa Mică locality.

From the source the water is taken to the storage tank (with a capacity of 20 c.m) from the



processing plant yard through the pump station equipped with pumps with the following features: $Q=6 \text{ m}^3/\text{h}$, $H= 130 \text{ mCA}$ and $U= 380\text{V}$.

R) Electric power supply

The electric power to the proposed mining project is supplied through the LEA 110 kV designed double circuit connected to the energetic system of the zone and the substation ST 110/6 kV 2 x 40 MVA proposed to be located within the Processing Plant yard.

The electric power distribution to the consumer is ensured at the 6 kV and 0,4 kV voltage. The receivers operating at the 6 kV voltage will be supplied through the cables directly from the 6 kV bars of the substation of 110/6 kV.

To supply the low voltage to the consumers from the platforms there are provided shifting posts located at the higher consumers, and their number and the transformer power being sized depending on the maximum required power.

Within the processing plant, there will be located 10 shifting posts of 6/0,4 kV equipped with power transformers in synthetic resin and low voltage boards.

To supply the vital receivers from the processing plant but also the seepage recycling pumps and the pumps from the floating barges there are provided backup power generators with diesel motor as per the provisions of the BAT.

There are proposed three shifting posts for the electric power consumers and to the outer lighting located within the tailings management facility area where the seepage recycling plants, clarified water pump stations etc ., are to be placed.

List of transformers from the site

No	Location	Type of transformers	Protection
1	Transformer located within the open pit yard	1 piece Type: ABB	Dry transformers cast in resin
2	Command and control room – primary crushing (MCC 001) –618 level	1 pcs Type: ABB	Dry transformer cast in resin
3	Command and control room processing plant (MCC 002+MCC 003+ MCC 004+MCC 005) +593m	4 pcs Type: ABB	Dry transformer cast in resin
4	Command and control room – thickener (MCC 006) –+593m level	1 pcs Type: ABB	Dry transformer cast in resin
5	Control + command building (MCC 007+MCC 009) –+548m level	2 pcs Type: ABB	Dry transformer cast in resin
6	CIL Command and control room (MCC 008+MCC 010) – cota +538m	2 pcs Type: ABB	Dry transformer cast in resin
7	Shifting post of certej pump station	2 pcs 20/0,4kV-1600kVA	Dry transformer cast in resin
8	Shifting posts of the flotation tailings management facilities	2 pcs Type: ABB	Dry transformer cast in resin
9	Shifting post of CIL TMF	1 pcs Type: ABB	Dry transformer cast in resin
10	Transformers 110/6kV 40 MVA	2 pcs 110 kV/6kV–40MVA	Transformers with oil cooling provided with sealed reinforced concrete basins
11	Transformatoare stația de pompe Mureș	2 pcs 20/0,4kV-1600kVA	Dry transformer cast in resin



CLOSURE STAGE / POST – CLOSURE

The works during the closure and post – closure stages are:

1. Necessary works to be conducted for the protection of the deposit and of the surface, namely: backfilling, collapsed zone balancing, bank-sloping.

2. Necessary works for closing the mine entrances and other access ways of the underground workings

- 4/4m Reinforced concrete plate coverage of the aeration raise from the explosive warehouse
- 30 m backfill at the entrance to the access gallery of the explosive warehouse
- weirs at the base of the airing raise in the connection gallery
- weir at the entrance of the access gallery to the warehouse and 30m behind the backfilling
- the weirs and concrete plates will be made in accordance with the PT-M28 of concrete with a thickness of minimum 0.5m, fixed in compact rock over the entire perimeter; the weirs will be provided with gas and water discharge tubes.

3. Necessary works for the mining yards decommissioning:

Demolishing of construction objects on the ramps:

- Demolition of superstructure and elevation of constructions
- Total removal of construction and technological equipment foundations
- Recovery of metal from resistance structures and metallic panels used for perimeter enclosures and roofs
- Backfilling of voids resulting from the foundations removal with adequate materials and land compacting to the existing level of soil
- Clearing the site of rubbles and total removal of unacceptable materials from the site
- Land levelling in order to conduct the environmental rehabilitation works and for the initial re-use
- Recovery of as many re-usable and saleable materials and elements as possible; for this purpose, the works methods and means will be established in such manner so to allow the preservation of the demolished element and material quality

The yard rehabilitation works consist of:

- Land levelling
- Laying of a layer of vegetal soil, either borrowed or from the vegetal soil dumps, with a thickness of 20 cm
- Surface dragging
- Re-vegetation technologies based on the use of land (agricultural/forest)

4. Works required for the infrastructure decommissioning

- Dismantling the outer electric grids, LEA 0.4 kV yard lighting, LEA 0.4 kV tailings management facility areas lighting and LEA 110 kV Certej
- Dismantling of tailings pipelines.



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- Dismantling the recycling network of the clarified waters.
- Dismantling the technologicla pipelines from the scaffolds.
- Dismantling the industrial water networks.

5. Works necessary for the environment rehabilitation:

Ecologization of Certej open pit

For the rehabilitation of Certej open pit and its harmonization with the landscape the following works are necessary:

- The storage of the debris resulted at the demolishing works on the open pit floor and of other acceptable waste in the zone (waste from the dumps) to raise the open pit floor;
- Levelling the debris transported and vegetal soil placement from the vegetal soil dump;
- Correction works of the open pit slopes
- Cleaning of the existing guard channels;
- Grass seeding and afforestation of the pads with specific vegetation of the zone;
- Maintenance and revision works of the plantations and void completion.

Ecologization of the mining yards

The main environmental protection works and ecological reconstruction works of the land surface area occupied are as follows:

- Mechanic levelling of the surface with the bulldozer;
- Scarifying the land up to 40-50cm depth;
- Land cleaning of remaining materials after scarifying
- Coverage of the respective surface with vegetal soil layer of 20cm, spread and levelled with the bulldozer;
- Soil fertilization;
- revegetation of surface

Ecologization of waste dumps

The main environmental protection works and ecological reconstruction of the waste dumps include the following operations:

- Levelling works and decrease of slopes;
- Removal of the oversized from the lands surfaces;
- Consolidation of slopes and their supporting with 3 m spaced wattles on the level curves;
- Works for the landscape rehabilitation by means of grass seeding (land harrowing, coverage of the respective surfaces with a topsoil layer of 20 cm thick; procurement of topsoil and its transport on site; grass seeding of surfces ; fertilizer management;; surface wetting.
- Afforestation with young accacia and birch trees planted in 30x30x30cm holes filled with vegetal borrow soil;
- Maintenance and revision works of the plantations, completion of voids .

Ecologization of the tailings management facilities



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The main works to be executed at flotation TMF closure to mitigate the pollution impact on the eco-systems and soils around:

- The planning of the tailings facility surface consists of the 5‰ slope construction along the longitudinal axis of the tailings facility beach from upstream to downstream and a 5‰ slope along the cross profile of the tailings facility beach to ensure the rainfall water flowing of the tailings facility surface from the central line to the guard channels from the valley sides.
- Rearrangement of guard channels to ensure functioning by declogging, reprofiling, and concrete dry walls.
- Dam rise on the entire crest of wave.
- Drainage and consolidation of the downstream zone of the dam leg.
- Complete coverage of the tailings facility with a layer of vegetal soil of 20 cm thick
- Works for forestry re-use by afforestation of the beach with species of the zone (accacia, birch)
- Monitoring of the project during the execution stage of the closure works, guarantee works (2 years) and post – closure stage (30 years).
- Other works resulting at the elaboration of documentation on the closure date

The main works to be done at the closure of the CIL tailings facility are meant to provide the safety of the tailings facility , to reduce the risk of incidents at the tailings facility and implicitly to avoid the eco-system pollution.

- Re-shaping works of the tailings facility surface similar with those of the flotation tailings facility
- Works for impermeabilization of the tailings facility surface consisting of the geomembrane layer placement and two layers of earth (clayous earth layer with sand/ gravel of 0.30m thick and a 0.20m thick topsoil layer).
- Ecologization works by grass seeding on the beach
- Implementation of a monitoring system of the project during the closure work stage, during the guarantee period (2 years) and post - closure stage (30 years).
- Other works resulting at the development of documentation on the closure date



TECHNOLOGICAL PROCESSES

1. TECHNOLOGICAL FLOW-SHEET EQUIPMENT S

Open pit yard	
Sewage treatment plant of open pit yard	
1	Sewage treatment plant of BIO CLEANER 75, type with a capacity of 7.5 c.m/h, discharge parameters according to NTPA001/2002
Ramp + 618 m, where the following buildings will be placed:	
Crushing plant and crude ore stockpiling	
1	Crude ore stockpile HP-001–
HP-001	Coarse ore silo of the open pit
	Tilting capacity 65t
	Useful capacity 71m ³
2	Primary crushing section – jaw crusher of 1500 x 1070mm is one mobile jaw type crusher and can take over the rock with maximum size of 1,000 mm and after crushing the rock size is 100 mm, with a productivity of 434 t/h.
BN-001	Silo for metal pieces
	Type Skipper with 1.5m ³ capacity suitable for utilization together with the fork lift
BR-001	Rock breaker mounted on pillar
	Type Hydraulic hammer on 180 degree rotary support
	Driving 22/0.8kw
BW-001	Belt weigher for ore stockpile feed
	Accuracy ± 1% for 10 to 110% of the designed capacity of the belt
CH-001	Oversized trough at the rod feeder
CH-002	Trough for passage to the rod feeder
CH-003	Main trough to the collection conveyor
CH-004	Trough for the magnetic residues
CH-005	Trough for jaw crusher discharge
CH-006	Main trough of crushed ore transfer conveyor
CN-001	Pulley block for the magnet above the belt
	Capacity 1t



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	Driving	1.5kW
CN-009	Pulley block for magnet above the belt	
	Capacity	6t
	Driving	2.5kW
CR-001	Jaw crusher	
	In operation/ spare	1/0
	Type	Jaw crusher with one spacing plate
	Capacity	434 ph
	Driving	200 kW
CV-001	Colletion conveyor	
	Type	Rubber hollow belt conveyor
	Capacity	520 t/h
	Driving	15 kW
DS-002	Dust removal system of the crusher	
	Type	Dust removal system with water spraying
	Points	Truck tilting Jaw crusher feed Jaw crusher discharge Collector conveyor discharge Discharge of the crushed ore belt conveyor
	Power	7.5 kW
FE-00	Rod feeder	
	Opening	100mm
	Driving	22 kW varyable speed
MA-001	Magnet above the belt	
	Power	3.0kW
ME-001	Metal detector	
PV- 01	Floor sump pump	
	Capacity	50m ³ /h



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	Pulp density	Nominal 1.8
	TDH	27m
	Driving	18.5W, fixed speed
SC-002	Fixed rod sieve	
SW-002	Crusher metal platform	
3	Belt conveyor -- one with capacity of 520 t/h, width of 1,000 mm, length of about 20 m, and elevation height of 3,1m, the second with capacity of 520 t/h, width of 1,000 mm, length of about 170 m and lifting elevation of 40,7 m Both belt conveyors are mounted on the suspended walkways supported on metal poles erected on reinforced concrete foundations provided with traffic corridors on one side. The belt is encased.	
CV-002	Crushed ore belt conveyor	
	Type	Type
	Capacity	Capacity
	Width	Width
	Length	Length
	Lifting elevation	Lifting elevation
	Driving	110 W
Concrete crushed ore silo		
1	Crushed ore silo - useful capacity of 6,800 t and total capacity including the non active load of 46,000 t. Beneath the silo there is a tunnel made of prefabricated concrete elements with inner dimensions of L = 78 m, H = 5,2 m, B = 3,5 m, provided at its upper part with two holes of 5,5 m x 1,5 m, for feeding the two plate feeders .The dust removal system based on water spraying is automatically operated and functioning with the associated feeder.	
CH-008	Feed trough Feeder Nr. 1	
CH-009	Feed trough Feeder Nr. 2	
CH-010	Discharge trough Feeder No1	
CH-011	Discharge trough Feeder No 2	
CI-001	Sump for the coarse ore stockpile spillage	
CV-003	SAG mill feed belt conveyor	
	Type	Rubber hollow belt conveyor
	Capacity	60 t/h
	Width	1000mm
	Length	143m
	Lifting elevation	-10.7m



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DS-00	Dust removal system at the ore silo feeding	
	Type	Water spraying from a single central system
	Points	Plate feeder no.1 Plate feeder no.2
FA-001	Tunnel ventilation system	
	Type	Axial fan and piping
	Driving	5.5kW temporary
FE-002	Plate feeder no.1	
FE-003	Plate feeder no.2	
	Utilization	SAG mill feed of the ore silo
	In operation/ standby	2/0
	Type	Electrically driven chain plate feeder , manganese plates
	Each capacity	Normal 190tph (2 feeders in operation) Max 400tph (1 feeder in operation)
	Maximum size of the boulders	20 mm
	Dimensions	914mm x 6 7m length.
	Driving	22 kW varyable speed
PC-001	Water pump at dust removal	
	Type	Horizontal centrifugal water pump
	Capacity	5m ³ /h
	Pulp density	1
	TDH	13m
	Driving	2.2W, fixed speed
V-002	Pump at the sump of the ore silo	
	Type	Type
	Capacity	Capacity
	Pulp density	Pulp density
	TDH	TDH
	Driving	Driving



TK-0 1	Water tank for dust removal										
Type	Close tanc										
Useful capacity	1.6										
Yard substations											
1	Command and control room of primary crushing (MCC 001)										
Transformer station ST 110/6kV											
1	Electric station										
Processing plant (grinding, classifying ,flotation, thickening , concentration)											
1	Concentrate thickener– thickener foundation of circular type with radius of 4.83m, foundation of overflow basin of octogonal shape with side of 1,574m, retention basin with dimensions of 18,8 x 15,9m with basin 1,6m above the level ±0,000 volume 461m ³ , metal ramp										
<table border="1"> <tr> <td>Concrete retention basin</td> <td>-Volume 461 c.m. – Volume of the biggest equipment: 350 c.m – Total volume of basin associated equi[pment: 381 c.m - Made of soft stiffened steel sheet and rubber lined - weight – 1,2 t - Volume 1 c.m</td> </tr> <tr> <td>PC – 018, PC – 018A Pumps from thickener overflow of Weir type 100/80 B-MU</td> <td>- Horizontal centrifugal pump with metal lining - Q = 89 mc / h - delivery H – 24 m - N = 11 kw - weight – 0,6 t</td> </tr> <tr> <td>PC – 95, PC – 095A Pumps for the concentrate thickener thickened material of Weir 4/3 C-AH type</td> <td>- Horizontal centrifugal pump with rubber lining and water seal - Q = 46 mc / h - delivery H – 10 m - N = 5,5 kw - weight – 0,4 t</td> </tr> <tr> <td>PV – 022 Pump of the concentrate thickener sump area</td> <td>- Difficult conditions, vertical centrifugal pulp pump - Q = 50 mc / h - H = 13 m - N = 11 kw - weight– 0 75 t</td> </tr> <tr> <td>TH – 002 Mechanism of concentrate thickener agitator TK – 006 Concentrate thickener basin t</td> <td>- High productivity thickener completed with driving unit, scraping booms, cone scraper, feed pipe including self-dilution within the feed pipe, walkway structure providing access to the driving unit and flocculant pipes and tube for pressurized foam spraying. - diameter 10 m - N rotation = 2 kw - N lifting = 0,75 kw</td> </tr> </table>		Concrete retention basin	-Volume 461 c.m. – Volume of the biggest equipment: 350 c.m – Total volume of basin associated equi[pment: 381 c.m - Made of soft stiffened steel sheet and rubber lined - weight – 1,2 t - Volume 1 c.m	PC – 018, PC – 018A Pumps from thickener overflow of Weir type 100/80 B-MU	- Horizontal centrifugal pump with metal lining - Q = 89 mc / h - delivery H – 24 m - N = 11 kw - weight – 0,6 t	PC – 95, PC – 095A Pumps for the concentrate thickener thickened material of Weir 4/3 C-AH type	- Horizontal centrifugal pump with rubber lining and water seal - Q = 46 mc / h - delivery H – 10 m - N = 5,5 kw - weight – 0,4 t	PV – 022 Pump of the concentrate thickener sump area	- Difficult conditions, vertical centrifugal pulp pump - Q = 50 mc / h - H = 13 m - N = 11 kw - weight– 0 75 t	TH – 002 Mechanism of concentrate thickener agitator TK – 006 Concentrate thickener basin t	- High productivity thickener completed with driving unit, scraping booms, cone scraper, feed pipe including self-dilution within the feed pipe, walkway structure providing access to the driving unit and flocculant pipes and tube for pressurized foam spraying. - diameter 10 m - N rotation = 2 kw - N lifting = 0,75 kw
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	<ul style="list-style-type: none"> -weight – 22 t - Volum 350 mc. 	
	TK – 008 Basin for the concentrate thickener overflow <ul style="list-style-type: none"> -Cylinder vertical basin opened at its upper part - standing time 0,3 hours - Q = 30 mc - diameter – 3,4 m - H = 4,3 m - weight – 2,8 t 	
2	<i>Grinding section</i>	
	<i>Command and control room.</i>	
	Concrete retention basin <ul style="list-style-type: none"> -Volume 378 c.m – Volume of the biggest equipment: 9 c.m – Total volume of the basin associated equipment: 9 c.m 	
	BW - 002 Belt weigher at the SAG mill feed <ul style="list-style-type: none"> -accuracy ± 5 % for 10 to 110% of the designed belt capacity - weight – 0,11 t 	
	CN – 002 Gantry bridge EOT beam from grinding sector <ul style="list-style-type: none"> - lifting load 30 t - N = 26.4 kw at pulley block; - N = 0.6 kw at cross trip - N = 1.2 kw at the trip along the hall length -span at the rolling way – 33,400 mm -lifting height – 20 m - weight – 28 t 	
	CN – 007 Pulley block of the feed cone at the SAG mill <ul style="list-style-type: none"> -lifting load 10 t - weight – 0,5 t 	
	CY – 001 Ball mill cyclones <ul style="list-style-type: none"> - normally 6 (max 7) in operation, 1 in standby. (8 installed) - cyclones with the diameter of 500 mm, mounted on a 9 horse power distributor with 8 pneumatically driven valves - input pressure 0.5 – 0.6 bars - weight– 3.8 t 	
	CY – 002 Cyclones from the regrinding sector <ul style="list-style-type: none"> - In operation / standby - Normally 4 (max 5) in operation, 1 in standby. (6 Installed) - vol. 1.5 c.m x 6 - 375 mm dia., cyclones mounted on a 7 horse distributor with 6 sealing valves and overflow and thickened collectuon troughs - presiunea de intrare - 0.7 – 0.8 Bars - Steel cyclones with rubber liners, rubber lined troughs for overflow and thickened 	
	MB – 001 Ball mill <ul style="list-style-type: none"> - mill diameter – 4,720 mm - metal ring length - 7,320 mm - slurry feed flow-rate - 741 c.m / h - 80% feed - 1.1 mm - 80 % discharge- 0.12 mm - N = 3000 kw, 	



MS – 001 SAG mill	<ul style="list-style-type: none"> - weight – 205,5 t - feed rate – 377 t / h - recycled ore feed rate – 83 t / h - ground slurry flow rate – 321 c.m / h - 80 % feed - 100 mm - 80 % discharge – 1.1 mm - mill diameter – 7,920 mm -metal ring length - 3,005 mm - N = 3000 kw, - weight – 384.5 t
PC – 002, PC – 003 Cyclone feed pumps	<ul style="list-style-type: none"> -centrifugal pulp pump -type - Krebs slurry MAX 14x12-38 - construction– rubber lined and chromium rotor - Q = 1729 mc / h - H = 31 m - N = 450 kw, - weight– 13 t
PV – 003 Vertical pump at the sump of the grinding sector	<ul style="list-style-type: none"> - horizontal centrifugal slurry pump, difficult conditions -Metso VS50 L150 O5 type - Q = 50 mc / h - H = 14 m - N = 11 kw, - weight– 0.7 t
CV – 004 Belt conveyor no. 1 for boulders	<ul style="list-style-type: none"> - Q = 135 t / h - belt width – 600 mm - belt length – 16.3 m - lifting height – 1.74 m - N = 5,5 kw, weight – 9.75 t
CV – 005 Belt conveyor no.2 for boulders	<ul style="list-style-type: none"> - Q = 135 t / h - belt width– 600 mm - belt length – 36.5 m - lifting height – 8.75 m - N = 11 kw, - weight – 15.06 t
CV – 006 Belt conveyor no.3 for boulders	<ul style="list-style-type: none"> - Q = 135 t / h - belt width– 600 mm



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	- belt length – 17.9 m - lifting height – 16.2 m - N = 15 kw, - weight– 15.06 t
AG – 001 Stirring mechanism at conditioning agitator	- agitator diameter – 1900 mm - 2 agitating rotors - N = 15 kw, - weight – 1,3 t

BW-003 – Belt weigher No. 1

Utilization	Measuring the boulder recycling load
Type	Load cell on a single roller
Precizie	±2% accuracy within the range 10 and 110% of the designed belt capacity.

CH-018 Main trough at belt conveyor no.1 for boulders

CH-021 Boulder trough

CH-023 Main trough at the belt conveyor no.3 Flexowell, for boulders

CV-004 Belt conveyor no 1 for boulders

Type	Hollow rubber belt conveyor
Capacity	135 t/h
Width	600mm
Length	16.6m
Lifting height	1.74m
Hollow angle	30°
Driving	5.5 kW

CV- 05 Belt conveyor no.2 for boulders

Type	Hollow rubber conveyor
Capacity	135t/h
Width	600mm
Length	36.5m
Lifting height	8.75m
Hollow angle	30°
Driving	11 kW



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	<p>CV-006 Flexowell Belt conveyor no.3, for boulders</p> <p>Type Flexowell</p> <p>Capacity 135t/h</p> <p>Width 600mm</p> <p>Length 17.9m</p> <p>Driving 15 kW</p> <p>LA-006 Trough for the boulder conveyor leaks</p> <p>SW 001 Corner transfer station to the boulder crusher</p>										
3	<p><i>Flotation building.</i> In the hall there is a 5 t gantry bridge at height of 19.93 m. The retention basin volume is 389 c.m – The volume of the biggest equipment: 130 c.m – Total volume of basin associated to the equipments: 1,080 c.m. Laterally, there is the <i>Command and control room and the reagent sector.</i></p>										
	<table border="1"> <tr> <td>CN – 008 EOT gantry at flotation sector</td> <td> <ul style="list-style-type: none"> - EOT single beam gantry , infra red remote controlled -lifting load 5 t - lifting height – 17.5 m - N = 21,3 kw, - weight – 8.29 t </td> </tr> <tr> <td>FC – 001... FC – 005 Flotation roughers</td> <td> <ul style="list-style-type: none"> - Cell volume – 130 c.m - Automatic control of the slurry level and rod valves - Automatic control system of the air flow at each cell group - N = 160 kw, - weight – 30 t </td> </tr> <tr> <td>FC – 010 la FC – 013 Upgrading cells 1</td> <td> <ul style="list-style-type: none"> - Cell volume– 30 c.m - Automatic control of the slurry level and rod valve - Automatic control system of the air flow at each cell group - N = 45 kw, - weight – 8 t </td> </tr> <tr> <td>C – 020... FC – 023 Cleaning cells</td> <td> <ul style="list-style-type: none"> - Cell volume – 30 c.m - Automatic control of slurry level and rod valves - Automatic control system of the air flow at each cell group - N = 45 kw, -weight – 8 t </td> </tr> <tr> <td>FC – 030... FC – 033 Upgrading cells 2</td> <td> <ul style="list-style-type: none"> - Cell volume– 20 c.m -Automatic control of the slurry level and rod valves - Automatic control system of air flow at each cell group </td> </tr> </table>	CN – 008 EOT gantry at flotation sector	<ul style="list-style-type: none"> - EOT single beam gantry , infra red remote controlled -lifting load 5 t - lifting height – 17.5 m - N = 21,3 kw, - weight – 8.29 t 	FC – 001... FC – 005 Flotation roughers	<ul style="list-style-type: none"> - Cell volume – 130 c.m - Automatic control of the slurry level and rod valves - Automatic control system of the air flow at each cell group - N = 160 kw, - weight – 30 t 	FC – 010 la FC – 013 Upgrading cells 1	<ul style="list-style-type: none"> - Cell volume– 30 c.m - Automatic control of the slurry level and rod valve - Automatic control system of the air flow at each cell group - N = 45 kw, - weight – 8 t 	C – 020... FC – 023 Cleaning cells	<ul style="list-style-type: none"> - Cell volume – 30 c.m - Automatic control of slurry level and rod valves - Automatic control system of the air flow at each cell group - N = 45 kw, -weight – 8 t 	FC – 030... FC – 033 Upgrading cells 2	<ul style="list-style-type: none"> - Cell volume– 20 c.m -Automatic control of the slurry level and rod valves - Automatic control system of air flow at each cell group
CN – 008 EOT gantry at flotation sector	<ul style="list-style-type: none"> - EOT single beam gantry , infra red remote controlled -lifting load 5 t - lifting height – 17.5 m - N = 21,3 kw, - weight – 8.29 t 										
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C – 020... FC – 023 Cleaning cells	<ul style="list-style-type: none"> - Cell volume – 30 c.m - Automatic control of slurry level and rod valves - Automatic control system of the air flow at each cell group - N = 45 kw, -weight – 8 t 										
FC – 030... FC – 033 Upgrading cells 2	<ul style="list-style-type: none"> - Cell volume– 20 c.m -Automatic control of the slurry level and rod valves - Automatic control system of air flow at each cell group 										



	<ul style="list-style-type: none"> - N = 30 kw, - weight – 6 t
FC – 040... FC – 042 Upgrading cells 3	<ul style="list-style-type: none"> - Cell volume– 20 c.m - Automatic control of slurry level and rod valves - Automatic control system of air flow at each cell group - N = 30 kw, -Weight– 6 t
ML – 001 Regrinding mill of flotation	<ul style="list-style-type: none"> - Q = 128 t / h - tower type mill - feed size - P80 120 microns - discharge particle size - P80 45 microns -recycling load – 150 % - N = 745 kw, - weight – 118,2 t
PC – 006 si PC – 006A Weir 6E-AHF type pumps for primary concentrate	<ul style="list-style-type: none"> - horizontal centrifugal froth pump lined with rubber - Q = 366 c.m/h - delivery H – 19 m - N = 75 kw, varyable speed - weight– 1,5 t
PC – 007 si PC – 007A Weir 10/8E-M primary tailings pump	<ul style="list-style-type: none"> - horizontal centrifugal froth pumps with rubber lining - Q = 515 c.m/h - delivery H – 9,4 m - N = 30 kw, varyable speed - weight – 2,5 t
PC – 008 and PC – 008A, Weir 6E-AHF type uograting concentrate pumps	<ul style="list-style-type: none"> - horizontal centrifugal froth pump lined with rubber - Q = 247 mc/h - delivery H – 21 m - N = 55 kw, varyable speed - weight 1,4 t
PC – 009 and PC – 009A Weir 6E- AHF upgrading concentrate pump 2	<ul style="list-style-type: none"> -horizontal centrifugal froth pump lined with rubber - Q = 295 mc/h - delivery H – 24 m - N = 75 kw, varyable speed -weight –1,5 t
PC – 010 and PC – 010A 4 D - AHF Concentrate upgrading pump 3	<ul style="list-style-type: none"> -horizontal centrifugal froth pump lined with rubber - Q = 121 mc/h - delivery H – 17 m



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	- N = 22 kw, varyable speed - weight -1 t
PC – 011 and PC – 011A 4D-AHF type concentrate cleaning pump	- horizontal centrifugal froth pump lined with rubber - Q = 118 mc/h - delivery H – 20 m - N = 20 kw, varyable speed - weight-1 t
PC – 012 and PC – 012A Weir – 10 / 8 E - M cleaning tailings pump	- horizontal centrifugal froth pump lined with rubber - Q = 477 mc/h -delivery H – 5 m - N = 11 kw, varyable speed - weight -2,4 t
PC – 013 and PC – 013A Krebs slurry MAX 12x10-30 cyclone feed pump	-horizontal centrifugal froth pump lined with rubber - Q = 740 mc/h - delivery H – 16 m - N = 75 kw, varyable speed - weight-4,2 t
PC – 014 and PC – 014A Weir 10/8 E-M pump no.1 and 2 tailings upgrading	-horizontal centrifugal froth pump lined with rubber - Q = 542 c.m/h - delivery H – 4 m - N = 15 kw, varyable speed - weight – 2,4 t
PM – 049 at PM – 052 Dosage pump for AP3477	- horizontal centrifugal froth pump lined with rubber - Q = 0 – 10 litri / h - delivery H – 15 m - N = 0,18 kw - weight – 0,2 t
PV-005 Pump Nr. 1 at the sump of the flotation section of Metso VS50 L150 O4D75	Difficult conditions, centrifugal slurry pump - Q – 50mc / h - delivery H – 20 m - N = 18,5 kw -weight – 0,8 t
PV-006 Pump at the regrinding sector	- Q – 50 c.m / h -delivery H – 20 m - N = 30 kw - weight – 0,9 t
V007 and PV-018 transfer pump	- Q – 12 c.m / h



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	<ul style="list-style-type: none"> -delivery H – 22 m - N = 7,5 kw - weight – 0,9 t
PV – 019 Weir 65QV-SPR type pump No. 2 at the flotation sump	<ul style="list-style-type: none"> -horizontal centrifugal froth pump lined with rubber - Q = 50 c.m / h - delivery H refulare – 24 m - N = 18,5 kw - weight – 0,8 t
PV – 041 feed pump of the regrinding mill	<ul style="list-style-type: none"> - Q = 80 c.m / h -delivery H – 10 m - N = 15 kw - weight – 1,5 t
TK – 002 Conditionner at rough flotation	<ul style="list-style-type: none"> - Cylinder vertical agitator opened at the upper part - standing time 11 minutes - capacity – 130 mc - diameter 5500 mm - height 6300 mm - Rubber lined carbon steel - weight – 10,6 t
PC – 017 and PC - 017A Weir 10/8 E-M type pumps no.1 and 2 for recycled water from the tailings thickener	<ul style="list-style-type: none"> - Metal lined horizontal centrifugal pump - Q = 752 mc / h - delivery H – 19 m - N = 75 kw -weight– 2,6 t
PC – 017B and PC 017C Weir 200/150D-MU pump 3 and 4 for the recycled water of the tailings thickener	<ul style="list-style-type: none"> -Metal lined horizontal centrifugal pump - Q = 234 mc / h -delivery H – 24 m - N = 30 kw - weight – 2 t
PM-020 Metso VS50 L150 O4D75 type vertical pump at flotation sump	<ul style="list-style-type: none"> -Difficult conditions, vertical centrifugal slurry ;pump - Q = 50 mc / h -delivery H – 14 m - N = 15 kW fixed speed - weight – 0,8 t
Compressed air sector	
BL – 004, BL – 005 Sufiante de aer	<ul style="list-style-type: none"> - Q = 248 mc / min - presiunea – 50kPa



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	<ul style="list-style-type: none"> - N = 400 kw, - masa – 7 t
4	<p><i>Preparation of flotation reagents</i> The building is equipped with a gantry bridge of 2.0 tf with rolling way on + 19,70m level. S = 1,043.55 sq.m</p> <p>Retention basin of 199c.m – Volume of the biggest equipment: 127 c.m – Total volume associated to the basin: 375 c.m</p>
AG – 018	<p>dissolution agitation PAX Tip Hydrofoil</p> <ul style="list-style-type: none"> - diameter = 1,100 mm - maximum twist = 450 Nm - N = 4 kw - Net weight 0.5 t
AG – 019	<p>Agitator for copper sulphate dissolution of Hydrofoil type</p> <ul style="list-style-type: none"> - diameter= 1100 mm - maximum torsion = 550 Nm - N = 3 kw -Net weight 0.5 t
AG – 043	<p>Agitator for sodium silicate dissolution of Hydrofoil type</p> <ul style="list-style-type: none"> - diametrul = 500 mm - torsione maxima = 69 Nm - N = 1,5 kw - Masa neta 0,2 t
BH – 001	<p>Handling system of copper sulphate batches</p> <ul style="list-style-type: none"> - Standardized system of bulk discharge and rotary valve to reduce at minimum the dust in the tank and a sealing system to attach the bulk pack to the output cone to prevent the dust emission. - The contacting parts are made of stainless steel. The others are made of carbon steel - N = 0.27 kw -Net weight 0.3 t
BH – 005	<p>PAX packs handling system</p> <ul style="list-style-type: none"> - Patented system for the bulk pack discharge and rotary valve to reduce at minimum the dust in the tank and a sealing system to attach the bulk pack to the output cone to prevent the dust emission. - the contacting parts are made of stainless steel . The others of carbon steel - N = 0,3 7 kw -net weight 0.3 t
CN – 028	<p>EOT gantry bridge in the reagent zone</p> <ul style="list-style-type: none"> - Monobeam EOT gantry bridge. Infrared remote control -lifting load 2 t - span– 12,500 mm - N = 3,6 kw -Net weight – 1.912 t
F – 008	<p>Vapor extractor</p> <ul style="list-style-type: none"> -Removal of the organic vapors formed in the PAX and frother tanks - Q = 400 c.m / h - H = 112 Pa - N = 0,55 kw



	- Net weight– 0.3 t
HS – 002 Sodium silicate heater	- Maintains the temperature at 40C - Electric heater around the circulation pipe - N = 6 kw -Net weight– 0,3 t
PC – 037 PAX transfer pump of Weir 100/80 B-MU type	-PAX solution transfer to the storage tank - Horizontal centrifugal pump - Q = 40 mc / h - H = 4,4 m - density – SG1.0 - N = 2.2 kw - net weight – 0.6 t
PC – 039 Copper sulphate transfer pump of Weir 2/1.5 B-AH type	- Copper sulphate transfer solution to the storage tank - Horizontal centrifugal pump - Q = 40 mc / h - H = 4,2 m - density – SG1.17 - N = 2,2 kw - Net weight – 0.3 t
PC – 085 Sodium silicate recycling pump of Weir 100/80 B-MU type	- Sodium silicate circulation around the storage tank -Horizontal centrifugal pump - Q = 33 mc / h - H = 29 m - density – SG1.45 - N = 18.5 kw - Net weight – 0.5 t
PC – 086 Sodium silicate transfer pump of Weir 2/1.5 B-AH type	- Transfer of diluted sodium silicate solution to the storage tank -Horizontal centrifugal pump - solution - 15% Na ₂ SiO ₃ - Q = 15 c.m / h - H = 8 m - density – SG1.0 - N = 4 kw - Net weight– 0.35 t
PM – 011 la PM – 014 Frother dosage pump	-in operation// standby 3 / 1 - utilization – frother dosage - Q = 0 – 20 liters / h



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	<ul style="list-style-type: none"> - H = 5 m - density – SG0.8 - N = 0,18 kw - Net weight – 0.2 t
PM – 015 la PM – 019 PAX dosage pump	<ul style="list-style-type: none"> - in operation / standby 4 / 1 - utilization–PAX dosage - Q = 0 – 20 litri / h - H = 5 m - density – SG1.04 - N = 0.35 kw - Net weight– 0.3 t
PM – 020 to PM – 022 Copper sulphate dosage pump	<ul style="list-style-type: none"> - in operation / standby 2 / 1 -utilization – copper sulphate dosage - Q = 300 litri / h - H = 5 m - density – SG1.17 - N = 0.35 kw - Net weight – 0,3 t
PM – 030 to PM – 032 and PM - 042 Sodium silicate dosage pump	<ul style="list-style-type: none"> - in operation / standby 3 / 1 -utilization – sodium silicate dosage - Q = 0 – 1,000 liters / h - H = 15 m - density – SG1.17 - N = 0.35 kw - Net weight – 0.3 t
PM - 041 Copper sulphate feed pump	<ul style="list-style-type: none"> - Copper sulphate solution transfer to the main tank -utilization copper sulphate dosage - Q = 1000 liters / h - H = 23 m - density – SG1.17 - N = 0.35 kw -Net weight – 0.3 t
PM - 043 PAX feed pump	<ul style="list-style-type: none"> - PAX solution transfer to the main tank -utilization – PAX dosage - Q = 1000 liters / h - H = 19 m - density– SG1.0



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	- N = 0.2 5 kw -Net weight – 0.2 t
PM - 044 Frother transfer pump	- Transfers the frother to the main tank -utilization – frother - Q = 60 liters / h - H = 15 m - density– SG1.0 - N = 0,2 5 kw -Net weight – 0,2 t
PV - 021 Porable pump at the reagent sump – Submersible electric pump	- Xanthate solutions, copper sulphate and organic frother - Q = 14 mc / h - H = 10 m - N = 1. 5 kw - Net weight – 0.3 t
PV - 032 Mobile frother feed pump	- Electric drum pump - Q = 85 liters / min - H = 15 m - N = 0.43 kw - Net weight – 0.1 t
PV – 039 Pump of the sump located within the sodium silicate area - Metso VS50 L120 O5 type	- Q = 50 c.m / h - H = 24 m - N = 22 kw - Net weight – 0.8 t
RV – 002 PAX rotary feeder PAX	- N = 0.75 kw - Net mass – 0.1 t
RV – 003 Rotary sulphate feeder	- N = 0.75 kw - Net mass – 0.1 t
SE – 004 Safety shower within the silicate zone	-Safety shower for inside use and pedal controlled , eye washing and face washing sinks - Net weight – 0,2 t
SE – 012 Safety shower within reagents area	- Safety shower for inside use and pedal controlled , eye and face washing sinks -Net weight– 0.2 t
TK – 038 Frother storage tank	-Vertical cylinder tank closed at the upper part - Q = 60 mc - diameter – 1.5 m - H = 2 m - density– SG 0.8 - Net weight– 0.7 t



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	- Volume 3.5 c.m.
TK – 039 Frother distribution tank	- Vertical cylindeer tank closed at its upper part - diameter– 0,6 m - H = 0,6 m - Net weight – 0.1 t - Volume 0.17 c.m.
TK – 040 PAX dissolution tank	- Vertical cylinder tank closed at its upper part - Q = 33 mc - diameter – 3.5 m - H = 3.9 m - Net weight – 5.4 t - Volume 37 c.m.
TK 041 PAX storage tank	- Vertical cylinder tank closed at its upper part - Q = 33 c.m - diameter – 3.5 m - H = 4.3 m - Net weight – 3.6 t - Volume 41 c.m
TK – 042 PAX distribution tank	- Veryical cylinder tank closed at the upper part - diameter – 0.6 m - H = 0,6 m - Net weight – 0.43 t - Volume 0.17 c.m.
TK – 045 Copper sulphate dissolution tank	- Vertical cykinder tank closed at its upper part - Q = 24 mc - diameter – 3 m - H = 4,3 m Material - GRP - Net weight – 4.4 t - Volume 30 c.m.
TK – 050 Copper sulphate storage tank	- Vertical cylinder tank closed at its upper part - Q = 24 mc - diameter – 3 m - H = 4.3 m Material - GRP - Net weight – 2,4 t - Volum 30 mc.



AGENCY FOR ENVIRONMENT PROTECTION HUNEDOARA

Str. Aurel Vlaicu nr. 25, Deva, Jud. Hunedoara, Cod 330007

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TK – 051 Copper sulphate distribution tank	<ul style="list-style-type: none"> - Vertical cylinder tank closed at its upper part - diameter– 0.6 m - H = 0.6 m Material - GRP -Net weight– 0.13 t - Volume 0.17 c.m
TK – 063 Sodium silicate storage tank	<ul style="list-style-type: none"> - Vertical cylinder tank closed at its upper part - carbon steel or GRP not lined. Mineral cotton 50mm sealing layer tank with stainless steel plating - Q = 111 c.m - diameter – 5.3 m - H = 5.8 m, - net weight – 7.6 t - Volume 127 c.m
TK – 097 Sodium silicate dissolution tank	<ul style="list-style-type: none"> - Vertical cylinder tank with agitator closed at its upper part - Carbon steel or GRP not lined. 4 deflectors - Q = 4 mc - diameter– 1,8 m - H = 2,5 m, - net weight – 1,6 t - Volum 6,3 mc.
TK – 098 Rezervor stocare silicat de sodiu	<ul style="list-style-type: none"> - Vertical cylinder tank with agitator closed at the upper part - Carbon steel or GRP not lined - Q = 10 mc - diameter– 2.4 m - H = 3.1 m - Net weight – 1.8 t - Volume 14 c.m
PM-001 Flocculant transfer pump at the flotation tailings thickener for instance XM - 002	<ul style="list-style-type: none"> - Centrifugal stainless steel pump with mechanic sealing - Q = 6 mc / h - N = 2.5kW - weight –0.3 t
PM-002 Flocculant feed pump to the XM-002 tailings thickener	<ul style="list-style-type: none"> - Progressive cavitation sealed stainless steel pump - Q = 0 - 3.5 c.m / h - N = 0,55 kW variable rotations - weight – 0.2 t
TK – 004 Flocculant storage tank for tailings thickening	<ul style="list-style-type: none"> - Cylinder vertical tank opened at the upper part -standing time– 8 hours Q = 44 c.m - diameter - 3.6 m



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	<ul style="list-style-type: none"> - height 4.1 m - weight -2.9 t - Volume 41 c.m
XM – 002 Flocculant installation for tailings thickening	<ul style="list-style-type: none"> - Automatic dissolution and transfer system. Polypropylene dissolution tank with spiral stainless steel agitator and level rods for high and low levels. The flocculant is fed from the bin by a worm feeder. Including PM001 pump and PM002 dosage pumps -dissolution rate - 16.2 kg/h solid flocculant as 0.5% solution - N= 5,5 kw - weight- 1.5 t
PM – 003 Flocculant transfer pump at the concentrate thickening – Part of XM 003	<ul style="list-style-type: none"> -mechanically sealed centrifugal pump - Q = 6 mc / h - N = 2,5 kw - weight – 0.01 t
PM – 004 Flocculant feed pump at the concentrate thickening – Part of XM-003	<ul style="list-style-type: none"> - Progressive cavitation stainless steel pump - Q = 0 – 3,5 mc / h - N = 0,55 kw - weight – 0,01 t
TK – 007 Flocculant storage tank for the concentrate thickening	<ul style="list-style-type: none"> - Vertical cylinder shaped basin opened at its upper part - Q = 2 mc - diameter 1.5 m - H = 1.8 m - weight- 0,5 t - Volume 3.1 c.m
XM - 003 Flocculant installation for concentrate thickening	<ul style="list-style-type: none"> - Automatic dissolution and transfer system. Polypropylene dissolution tank with level rods for low and high level indicating. The flocculant fed from the bin by a worm feeder. Including PM003 transfer pump and PM004 dosage pump - dissolved flow rate = 0.6 kg/h solid flocculant as 0.5% solution - fed from 25 bags , - weight- 1.5 t t
TK – 059 Flocculant storage tank at the water thickener of the flotation TMF	<ul style="list-style-type: none"> - cylinder shaped vertical tank opened at its upper part -standing time- 8 hours - Q = 27 mc - diameter 3.6 m - H – 4.1 m - weight –2.9 t, - Volume 41 c.m
XM – 007 Flocculant installation at thickener of flotation TMF water	<ul style="list-style-type: none"> - automatic dissolution and transfer system made of polypropylene with spiral stainless steel agitator with level rods for low and high level indicating - including the PM – 038/038° transfer pump PM -039/039A dosage pump and



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	PM – 010 / 010A Dissolution flow-rate 16 kg /h solid flocculant as 0,5 % solution - weight – 1,5 t
PM – 038 / 038A Flocculant transfer pump to flotation TMF water thickener	- Q = 25 mc / h - N = 2,5kW - progressive cavity pump of stainless steel with mechanical seal - weight – 0,3 t
PM – 039 / 039A Flocculant feed pump to open pit water thickener	- Q = 0 – 2,2 mc / h - N = 0,55 kW - progressive cavity pump of stainless steel with mechanical seal - weight – 0,2 t
PM – 010 / 010A Flocculant feed pump to flotation TMF thickener	- Q = 0 – 1,2 mc / h - N = 0,55kW - progressive cavity pump of stainless steel with mechanical seal - weight – 0,3 t
5	<i>Tailings thickener</i> retention basin made of concrete, with the followings dimensions:44.6 x 29.15m, provided with a protection parapet around the basin and having 1.80 m height above the 0.00 elevation of the foundation ground ; the volume of the retention basin is 1367 m ³ - the foundation of the thickener is of circular type with a radius of 20.6m, the foundation of the recycle water basin is of hexagonal shape with 4.37m side; metallic platform
CI-004	Flotation tailings thickener - retention basin The volume is 1367 m ³ . – The volume of the largest equipment: 880 m ³ – The total volume of the equipments afferent to the retention basin is 1218 m ³ .
BX-004	Flotation tailings thickener feed-box
	Lining Lining
CI-013	Emergency dump pond/sump of the flotation tailings pipeline
	Type Type
	Capacity Capacity
	Dimensions Dimensions
CN-030	Flotation seepage return pump hoist
	Type Type
	Capacity Capacity
PC-017	Pump No.1 – Recycled water
PC-017A	Pump Nro.2 – Recycled water
	Number operating / stand-by Number operating / stand-by

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	Type	Type
	Q (flow)	Q (flow)
	Head	Head
	N (drive)	N (drive)
PC- 17B	Pump No.3 - Recycled water	
PC-017C	Pump No.4 - Recycled water	
	Number operating /stand-by	Number operating /stand-by
	Type	Type
	Q (flow)	Q (flow)
	Head	Head
	N (drive)	N (drive)
PV-020	Flotation tailings thickener sump pump	
	Type	Type
	Capacity	Capacity
	Slurry density	Slurry density
	TDH	TDH
	Drive	Drive
TH-001	Flotation Tailings Thickener Mechanism	
TK-00	Flotation tailings thickening tank	
	Type	High rate thickener complete with drive unit, rake arms, con scraper, feed pipe including auto-dilution to the feed well, bridge structure with access walkway to the drive unit and flocculant pipe.
	Diameter	20m
	Sidewall height	2. m
	N rotation drive	5.5kW
	N raise / lower drive	1.5kW
	Instrumentation:	Bed level, bed pressure, rack torque
	Volume	880 m ³ .
TK-005	Recycled water tank	
	Type	Open tanc
	Residence time	0.5 Hours



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	Q (live capacity)	338mc
6	Emergency sump – section: 16.6 x 7.6 x 1.8m, made of water-proof monolithic concrete and sized to accommodate the flotation tailings seepage of the pipeline in case of emergency situations (220 m ³).	
Grinding balls storage platform		
1	Grinding balls storage platform – concrete platform with the following dimensions: 50m x 20m, enclosed	
Reagent storage area		
1	Reagent storage area – metallic construction with the following dimensions: 45m long x 18m wide x 4.5m high	
Substations - at the facilities		
1	MCC Control room at the processing plant (MCC 002+MCC 003+ MCC 004+MCC 005)	
2	MCC Control room at the thickener (MCC 006)	
Flotation tailings reclaim water treatment plant		
1	Flotation tailings reclaim water treatment plant – mono-block foundation on which the following items are installed: water treatment tank- V _{util} = 85 m ³ ; Ø 4.8 m (fitted with agitation system); mechanical agitator - Ø 1700 mm; screen and feeding box of the water treatment tank; radial decanter -Ø12 m, fitted with scraper system installed on bridge mechanism → scraper, shaft , scraper arms, feeding pipe, bridge; thickened slurry drain pump Q =15 m ³ /h; lime slurry storage tank - V _{util} = 51 m ³ , Ø 4.4 m (with agitation system); mechanical agitator - Ø 1400 mm; lime slurry pumps - Q = 10m ³ /h; decanter sump pump - Q = 36 m ³ /h; lime storage tank sump pump - Q = 50 m ³ /h	
CI-003	Retention basin at the lime storage tank	Concrete floor inclined to the collecting sump -The volume is 85 m ³ . – The volume of the largest equipment is 80 m ³ – Total volume of the afferent equipments of the retention basin is 80 m ³ .
AG-045	Lime storage agitator tank	Type Hydrofil Agitator diameter 1400 mm
SC-003	Screen and feed box at the flotation tailings thickener /clarifier	Fabricated Mild steel sheet properly stiffened with static screen Lining No lining
CI-019	Retention basin at the thickener/clarifier of the flotation tailings reclaim water WTP	Volume- 615 m ³ . – The volume of the largest equipment: 460 m ³ – Total volume of the afferent equipments of the retention basin is 692 m ³ .
AG-016	Agitating tank - water treatment plant	Type Hydrofoil Agitator diameter 700 mm Number of agitators 1 Maximum torque 920 Nm



PC-035	Drive	4 kW
	Material	Carbon steel
	Volume	96 m ³ .
	Flotation tailings reclaim water thickener/ clarifier underflow pump	
	No. operating/stand-by	1/0
	Utilization;	Evacuation and re-cycle of the thickener /clarifier underflow
	Type:	Horizontal, centrifugal pump with gland water seal
	Q (flow):	15 m ³ /h
PC-104 & 105	Density:	SG 1.0
	Head:	13m
	Drive:	2.2kW fixed speed
	Pumps No. 1 & No. 2 at the lime milk ring main	
	No. operating/stand by	1/1
	Utilization:	Recycling of the lime milk
	Type:	Rubber lined, horizontal, centrifugal pump with gland water seal
	Q(flow)	10 m ³ /h
PV-004	Density	SG 1.23, 32% /w
	Head:	25m
	Drive:	3kW fixed speed
	Lime storage tank sump pump	
	Type:	Heavy duty vertical centrifugal slurry pump
	Capacity:	50m ³ /h
	Slurry density:	Nominal 1.8
	TDH	10m
PV-031	Drive	11W, fixed speed
	Flotation tailings reclaim water thickener /clarifier sump pump	
	Type:	Heavy duty vertical centrifugal slurry pump
	Capacity:	36m ³ /h
	Slurry density:	SG 1.0
	TDH	10m



TH-005	Drive:	5.5W, fixed speed
TK-033	Thickener mechanism – Flotation TMF	
	Flotation TMF Clarifier Tank	
	Type:	Eimco HRB clarifier reactor completed with bridge installed mechanism Including drive unit of rakes and shaft, , rake arms, feed pipe including auto-dilution to the feed well, bridge structure with access walkway to the drive unit and flocculants pipe. The reactor tank consists of side walls made of carbon steel placed on a concrete basement
	Diameter:	12m
	Height of the side wall:	3.9m
	Rack drive;	0.55kW
	Shaft drive	0.75kW
	Instrumentation:	Rack torque overload device
	Material	Carbon steel
	Volume	460 m ³
TK-035	Water treatment tank	
	Type:	Open top, vertical, cylindrical agitate tank
	Retention time:	0.5 hours
	Live capacity:	85m ³
	Diameter:	4.8m
	Freeboard:	0.5m
	Total height:	5.3m
	Material	Carbon steel
	Deflectors:	3
K-103	Lime storage tank	
	Type:	Vertical, cylindrical, closed top agitate tank
	Live capacity:	51m ³
	Diameter:	4.4m
	Total height:	5.35m
	Freeboard:	0.5m
	Deflectors	3
	Material:	Unlined carbon steel



Open pit and waste dumps ARD water treatment plant	
1	Open pit and waste dumps ARD water treatment plant – mono-block foundation on which the followings are placed: ARD water treatment tank, $V_u = 159 \text{ m}^3$, diameter 5.9 m (fitted with agitating system); ARD water treatment tank agitator, with a diameter of 2100 mm; screen and feed box of ARD water treatment tank; Mine water ARD clarifier tank, with a diameter of 16 m and wall height of 3.9 m (including rake and turbine drive units and feed –well bridge structure); mine water ARD clarifier overflow tank, $V_u = 22 \text{ m}^3$, diameter 3.5 m; mine water ARD clarifier area sump pump, $Q = 36 \text{ m}^3/\text{h}$, $H = 9 \text{ m}$; mine water ARD clarifier overflow pump, $Q = 185 \text{ m}^3/\text{h}$, $H = 74 \text{ m}$; mine water ARD clarifier underflow discharge pump, $Q = 15 \text{ m}^3/\text{h}$, $H = 12 \text{ m}$
Retention basin made of concrete	-Volume: 940 m^3 . – The volume of the largest equipment: 785 m^3 – The total volume of the afferent equipments: 966 m^3 .
TK-092 ARD water treatment tank	Type – Vertical, cylindrical, open top <i>agitated tank</i> . - Fabricated from carbon steel - Live capacity – 159 m^3 - Diameter – 5.9 m - Total height – 6.65 m (freeboard = 0.75 m) - Mass = 12.1 to
AG-041 ARD water treatment tank agitator	- Fabricated from carbon steel - Number of impellers -1 - Impeller diameter– 2100 mm - Max. torque – 2100 Nm - Drive – 7.5 kW - Mass = 1.1 to
SC-015 ARD water treatment tank - Screen and feed box	- Fabricated from mild steel plate suitably stiffened, corresponding with static screen - Mass = 1 to
TK-034 Mine water ARD Clarifier tank	Type - Eimco HRB reactor clarifier complete with bridge mounted mechanism. Included rake and turbine drive units, rake arms, feed pipe to the feed –well bridge structure with access walkway to the drive unit and flocculants piping. Tank comprises carbon steel sides sited on a concrete basement. - Fabricated of carbon steel - Diameter – 16 m - Sidewall height – 3.9 m - Rake drive – 0.75 kW - Turbine drive – 1.1 kW - Instrumentation – Rake torque overload device - Total mass (incorporated in TH-006 mechanism = 34 to) - Volume- 785 m^3 .
TH-006 Mine water ARD clarifier mechanism	- Part of mine water ARD clarifier tank TK -034 - Drive – 1.85 kW - Total mass, which incorporates the mass of TK-034 = 34 to
TK-089 Mine water ARD clarifier overflow tank	Type – Vertical, cylindrical, open top tank - Fabricated from carbon steel



	<ul style="list-style-type: none"> - Live capacity – 22 m³ - Diameter – 3.5 m - Total height – 3.5 m (Freeboard = 0.3 m) - Mass = 2.4 to
PV-075 Mine water clarifier area sump pump	ARD Type – heavy duty, vertical, centrifugal pump <ul style="list-style-type: none"> - Capacity – 36 m³/h - Density – SG 1.0 t/m³ (specific gravity) - TDH – 9 m (pump head) - Drive – 4 kW , fixed speed - Mass – 0.5 to
PC-072 Mine water clarifier overflow pump	ARD Type – Metal, horizontal, centrifugal pump <ul style="list-style-type: none"> - Flow-rate – 185 m³/h - Head – 74 m - Drive – 45 kW, fixed speed - Mass – 1.5 to
PC 073 Mine water Clarifier Underflow Discharge Pump	ARD Type – Horizontal centrifugal pump with gland water seal <ul style="list-style-type: none"> - Flow-rate – 15 m³/h (Note: intermittent flow on timed cycle) - Head – 12 m - Drive – 2.2 kW, fixed speed - Mass – 0.3 to
Platform at + 565 m elevation, where the followings will be sited :	
Oxygen Plant	
<p><i>Oxygen Plant</i> – will produce cryogenic oxygen used in Albion process flow-sheet for the oxidation of pyrite concentrate; in plan view, the dimensions of the oxygen plant are 40 x 85m, as indicated by one specialized company, and the plant capacity is 525 t/day of 100% oxygen.</p>	
	<div style="border: 1px solid black; padding: 5px;"> <ul style="list-style-type: none"> 2 x SIGMA unit 2 x main air compressor with the afferent drive motor and electric panel 2 x compressed air boosters, including the turbine system 2 x air purifying main systems with two air absorbents, including the valve control system 2 x air segregation columns with heating exchanger with air and double distillation column Liquid oxygen storage system: 2x 60,000 liters Vaporization system (4 x 2,000 Nm³/h) Cooling towers including osmosis system for chemical treatment of complete water Noise isolating system to have a noise level of 80 dB(A) at 1 m distance Control room of the separation plant and of the storage – vaporization system Pressure reduction station of gaseous oxygen after buffer vessels Fire fighting system Measure and control devices (analyzers) </div>



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	<p>Electric power distribution within the separation plants Distribution network between the air separation plants and storage systems Oxygen measurement systems delivered to Deva Gold</p>
Platform at + 563 m elevation, where the following buildings will be sited :	
<i>Processing plant maintenance workshop</i>	
<i>Chemical analysis laboratory</i>	
1	<i>Chemical analysis laboratory and the associated equipment</i>
Platform at + 548 m elevation, where the following buildings will be sited:	
<i>Albion Plant</i>	
1	<p><i>Albion tanks</i> The construction works afferent to the installation of the Albion leaching tanks, respectively, the embanking of the facility in order to protect the area in case of emergency, consists of the followings:</p> <ul style="list-style-type: none"> - The foundations of the Albion leaching tanks are isolated foundations of block type, made of monolithic reinforced concrete with: <ul style="list-style-type: none"> • Octagonal shape in plan view, with the A side = 5.302m; • Built surface: $A_c = 135.77\text{m}^2$; - The embankment walls are located on the contour of the area afferent to the Albion leaching plant, at +2.3m elevation. Elastic support walls made of monolith reinforced concrete; <ul style="list-style-type: none"> - Floor, with 1% slope orientated along transversal direction to the collecting basin; it consists of : <ul style="list-style-type: none"> • A concrete slope layer of variable thickness = 30cm - 2cm. <p>The proper floor of 20 cm thickness.</p> <ul style="list-style-type: none"> - a polyethylene liner of 0.8cm thickness for water –proofing; - a 10 cm thickness simple concrete levelling layer; <ul style="list-style-type: none"> - Collecting basin (sump pump- Pv-028): it is located in the proximity of the wall, in the axe of the foundation corresponding to “FT4” leaching tank, it has a rectangular shape and the footing dimensions in pan view: 1.20m x 1.20m - access stairs to the facility;
Retention basin made of concrete Volume 2190 m^3 . The volume of the largest equipment: 1500 m^3 – The total volume of the equipments afferent to the basin: 7500 m^3 .	



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at Albion Leach	
TK- 014 Albion Leach Feed Tank	- type: mild steel - capacity - cca. 6 m ³ - mass: 2t
TK- 015 ISAMILL Feed Tank	- type: mild steel, fitted with sieve bend inlet screen sized to remove broken grinding media - capacity: cca. 6 m ³ -screen aperture: 2 mm
BN - 007 Isa Mill Media Feed Bin	- live volume: 14m ³ - length- 4m - width - 3m - height- 2 m - freeboard – 0.5m
FE - 006 IsaMill Media Screw Feeder	- drive - 37 kW - feed rate- 0.034 t/h
ML -002 ISA MILL	- feed rate - 40t/h - mill size - P80- 26 microns - product size - P90 – 9microns - specific energy - 57kwh/t - installed power - 3000 kW - length - 22m - width – 3.5m - height - 3.4m - mass - cca 62 t
PC-024,024A ISAMILL Feed Pump	- drive- 30 kW - flow-rate 59 m ³ /h
PC-025,025A Albion Leach Feed Pump	- rubber lined, horizontal, centrifugal pump - drive - 11 kW - flow-rate -76 m ³ /h - pulp density – 1.6 kg/dm ³ - head - 13m
PV-008 ISAMILL Sump Pump	- capacity - 35m ³ /h - pulp density - 1,6 kg/dm ³ - head- 23m - drive fixed speed - 11kW
TK- 020- 024 Albion Leach Feed Tank no.1 –no. 5	- capacity - 1500 m ³ - mass – 87.6 t



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	<ul style="list-style-type: none"> - diameter - 11.52m - total height – 15.4m - freeboard - 1m - pulp density – 1.6 – 1.25 kg/dm³ - baffles- 3 - the equipment will be paint outside
AG-008-012 Albion Leach Feed Tank	<ul style="list-style-type: none"> - number of impellers- 2 - impeller diameter - A310 -3930mm <li style="padding-left: 20px;">- A315 -3970mm - peak torque - 84400Nm - max. speed - 6.6m/s - drive - 225 kw, fixed speed - pumping rate - 1098m³/min - buffers - 3
LA- 001-005 Albion Leach Tank Launderers	<ul style="list-style-type: none"> - wide - 200 mm - depth - 450 mm - length - 2508mm - material - LDX 2101
SK-003-007 Albion Leach Vent Stacks	<ul style="list-style-type: none"> - diameter – 1.3 m - 6.5 m height above tank top - max. gas temperature - 96 °C
FA-002,012-015 Albion Leach Vent Fans	<ul style="list-style-type: none"> - capacity - 38,000 Nmc/h - max. gas temperature - 96 °C - differential pressure - 30 Pa - drive- 7.5 kw, each vent
PV-028 Albion Leach Area Sump Pump	<ul style="list-style-type: none"> - capacity - 35m³/h - pulp density – 1.6kg/dm³ - head- 23m - drive - 11kw
SP-006 -010 Oxygen sparge pipes	<ul style="list-style-type: none"> - number of lances per tank - 24 - diameter of sparge inlet – 7.62 mm - sparge overall length - 2600 mm - air flow - 140 Nmc/h - sparge inlet pressure - 650 kPa - material – stainless steel 316L (2 MoNiCr175)
2	<p><i>Albion thickener</i></p> <p>The construction works afferent to the installation of the equipments, respectively, the embanking of the facility in order to protect the area in case of emergency, consists of the</p>



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followings:

- The foundations of the Albion neutralization tank is an isolated foundations of block type, made of monolithic reinforced concrete with:
 - octagonal shape in plan view, with the A side = 1.78m (□ closed circle = 4.30m);
 - built surface $A_c = 15.35\text{m}^2$;
 - the foundations of the thickener overflow pumps (2 pieces) PC-027, PC-027A; neutralization tank feed pumps (2 pieces) PC-028, PC-028A; the foundations of the thickener underflow pumps (2 pieces) PC-026, PC-026A, all these have:
 - a rectangular shape in plan view, with the width A= 1.00m; the length B =1.40m;
- The support platform of the thickener overflow tank has the following characteristics:
 - square shape in plan view, with the inter-axe side of 3.00m;
 - the foundations are isolated type, with the following plan view dimensions: 0.70m x 0.70m;
 - The embankment walls are:
 - Located on the contour of the area afferent to the leaching plant,
 - Elastic support walls made of monolithic reinforced concrete;
 - The upper level of the height/ elevation is = +2.20m;
- Floor with 1% slope orientated along transversal direction to the collecting basin;
- Collecting basin (sump pump - Pv-026):
 - in plan view, it has a rectangular shape with the following dimensions: 1.10m x 1.20m
 - the walls have 20 cm thickness,
 - retention basin made of concrete with a volume of 1815m^3 –The volume of the largest equipment is 1385m^3 . The total volume of the equipments afferent to the basin is 1486.5m^3 .– access stairs to the facility

TK-017 Albion Thickener Tank	- diameter - 21m - sidewall height - 4 m - rotation drive - 3.0 kw - Volume - 1385m^3 .
TK-017A Thickener Tank Cover	- diameter - 21m - material - LDX2101
BX-018 Albion Discharge Box	- closed top tank - Volume – 2.5m^3 .
BX-008) Albion Thickener Feed Box	- closed top tank - material - LDX2101 - Volume – 2.5m^3 .
TH-003) Albion Thickener Mechanism	- diameter - 21 - material - LDX 2101
TK-018 Albion Thickener Overflow Tank	- capacity – 12.5mc - diameter - 3 m



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	<ul style="list-style-type: none"> - total height – 3.0m - carbon steel - LDX 2101 - residence time - 4 min - freeboard - 0.3m
TK-019 Albion Slurry Neutralization Tank	<ul style="list-style-type: none"> - capacity - 84 m³ - diameter – 4.8 m - total height - 5.3 m - carbon steel, rubber lined - residence time - 0.5 h - freeboard – 0.5m
AG-007 Albion Slurry Neutralization Tank Agitator	<ul style="list-style-type: none"> - impeller diameter - 1500mm - max. torque - 150 daNm - drive – 7.5kW - carbon steel, rubber lined
PC-026,026A Albion Thickener Underflow Pump	<ul style="list-style-type: none"> - flow-rate - 107m³/h - density - 60 %w/w, SG1.6 - head - 18m - drive - 15kW, variable speed - suction / pressing size - 100/75 mm
PC-027,027A Albion Thickener Overflow Pump	<ul style="list-style-type: none"> - flow-rate - 206m³/h - head - 33m - drive- 30kW, variable speed - suction/pressing size - 150/100 mm
PV-26 Albion Thickener Area Sump Pump	<ul style="list-style-type: none"> - flow-rate - 36m³/h - density – 1.6kg/dm³ - head - 13m - drive - 7.5 kW- fixed speed - suction/ pressing size - 150/100mm
3	<p><i>Albion Cooling Tower</i></p> <p>The construction works afferent to the installation of the equipments, respectively , the embankment of the facility in order to protect the area in case of emergency, consists of the followings:</p> <p>The hall itself – is a hall with :</p> <ul style="list-style-type: none"> - structural strength of the building consists of two (2) transversal metal frames - the infrastructure consists of isolated foundation of block type (with two benches/steps along the long side), made of simple concrete and a reinforced concrete bolster; - running beam of hoist – load Q = 5.00tf



AGENCY FOR ENVIRONMENT PROTECTION HUNEDOARA

Str. Aurel Vlaicu nr. 25, Deva, Jud. Hunedoara, Cod 330007

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1.10m	<ul style="list-style-type: none"> - the supporting frame of the screen, at the +2.30m level made of metallic profiles of IPE 400 type - Access platform around the screen at +2.30m level. <ul style="list-style-type: none"> - Foundations of the neutralization pumps (2 pieces), which have a rectangular shape in plan view; - The embankment walls are: <ul style="list-style-type: none"> - located on the contour of the area afferent to the cooling tower of the Albion plant product; - the vertical wall has a constant thickness along vertical: $b = 0.20\text{m}$; - Floor with 1% slope orientated along transversal direction to the collecting basin; - Collecting basin is located in the proximity of the right embankment wall and half to its opening; it has a rectangular shape in plan view, with the gap size of $1.00\text{m} \times 1.10\text{m}$ - the retention basin has a volume of 102m^3 – The volume of the largest equipment is 6.1 m^3 – The total volume of the equipments afferent to the basin is 6.1 m^3. - the access stairs are at the Albion cooling tower facility;
CT-001 Albion slurry cooling tower	<ul style="list-style-type: none"> - feed - $97\text{m}^3/\text{h}$ slurry, 63.4 t/h water and 94 t/h solids - inlet temperature - $95\text{ }^\circ\text{C}$ - outlet temperature - $45\text{ }^\circ\text{C}$ - slurry pH - 5 - fan airflow - $180000\text{ Nm}^3/\text{h}$ - fan power- 37 kw - diameter – 4.5 m - height - 8 m
PB-016 Cooling tower Pump Box	<ul style="list-style-type: none"> - flow-rate - $170\text{ m}^3/\text{h}$ - capacity – 6.1m^3 - material – carbon steel, unlined
KB-007 Gypsum Clean-down Kibble	<ul style="list-style-type: none"> - material – mild steel plate suitably stiffened, unlined - mass – 0.5t
KB-008 Trash Collection Kibble	<ul style="list-style-type: none"> - mass – 0.5t
SC-016 CIL Trash Screen	<ul style="list-style-type: none"> - feed rate: 110t/h solids and $193\text{ m}^3/\text{h}$ pulp - material size: $1800 \times 4800\text{ mm}$ - aperture – $0.6 \times 9\text{mm}$ - drive - 15kw - screen deck material – polyurethane
PC-028,028 A AlbionCooling Tower Feed Pump	<ul style="list-style-type: none"> - flow-rate $106\text{ m}^3/\text{h}$ - density - $60\% \text{ w/w}$, SG1.63 - head - 28m - drive - 22kW , variable speed - suction / pressing size - $100/75\text{mm}$
PC-100,100A CIL Feed Pump	<ul style="list-style-type: none"> - flow-rate - $185\text{m}^3/\text{h}$



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PV-76 Albion Cooling Tower Area Sump Pump	<ul style="list-style-type: none"> - density - 41 % w/w, SG1.4 - head - 18m - drive- 18.5 kW - variable speed - suction/pressing size - 150/100mm - flow-rate 36 m³/h - density – 1.6 kg/dm³ - head - 13 m - drive – 7.5 kW – fixed speed
CN-036 Hoist – CIL Inter-stage Screen Manipulation	<ul style="list-style-type: none"> - capacity- 5t - hoist
CIL Leaching	
<i>Compressor Station</i>	
SP-013÷018 Air spargers	<ul style="list-style-type: none"> - air demand - 1226 Nm³/h tank - air pressure to spargers – 1.5bari
CP-001÷002,007 CIL Air Compressor Cooling Water Package	<ul style="list-style-type: none"> - with screw, water cooled - capacity - 10.000Nm³/h - cooling water flow-rate - 56m³/h each - drive - 450kw each
<i>Compressor Cooling Tower</i>	
CT-002 - CIL Air Compressor Cooling Water Package	<ul style="list-style-type: none"> - forced draft cooling tower and pump - cooling water flow-rate - 168m³/h - drive - 9 kw - cooling water / hot water returned temperature 40⁰C/ 50⁰C
2	CIL Tanks – the tanks (4) will be sited in open space on a mono-block foundation; in plan view , the foundation has the following dimensions: 39 x 9.9m; the surface is enclosed with embanking walls disposed on the contour of the area afferent to the CIL tanks; the vertical wall is even thickness along the height (h=1.5m); the floor has 1% slope and is orientated along transversal direction to the collecting basin , which is located in the proximity of the longitudinal embanking wall and is fitted with a sump; from the sump the spillages are pumped into the feeding tank of the CIL tanks.
Concrete retention basin	
-Volume: 1735 m ³ . – The volume of the largest equipment: 830 m ³ – The total volume afferent to the basin: 4346.5 m ³ .	
TK - 070÷075 CIL Tanks	<ul style="list-style-type: none"> - number of impellers - 2 - material: carbon steel, rubber lined with 3 deflectors - live capacity - 830 m³ - diameter - 10.1m - height - 11.1m - residence time/ tank - 5 h - material: carbon steel, unlined



SM-22 CIL Feed Sampler	- drive – 0.37kW - material - OL/W1.4541
AG-033÷038 CIL Tank Agitator	- max. torque - 33700 Nm - peak speed - 5.87 m/s - drive - 75 kw
BN-008 Carbon Bin	- capacity – 1.5m ³ - collect tramp oversize carbon from carbon safety screen
SC-005÷011 CIL Inter-staged Screens	- screen area - 3.5 m ² - nominal feed rate- 222m ³ /h - maximum feed rating- 300 m ³ /h - screen aperture - 0.8 mm - carbon concentration - 50 g/l - carbon size – 2.5 x 1.25mm - solid size - 80% -80µm - drive -5.5 kw
SC-012 Loaded Carbon Screen	- deck size - 610 x 3050 mm ² - feed rate - 28t/h or 55m ³ /h - aperture - 0.5 x 8.8 mm - carbon removed – 2.5t/h - screen deck material - polyurethane - spray bars - 4 - drive - 2 x 1.6 kw
SC-013 Carbon Safety Screen	- deck size - 1800 x 6000 mm - feed rate - 127t/h in 245m ³ /h pulp - aperture - 0.6 x 9 mm - screen deck material - polyurethane - drive- 15 kw
TK-076 Loaded Carbon Tank	- live capacity - 11t - diameter - 4 m - total height - 5 m - cone included angle - 80 ⁰ - material – carbon steel with stainless steel cone bottom
TK-099 CIL Solution Returns Surge Tank	- live capacity - 150 m ³ - diameter - 6 m - freeboard – 0.3 m - total height - 6.1 m



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Str. Aurel Vlaicu nr. 25, Deva, Jud. Hunedoara, Cod 330007

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	- cone included angle - 90 ⁰ - material: carbon steel, unlined
TK-069 CIL Head Tank	- diameter – 2.2 m - total height – 2.6 m - material: carbon steel, rubber lined - Volume – 9.5 m ³ .
SM-025 Cyanide Analyzer	- to analyse free cyanide and pH in the CIL feed and discharge - silver nitrate titration
CN-021 CIL Sump Pump Hoist	- manual hoist - capacity 1 t
CN-010,032 CIL Inter-stage Screens Hoist	- monorail type - capacity - 5 t - drive - 9.1kW hoist and 2.2kW long
CT-002 CIL Air Compressor Cooling Water Package	- forced draft cooling tower and pump - cooling water flow rate - 168m ³ /h - drive - 9 kw - cooling water / hot water returned temperature 40 ⁰ C/ 50 ⁰ C
AR-006 Air Buffer Receiver	- capacity - 25 m ³ - buffer receiver pressure – 2.3 bars
PV-042÷048 CIL Carbon Pumps	- flow-rate - 55m ³ /h - pulp density - 1,31 kg/l - head - 6 m - drive -7.5 kw - fixed speed
PV-049 CIL Spillage Pump	- flow-rate - 35 m ³ /h - pulp-density – 1.2 kg/l, - head - 6 m - drive- 11 kw - fixed speed
PV-050 CIL Drain Pump	- flow-rate - 50 m ³ /h - density – 1.31kg/l - head – 1.5 ÷ 12 m - drive – 7.5 kw - type: heavy duty, submersible slurry pump with lined impeller
PC-058 Loaded Carbon Transfer Pump – Rubber Lined Horizontal Centrifugal Pump with Recessed	- flow-rate 60 m ³ /h - density 1.06 kg/l



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Impellor	- head - drive - size	22 m 11kw 75/50
PC-090,090A CIL Solution Return Pumps	- horizontal, centrifugal pump - flow-rate - 0-15 m ³ /h - density - 1.0 kg/l - head - 35 m - drive - 4 kw - variable size - size - 32/25	
SE - 007 CIL Safety Shower		
CH-061 Safety Carbon Screen Feed Chute	- mass - 1.2t - low reinforced construction - unlined	
BX-010 CIL Tailings Thickener Feed Box	- closed top tank - unlined - material – fabricated from mild steel plate suitably stiffened	
TK-025 CIL Tails Flocculant Storage Tank	- live capacity - 12 m ³ - diameter – 2.4 m - empty height - 0.2 m - total height - 3.3 m - material : carbon steel unlined	
3	<i>Cyanide mixing and storage</i> – a safety building with one level, in plan view having the following dimensions: 18 x 15 m, the building has an internal concrete basin with 0.4 m height and with an inclined floor to a sump, to collect and pump the spillages back into the flow-sheet at the CIL tanks. The cyanide box –pallets are stored into a compartment of the building, from where with a lifting system are diverted to the dissolution/mixing tanks. Cyanide mixing/dissolution tank and the cyanide storage tank are closed top tanks, the gases being evacuated with a vent into the atmosphere. The transfer pumps deliver the cyanide through the steel pipes into the CIL tanks and to elution.	
Retention basin made of concrete	- Volume 147 m ³ . – The volume of the largest equipment: 30 m ³ – The total volume of the equipments afferent to the basin: 60 m ³ .	
Tk-064 Sodium Cyanide Mixing Tank	- type : vertical, cylindrical, closed top tank - capacity: 30m ³ - diameter: 3.5m - total height: 3.9m - material: carbon steel, unlined, with 3 deflectors	
AG-025 Sodium Cyanide Mixing Tank Agitator	- type : hydrofoil - diameter- 1000mm - No. of impellers - 1 - max. torque - 750 Nm	



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Str. Aurel Vlaicu nr. 25, Deva, Jud. Hunedoara, Cod 330007

E-mail: office@apmhd.anpm.ro; Tel: 0254/215445, Fax: 0254/212252

	<ul style="list-style-type: none"> - drive – 5.5kw - material – carbon steel
BH-003 and RV-006 - Sodium Cyanide Big Bag Handing System and Sodium Cyanide Feed Rotary Valve	<ul style="list-style-type: none"> - complete with rotary valve to minimise dusting in the tank and a seal to attach the bulk bag spout to the outlet chute to prevent dust escape - drive – 0.37kw - material: contact parts stainless steel; otherwise carbon steel
CH-041 Sodium Cyanide Feed Chute	<ul style="list-style-type: none"> - fabricated from steel suitably stiffened, unlined
CN-032 Cyanide Bag Hoist	<ul style="list-style-type: none"> - capacity - 1t - drive – 1.5kw
FA-016 Cyanide Mixing Vent Fan and Storage Tank	<ul style="list-style-type: none"> - type : centrifugal - flow-rate - 2000 m³/h - pressure 1300 Pa - drive – 2.2kw
PC-054 Sodium Cyanide Transfer Pump	<ul style="list-style-type: none"> - type :horizontal, centrifugal pump, mechanical seal - flow-rate: 36m³/h - fixed speed - head – 3.5m - drive – 2.2 kw, - fixed speed
PM-033 ÷34 Sodium Cyanide Solution Pumps	<ul style="list-style-type: none"> - type :progressive cavity pump - flow-rate – 1.5m³/h - head - 30 m - drive – 1.1kw, - fixed speed
PM-35 Cyanide Metering Pump	<ul style="list-style-type: none"> - type : progressive cavity pump - flow-rate: 14 m³/h - head - 10 m - drive - 2.2 kw, - fixed speed
PV-040 Cyanide Area Sump Pump	<ul style="list-style-type: none"> - type : horizontal, centrifugal, with SG iron/chrome alloy - flow-rate: 14m³/h - head - 24 m - drive – 5.5 kw, - fixed speed
TK-065 Sodium Cyanide Storage Tank	<ul style="list-style-type: none"> - type : vertical, cylindrical, closed top tank - capacity: 30m³ - diameter: 3.5m



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E-mail: office@apmhd.anpm.ro; Tel: 0254/215445, Fax: 0254/212252

	- total height: 3.9m - material: carbon steel, unlined
SE-005 Cyanide Safety Shower	
4	Compressor cooling tower - metallic construction located outside the building of the compressor station
Lime slurry preparation station	
Concrete retention tank	-Volume 176 m ³ – Volume of the largest installation: 60 m ³ – Total volume of the tank related installation: 97 m ³ .
TK– 062 Lime slurry storage tank	-type : closed top vertical cylindrical - capacity about 60 m ³ - diameter 5.4 m - total height 5.7m - deflectors 3 - material: unlined carbon steel - weight 11.5t
TK– 110 Lime slurry preparation tank	-type: closed top vertical cylindrical - capacity about 37 m ³ - diameter 3.5 m - total height 4.2 m - material: unlined carbon steel - weight 5.4 t
AG- 024 Agitator of lime slurry storage tank	- diameter Ø 1300 mm - no.of rotors 1 - maximum torque 690Nm - construction: average steel, rubberized - drive power 4kw
AG- 002 Agitator of lime slurry mixing tank	- diameter Ø 1900 mm - no. of rotors 1 - maximum torque 1.700 Nm - construction: average steel, rubberized - drive power 45.5 kw
PC – 015 Lime slurry transfer pump	- type : horizontal vertical rubberized - flow 100m ³ - pulp density 1.23 kg/l - delivery height 4.5m - power 3kw
PC – 052, 053: Lime slurry circulation pumps	- type: horizontal vertical rubberized - delivery 11m ³



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Str. Aurel Vlaicu nr. 25, Deva, Jud. Hunedoara, Cod 330007

E-mail: office@apmhd.anpm.ro; Tel: 0254/215445, Fax: 0254/212252

	- pulp density 1.23 kg/l - delivery height 39 m - power 5.5 kw
PC – 053A Lime slurry transfer pump	- type : horizontal vertical rubberized - delivery 100m ³ - pulp density 1.23 kg/l - delivery height 70 m - power 28 kw
PV – 038 Pump in the sump of lime slurry area	- type: heavy duty vertical centrifugal for sludge - delivery 50 m ³ - pulp density 1.8 kg/l - delivery height 25 m - power 18 kw
SE-003 Safety shower in the lime station area	
SI - 001 Lime silo assembly	- capacity 200 t - density in mass 0.4t/m ³ - diameter 6m - height 17m - material: carbon steel
Transformer stations for enclosures (platform +548)	
1	Control + command building (MCC 007+MCC 009)
2	Electrogenic group – power 1600 kVA/400 V
Limestone tank	
1	<p>Limestone tank – the limestone storage installation enclosure has the following characteristics:</p> <p>Built area: $A_c = 211.72\text{m}^2$, One transversal inter axial opening: $B = 13.40\text{m}$; One longitudinal inter axial opening: $A = 15.80\text{m}$; Elevation of the inner platform is: $\pm 0.00 = +548.00\text{m} = \text{CTS}$.</p> <p>Construction works, related to limestone storage tank and pumps mounting, respectively, to impoundment of enclosure to protect the area in case of emergency, consist of the following:</p> <ul style="list-style-type: none"> - Foundation of limestone storage tank -FTC, is an insulated foundation block type, made of monolithic reinforced concrete, octagonal shape in plan, with side of $A = 3.976\text{m}$; built area $A_c = 75.94\text{m}^2$; - Foundations of centrifugal pumps PC-023, PC-023A, are rectangular in plan, width $A = 0.90\text{m}$; length $B = 1.30\text{m}$; - Impoundment walls are placed on the contour of the area related to limestone storage installation; the walls are elastic supporting wall type, - 1% inclined floor oriented transversally – toward the collecting gutter - Collecting gutter is placed at the bottom of the wall, its section is 30cm x 30cm. - Collecting basin is rectangular in plan with dimensions of 1.2m x 1.2m x 1.2m - Access staircase to the precinct is an 45° inclined metallic staircase



Concrete retention tank	-Volume 695 m ³ . – Volume of the largest equipment: 535 m ³ – total volume of tank related equipment: 535 m ³ .
TK– 012 Limestone slurry storage tank	- type : vertical cylindrical with stirring - capacity about 535 m ³ - diameter 8.8m - total height 10m - deflectors 3 - weight 26.2t - material: carbon steel with rubber lining
AG– 003 Agitator of the limestone slurry storage tank	- type: self-supporting - diameter of agitator 2300, respectively 1700mm - no. of agitators 2 - maximum torque 9200 Nm - drive power 22kw - material: rubberized carbon steel
PC-023 and 023A Pump of the limestone circular pipe	- no. in use / reserves 1/1 - type: horizontal centrifugal for slurry - capacity 159m ³ /h - slurry density 1.3 t/ m ³ - delivery 35 m - power 45 kw - fixed speed - construction: rotor and rubber liner - weight 1.3 t
PV-009 Pump in the sump of limestone storage	-type: heavy duty vertical centrifugal for slurry - density 1.36 t/ m ³ - capacity 50m ³ /h - delivery 12m - drive power 11 kw - fixed speed - weight 0.8 t
Platform elevation +575m	
Limestone preparation installation	
1	<i>Limestone preparation section</i> – total footprint of the limestone grinding building will be about 19x18m. In the building will operate a 15t bridge crane. Limestone requested by Albion process will be transported into the installation feeding bin or, alternatively, into and open storage space. Bunker has 180t capacity and emergency storage has 1250 m ³ capacity (aprox. 1800t). Feed bin of the limestone installation supplies directly the secondary limestone crusher through a vibrating feeder. Secondary crushing is performed by an impact mill to reduce the size of limestone to 80% -15 mm. Crushed limestone supplies the ball mill through a belt conveyer provided with belt scale. The mill operates in closed circuit with a 250mm hydro cyclones battery, 3 in use and 1 reserve with manual isolation valves and it is designed with recirculation load of 250% to



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Str. Aurel Vlaicu nr. 25, Deva, Jud. Hunedoara, Cod 330007

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	<p>provide the hydro cyclone overdrenage of 80% -75 microns and 40% solid. Hydro cyclone overdrenage is pumped to the limestone storage tank placed next to the Albion installation. A 535m³ storage agitator made of carbon steel lined with rubber, with open top, provides a total capacity for the 8 hours consumption. From the storage tank, a pump recirculates the limestone through a circular pipe around the Albion tanks.</p> <p>Limestone grinding uses recirculated water from the CIL pond.</p>
Concrete retention tank	-Volume 75 m ³ . – Volume of the largest equipment: 30 m ³ – total volume of equipment related to tank: 36.8 m ³
AR-005 Air receiver for the limestone mill	- weight 0.5t
MB-002 Ball mill for limestone	<ul style="list-style-type: none"> - feed flow 40t/h - size of product: - overdrenage 80% -75 µm - diameter 3m inner shell - length 5m - spindle bearings: bearings with spherical rollers - lubrication: vaseline - balls size 80mm - pinion power 450kw - motor 600kW – induction, fixed speed and coiled rotor. Starter - weight 71.7 t
HP-004 Limestone installation feed bin	<ul style="list-style-type: none"> -type: made of steel with rectangular section with 900mm outlet - material: 6mm steel suitably stiffened unshielded - capacity 180t - width 4.6m - length 5.5t - total height 7.9m - wall inclination max 55⁰ - bin weight - 40 t - support structure 15 t
FE-007 Limestone installation feeder	<ul style="list-style-type: none"> -type: vibrating feeder - capacity 0 -40t/h variable - drive power: 1.5kW vit.,8 variable - material: carbon steel with shielding with stainless steel output section - weight 1.5t
CH-027 Limestone installation feeder discharge chute	<ul style="list-style-type: none"> - made of mild steel sheet suitably stiffened - steel shielding with bolts - weight 0.3t
CN- 012 Limestone installation magnetic pulley	<ul style="list-style-type: none"> - type: mono-girder pulley controlled by movable hanging controls - capacity 1t - drive power 1.5kw - weight 1.5t



AGENCY FOR ENVIRONMENT PROTECTION HUNEDOARA

Str. Aurel Vlaicu nr. 25, Deva, Jud. Hunedoara, Cod 330007

E-mail: office@apmhd.anpm.ro; Tel: 0254/215445, Fax: 0254/212252

MA-005 Limestone installation feeder magnet	<ul style="list-style-type: none"> - iron removal from secondary crusher feeding - fixed electromagnet suspended by a winch - power 3.8 kw - weight 1.13 t
BN-005 Metallic bunker for foreign materials	<ul style="list-style-type: none"> - type: tipping skip - capacity 1.5 m³
MH-001 Secondary limestone crusher	<ul style="list-style-type: none"> - type: impact crusher with manganese hammers and breaking plates - capacity 40t/h - silica content SiO₂ < 2.4 % - feeding F80 120 mm - product P80 15 mm - drive power 90kw - weight 7.24 t
CH-030 Secondary crusher discharge chute	<ul style="list-style-type: none"> - made of mild steel sheet suitably stiffened - steel shielding with bolts - weight 1 t
DE-003 Limestone installation dedusting system	<ul style="list-style-type: none"> - type bag filter and fan - power 1.5kw - weight 2 t
CV-007 Feeding conveyer for limestone mill	<ul style="list-style-type: none"> - type: concave rubber belt conveyer - capacity 60 t/h - width 600mm - length 27m - height 7 m - speed 1.5 m/s - concavity angle 30⁰ - drive power 7.5kw - weight 9.68 t
BW-005 Belt scale for limestone	<ul style="list-style-type: none"> -type: with load cell on one roller equipped with load cell with precision instrument measuring voltage provided in a preassembled integrator in weight frame, with digital sensors for the belt speed and rollers for weighing quality - precision: ± 1% for 10 to 110% of the design capacity of the belt and will have a repeatability of minimum 3 months (normal precision) - weight 0.11 t
CH-051 Limestone mill feeding conveyer main chute	<ul style="list-style-type: none"> - material: mild steel sheet suitably stiffened - steel shielding fixed with bolts
CN-013 Limestone mill EOT crane bridge	<ul style="list-style-type: none"> -type: with two girdles, infrared remote control, with suspended control



AGENCY FOR ENVIRONMENT PROTECTION HUNEDOARA

Str. Aurel Vlaicu nr. 25, Deva, Jud. Hunedoara, Cod 330007

E-mail: office@apmhd.anpm.ro; Tel: 0254/215445, Fax: 0254/212252

	<ul style="list-style-type: none"> - capacity 15 t - opening 17m - drive power: pulley 13 kw , transversal shifting 0.6 kw, longitudinal shifting 2 x 0.9 kw - weight 8.143 t
PB-013 Basin of limestone mill discharge	<ul style="list-style-type: none"> - material: soft 6mm steel stiffened accordingly - rubber liners - weight 1.7t - surface 16m² - Volume 30 mc.
PC-022 and 022A Limestone cyclones feeding pump	<ul style="list-style-type: none"> - no. In use / reserves 1/1 -type: horizontal centrifugal for slurry - capacity 185m³/h - slurry density 1.6 t/ m³ - delivery 23 m - power 37 kw - variable speed - construction: steel Cr rotor lined with rubber - weight 1.8 t
CY-003 Limestone hydro cyclones battery	<ul style="list-style-type: none"> - no. In use / reserves 3/1 -type: 300mm diameter mounted on a 4-ways valve distributor with pneumatically operated isolation cutter and supplemented with collecting gutters for overdrainage and thickened - construction: polyurethane cyclone input distributor, gutters lined with rubber for overdrainage and thickened. - in use: normal 2, maximum 3 - input pressure 0.5 – 0.55 bar - weight 2.5 t - volume 1.5 m³.
PB-015 Basin at the limestone hydro cyclones overdrainage	<ul style="list-style-type: none"> - material: 6mm mild steel sheet suitably stiffened - rubber jacketing - capacity 2.3m³ - weight 1.6 t
PC-091 and 091A Limestone hydro cyclones overdrainage pump	<ul style="list-style-type: none"> - nr. 1/1 -type: horizontal centrifugal for slurry - capacity 75m³/h - slurry density 1.3 t/ m³ - delivery 10 m - power 5.5 kw - variable speed



PV-025 Pump in the limestone grinding sump	<ul style="list-style-type: none"> - construction: rotor and rubber lining - weight 0.4 t -type: heavy duty vertical centrifugal for slurry - density 1.6 t/ m³ - capacity 50m³/h - delivery 12m - drive power 11 kw - fixed speed - weight 0.8 t
SC-001 Fixed grate of the loading bin	<ul style="list-style-type: none"> -type: with fixed bars - width 4.6m - length 5.5m - opening between the bars 200mm (F80=120mm) - weight 8 t
KB-004 Limestone rollers bucket	<ul style="list-style-type: none"> - material: 6mm mild steel sheet suitably stiffened - shielding not shielded - weight 1 t
CH-034 Misplaced metals chute	<ul style="list-style-type: none"> - material: mild steel sheet suitably stiffened - shielding: not shielded - weight 0.75 t
CH-048 Ball feeder chute	<ul style="list-style-type: none"> - material: mild steel sheet suitably stiffened - shielding not shielded - weight 1t
CH-057 Oversized limestone collection chute	<ul style="list-style-type: none"> - material: mild steel sheet suitably stiffened - shielding not shielded - weight 0.8 t
Platform elevation + 538 m	
CIL Installation	
1	<p><i>Electrowinning gold room</i></p> <p>The building is developed on two levels – partially one level, has the modular axes plan dimensions of 20.0 x 25.0 m, S = 500 m², with bays of 11.70 and 8.30 m placed at 50 m distance. Cornice height of the structure is different as follows: 9.00 m for the area between axes A – B and 4.0 m for the area between axes B – C over the entire 25.0 m length of the object. The structure is built on steel frames with two modular openings of 11.70 m and 8.30 m placed at 5.0 m distance between them, thus the preparation area between the axes A – B the frame is made with ridged roof beam with the ridge at the middle of the opening placed at 10.50 m elevation, and in the storage – distribution area between the axes B – C the roof beam has only one slope between the elevations 6.25 and 4.00 m.</p>
Concrete retention tank	-Volume 18 m ³ – Volume of the largest equipment: 5 m ³ – total volume of equipment related to tank: 8.7 m ³
BN-009 Slag pot	- 2 slag baskets
CN-024, 025 Anode/cathode lifting pulley	- type manual



AGENCY FOR ENVIRONMENT PROTECTION HUNEDOARA

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	- capacity 1t
DE-004 Furnace air filter package	- type: cartridge 142m ² - included in the package, “gold room”
EC-001 ÷ 004 Electrowinning cells	- assembling : 2 parallel and 2 serial - material : 0.82m ² stainless steel mesh - cathode electrodes 33 pieces: 0.82m ² stainless steel mesh - anode electrodes 36 pieces stainless steel - eluate pumping rate 20m ³ /h/row - electrowinning cycle duration 10h max - Volume 5 m ³ .
ER-001÷ 004 Rectifiers	- power 18kw each -parameters 0-2000A ; 0-9V
FH-001÷ 004 Fume hoods	
FH-005 Gas housing for oven and casting	
FH-006 Mixing flux hood	
FU-002 Induction furnace	- purpose : melting of filtered and dried mud from the stainless steel mesh - type : electric induction furnace - normal dore production 600kg/week - -//- max. 900kg/ week - necessary for heating 125kw - hydraulic group power 1.1 kw - controlling circuit 0.55kw
FA-006 Oven extraction ventilation fan	- drive power 7.5kw - height 200mm - included in the package, “gold room”
FA-007 Electrowinning ventilation fan	- capacity 13600m ³ /h - drive power 11kw - included in the package, “gold room”
FL-006 Sludge filter with precious metal	- type : flat press filter with hydraulic or pneumatic lock - capacity 283 l - included in the package, “gold room”
FU-001 Dry oven	- type : electrical dry with 6 trays and ventilation - capacity 75l - power 24 kw - included in the package, “gold room”
PC-070 Pressurized water cleaning rod	-type : portable with high pressurized water



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PC-102 Precious metal and sludge pump	- included in the package, “gold room” - power 5.5 kw - construction lined metal rotor
PC-107, 108 Electrolyte depleted pump	-type : vertical centrifugal with metallic wet parts - capacity 60m ³ /h - delivery height 30m - power 11kw
PV-055 Pump in the sump of “gold room”	-type : vertical centrifugal with wet parts made of Cr alloy - capacity 15m ³ /h - delivery height 5m - power 2.2kw - fixed speed
PB-017 Electrolyte depleted pump box	- type : cylindrical, closed top basin - capacity 1.7m ³ - diameter 1.6m - total height 1.9m - material stainless steel 340L
SE-010 Safety shower for “gold room”	
SM-023 Charged electrolyte sampler	
SM-024 Depleted electrolyte sampler	
TK-100 Electrowinning mud tank	- type: cylindrical, vertical closed top, with conical bottom - capacity 2 m ³ - diameter 2 m - height 1.5 m - material: stainless steel 304 L (2 NiCr 185)
XG-001 "gold room" package	- ZM-001 1 flow mixing tool kit (fondant) - ZM-002 1 cascade molds kit - ZM-003 1 precious metal preparation tools kit - ZM-004 steel workbench - ZM-005 dore bullion balance - ZM-006
2	<i>Elution</i> – the building has the total footprint area of 28m length x 10m width, consisting of bearing steel frames in a common building, properly anchored both longitudinal and at the ends of pediments, has two levels at the eaves, one at a height of 21.5m in the elution column section and one at a height of 14.5m in the carbon.regeneration section
Concrete retention tank	-Volume 250 m ³ . – Volume of the largest installation: 160 m ³ – Total volume of the tank related installation: 749 m ³ .
VS- 001 Acid wash column	- type : vertical, conical bottom, closed top, upper flow at atmospheric pressure - carbon capacity 11t , 12 m ³



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	<ul style="list-style-type: none"> - feet flow 46 m³/h - acid wash solution 3% HCl - maximum capacity of the fluid 26m³ - material: rubberized carbon steel - mesh insertion: plastic
TK-029 Acid neutralizing tank	<ul style="list-style-type: none"> - capacity of solution 24 m³ - diameter 3 m - empty height 0.3 m - total height 4 m - environmental operating temperature - material : GRP or rubberized carbon steel
AG-014 Agitator of the acid neutralizing tank	<ul style="list-style-type: none"> - diameter of rotor 700mm - number of rotors 1piece - maximum torque 205Nm - drive power 1.1kw - number 3 - material: rubberized carbon steel
TK-077 Acid circulation tank	<ul style="list-style-type: none"> - capacity of solution 28 m³ - diameter 3.5 m - empty height 0.3 m - total height 3.5 m - material : GRP or rubberized carbon steel
PC-059 Acid circulation pump	<ul style="list-style-type: none"> -type: horizontal pump made of plastic/GRP with mechanical seal - flow 55 m³/h - pulp density 1.02 kg/l - delivery height 24 m - environment 3%HCl - drive power 7.5kw - fixed speed
PC-068 Acid wash carbon pump	<ul style="list-style-type: none"> -type: horizontal, centrifugal, rubberized with recessed rotor - flow 60 m³/h - pulp density 1.06 kg/l - delivery height 20 m - drive power 15kw - fixed speed - size 75/50
PC-092 Acid evacuation pump	<ul style="list-style-type: none"> -type: horizontal, centrifugal, rubberized with recessed rotor



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	<ul style="list-style-type: none"> - flow 46 m³/h - environment 0-3% HCl - pulp density 1.02 kg/l - delivery height 50 m - drive power 15kw - fixed speed
PV-51 Acid wash sump pump	<ul style="list-style-type: none"> - vertical, centrifugal with plastic wet parts - flow 46 m³/h - pulp density 1 kg/l - delivery height 7.3 m - drive power 3kw - fixed speed
FA-011 Acid wash fan	<ul style="list-style-type: none"> - type centrifugal - air flow 1057m³/h - pressure difference 1KPa - power 0.55kw - material GRP/plastic
SE-008 Elution safety shower SE-009 Acid wash safety shower	
VS-002 Elution column	<ul style="list-style-type: none"> - carbon capacity 11t , 12 m³ - feed flow –superior 46 m³/h - temperature 130⁰C - feed flow 46 m³/h - material: stainless steel column - mesh insertion stainless steel
TK 078 Pre-wetting tank	<ul style="list-style-type: none"> - type : vertical closed top - solution capacity 35 m³ - diameter 3.8 m - empty height 0.5 m - total height 4 m - material : carbon steel, basalt insulation, plated with stainless steel
TK- 079 Depleted solution tank	<ul style="list-style-type: none"> - type : vertical closed top - solution capacity 160 m³ - diameter 6.2 m - empty height 0.37 m - total height 6.4 m - temperature max.95



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	- material : carbon steel, basalt insulation, plated with stainless steel
TK- 080 Elution water tank	-type : vertical open top - solution capacity 160 m ³ - diameter 6.2 m - empty height 0.5 m - total height 6.4 m - material : carbon steel, basalt insulation, plated with stainless steel
TK- 081 – 082 Charged solution tank	-type : vertical closed top - solution capacity 160 m ³ - diameter 6.2 m - empty height 0.37 m - total height 6.4 m - operating temperature max 95 °C - material : carbon steel, basalt insulation, plated with stainless steel
FL-004-005 Carbon collectors	-type : cylindrical with stainless steel mesh insertion
HS-001,001A Elution heating package	- type : horizontal heater with fire in tube - fuel (LPG) propane - thermal fluid - fluid pump flow 237m ³ /h - fluid pump power 55kw - heating assessment 3200 kw - burner power 9 kw - temperature of operating fluid 140 °C
HX-001 Heat recovery exchanger	- type: flat heat exchanger - heat transfer 3500kw - area 8m ² - number of plates 59 - flow 46m ³ /h - pressure drop : Hot part 89kPa Cold part 99kPa - material : stainless steel plates and EPDM fittings
HX-002 Primary heat exchanger	-type: flat heat exchanger - heat transfer 3200 kw - area 72 m ² - number of plates 118 - flow : Hot part 237 m ³ /h



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	<p>Cold part 46 m³/h - eluate heating temperature 130 °C</p>
KN-001 Carbon furnace installation	<p>- type: helical feeder, horizontal furnace with power box, preheating, final water cooling, external scrubber. - capacity 1000kg/h dry carbon and 50% (500kg) water - nominal temperature 750 °C - heating elements 1100 kw - heating output 0.9kW/kg carbon - drive: helicoidal feeder 1.1 kw Furnace drive 1.5 kw Emergency drive DC 24V DC Pre-drying fan 0.55kw</p>
CN- 022 Furnace manual pulley	- capacity 5t
CN- 035 Elution construction manual pulley	
CH- 052 Eluted carbon chute	<p>- material: light steel plate suitably stiffened - unlined metallic sheet</p>
CH- 053 Fine carbon and bags recovery frame	- material: light steel to support a bag of products
CH- 054 Carbon additions chute (bags)	<p>- material: light steel to support a bag of products - unlined metallic sheet</p>
CH- 055 Carbon sorting screen chute	<p>- material: light steel to support a bag of products - unlined metallic sheet</p>
TK-083 Eluted carbon tank	<p>- type : vertical closed top, conical bottom - max. fluid capacity 54m³ - capacity 17 t carbon - diameter 4m - empty height 0.5 m - total height 6.1m - material : carbon steel, cone made of stainless steel</p>
TK-084 Regenerated carbon tank	<p>- type : vertical closed top, conical bottom - max.fluid capacity 43m³ - capacity 11 t carbon - diameter 4m - empty height 0.5 m - total height 5 m - material : carbon steel, cone made of stainless steel</p>
TK-085 Transportation water tank	<p>- capacity 40 m³ - diameter 5.2 m - empty height 0.5 m</p>



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	<ul style="list-style-type: none"> - total height 2.9 m - material : carbon steel
TK-087 Calming tank	<ul style="list-style-type: none"> - maximum capacity of fluid 7m³ - capacity 2 t carbon - diameter 2.5m - total height 2.6 m - material : carbon steel, cone made of stainless steel
PC-060, 061 Elution pump	<ul style="list-style-type: none"> - type: horizontal plastic/GRP pump, with mechanical seal - flow 50 m³/h - pulp density 1.02 kg/l - delivery height 80 m - environment 3% NaCN, 2% NaOH - temperature max.130 °C - drive power 30 kw - fixed speed
PC-062 Elution water distribution pump	<ul style="list-style-type: none"> - type: horizontal pump with lined metal rotor. - flow 40 m³/h - potable water density 1.0 kg/l - delivery height 19 m - drive power 5.5 kw - fixed speed
PC-063, 064 Pump 1 and 2 charged solution	<ul style="list-style-type: none"> - type: horizontal pump with lined metal rotor - flow 60 m³/h - pulp density 1.02 kg/l - delivery height 10 m - fluid environment 3% NaCN, 2% NaOH - temperature max.90 °C - drive power 3 kw - fixed speed
PC-065 Transportation water pump	<ul style="list-style-type: none"> - type: horizontal pump with lined metal rotor - flow 82 m³/h - pulp density 1.02 kg/l - delivery height 10 m - fluid: treated water with carbon traces - drive power 15 kw - fixed speed
PC-066 Regenerated carbon pump	<ul style="list-style-type: none"> - type: horizontal, centrifugal, rubberized pump with recessed rotor



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	<ul style="list-style-type: none"> - flow 10 m³/h - pulp density 1.06 kg/l - power 4kw - fixed speed
PC-067 Regenerated carbon transfer pump	<ul style="list-style-type: none"> - type: horizontal, centrifugal, rubberized pump with recessed rotor - flow 52 m³/h - pulp density 1.06 kg/l - delivery height 19 m - power 22kw - fixed speed
PV-052 Elution sump pump	<ul style="list-style-type: none"> - type: vertical sludge pump with wet parts made of stainless steel - flow 39 m³/h - pulp density 1.0 kg/l - delivery height 37 m - power 15kw - fixed speed
PV-053 Regeneration sump pump	<ul style="list-style-type: none"> - type: vertical sludge pump with wet parts made of stainless steel - flow 30 m³/h - pulp density 1.2 kg/l - delivery height 9.4 m - power 4kw - fixed speed
PV-054 Carbon slam transfer pump	<ul style="list-style-type: none"> - flow 15 m³/h - delivery height 16 m - power 4kW - fixed speed
SK-001 Oven carbon stack	
SC-004 Eluted carbon draining screen	<ul style="list-style-type: none"> - purpose: water drainage from carbon for elution column - flow 12t/h and 48m³ pulp - carbon removed 12t/h - panel size 1.22m x 2.44 m - opening size (slot) 0.62 x 8.8 mm - drive power 2 x 1.5 kw - material of screen panel: polyurethane
SC-014 Carbon sorting screen	<ul style="list-style-type: none"> - purpose : removal of regenerated carbon fine fraction - flow 12t/h and 48m³ pulp - carbon removed 12t/h



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	<ul style="list-style-type: none"> - panel size 1.22m x 2.44 m - opening size (slot) 1mm x 8.8 mm - drive power 2 x 1.5 kW - sprai 2 bars - material of screen panel polyurethane
3	<p><i>Preparation /storage of HCl, unloading ramp</i> - construction for preparation and storage of hydrochloric acid will be located outdoors Construction is developed at the ground level and consists of a concrete platform with dimensions 9.00 x 9.00 in plan, forming an enclosure surrounded by a reinforced concrete wall 1.25m high; within this platform is located the hydrochloric acid tank foundation - circular equipment of 4.50m diameter and 5.50m height. Foundation of the tank is circular ring made of reinforced concrete and stands 15 cm above the floor elevation. Access to the site is made on reinforced concrete stairs, which enables crossing over the surrounding wall. The precinct floor is inclined towards a collecting channel with discharge into a sump provided with exhaust pump for liquids from rainfall or solution from plant in case of failures. Any leaks are recircuited in the storage tank or are directed to neutralization - acid wash. Adjacent to this precinct, on the south-east side is built a concrete platform for unloading (ramp) 2.0 x 5.50m, with a 30 cm thick plating contour, made all of reinforced concrete. Platform floor is also inclined toward a collecting sump. On this platform are placed the discharge pumps and recirculation pumps for possible hydrochloric acid leakage, also there will be a facility for cleaning and washing (shower) for service personnel. In order to unload hydrochloric acid from the transport mean (road tanker) is required the execution of unloading ramp located in the north-east to the main precinct, in the wheelbase road. Unloading ramp is made of 30 cm thick concrete road B300 fitted with safety reinforcement and placed on a layer of ballast 20cm thick pillar and in this case there are provided drainage slopes to a sump. There are provided special protection antacid made with bituminous mixtures, especially in the area of the hydrochloric acid tank and others (platform, ramp).</p>
Concrete retention tank	-Volume 110 m ³ . – Volume of the largest installation: 75 m ³ – Total volume of tank related installation: 75 m ³ .
PM-29 HCl transfer pump	<ul style="list-style-type: none"> - type : progressive cavity - flow 10 m³/h - delivery height 20 m - drive power 1.1 kw, - fixed speed - temperature 80⁰ - fluid 32 %HCl
PV-037 Pump in the sump of HCl zone	<ul style="list-style-type: none"> -type : horizontal centrifugal with wet parts made of thermoplastic - flow 14m³/h - delivery height 24 m - drive power 5.5 kw, - fixed speed - fluid 32 %HCl - material: polymer/GPR
SE-002 HCl zone safety shower	
SE-006 Sodium hydroxide zone safety shower	



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TK-061 HCl storage tank	<ul style="list-style-type: none"> - type : vertical, cylindrical closed top - capacity 75m³ - diameter 4.5 m - total height 5.5 m - material : GRP lined with polypropylene or epoxy lined carbon steel 	
XM-013 HCl ventilation scrubber	<ul style="list-style-type: none"> -type: HDPE column with Raschid rings made of polythene - height 1.5 m, - diameter 350mm 	
4	<p><i>Preparation /storage of elution reagents (metabisulphite, flocculant and sodium hydroxide)</i>- the building is an industrial, metallic hall, which is destined for preparation and storage of reagents solutions for elution, respectively, for cyanide neutralization in CIL tailings.</p> <p>Construction is developed on one level – ground floor and there are only two partially intermediate floors at elevations + 4.25 and 5.35 m.</p> <p>Plan dimensions of the modular axes are 12.0 x 26.0 m, S = 312 m², with bays of 7.00 and 5.00m placed at 6.5m distance. Cornice height is different, meaning 10.20m for the area between the axes 1-2 and 5.15m for the area between the axes 2-3 for the entire 26.0m length of the object.</p> <p>Foundations are insulated foundations made of reinforced concrete with foot and bushings; they will be located at the intersection of axes with strings under each pillar of the structure and at pediments closing poles. Mounting posts on foundations is made using steel bolts embedded in the foundation bushings mounted in the base board of the post.</p> <p>Floor structure is made of 15cm thick concrete equipped with safety reinforcement. This system was applied taking into account that inside the building they are working with the forklift .</p>	
Concrete retention tank	<ul style="list-style-type: none"> -Volume 69 m³. – Volume of the largest installation: 40 m³ – total volume of the tank related installation: 85 m³. 	
TK-112 Sodium metabisulphite dissolving tank (SMBS)	<ul style="list-style-type: none"> Type- vertical cylindrical closed top tank, with <i>agitator</i> Material- GRP or stainless steel 316L - Useful capacity- 35 m³ - Diameter - 3.6 m - Total height - 4.4 m - Weight -5.7 t 	
AG-046 Agitator of the sodium metabisulphite dissolving tank	<ul style="list-style-type: none"> Type -Hydrofoil, made of stainless steel 316L - Diameter agitator- 1100mm - Number of agitators -1 - Drive power - 4kW - Weight- 0.7 t 	
CH-060 Feeding chute SBMS	<ul style="list-style-type: none"> Made of steel sheet properly stiffened - Weight- 0.56 t 	
RV-007 Rotating valve	<ul style="list-style-type: none"> - Weight- 0.1t 	
BH-007 Sodium metabisulphite bale handling system	<ul style="list-style-type: none"> Type - Patented bale discharge system, with rotating valve and sealing device Contact parts made of stainless steel. Other parts made of carbon steel - Drive power - 0.37kW - Weight - 0.2t 	



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PC-110 Sodium metabisulphite transfer pump	Type- horizontal centrifugal pump Mechanical seal and wet parts made of stainless steel 316L - Flow – 60 m ³ /h - Delivery height – 6 m - Drive power – 2.2 kW , fixed speed - Weight – 0.4 t - Density - 1.14 t/ m ³
TK-113 Sodium metabisulphite storage tank	Type- vertical cylindrical closed top tank Material- GRP - Useful capacity- 40 m ³ - Diameter - 3.6 m - Total height- 4.4 m - Weight- 3.8 t
FA-010 Sodium metabisulphite dissolution ventilation fan	Type- Centrifugal - Flow- 1300 m ³ /h - Differential pressure - Nominal 200 Pa - Drive power - 0.55 kW
PM-047-048 Sodium metabisulphite dosing pumps	Type- Dosing diaphragm pump. Variable speed. Wet parts made of stainless steel 316L - Flow: 0- 2400 L/hour - Delivery height – 10 m - Drive power – 0.35 kW , fixed speed - Weight – 0.3 t - Density of dosed fluid - 1.14 t/ m ³
PV-078 Sodium metabisulphite sump pump	Type- vertical centrifugal pump Wet parts made of stainless steel 316L or plastic - Flow: 46 m ³ /h - Delivery height – 30 m - Drive power – 15 kW - Weight – 0.6 t - Density of dosed fluid - 1.14 t/ m ³
SE-013 Safety shower SBMS	Type – Heated safety shower for outdoor use supplemented with footswitch control, eye bath and face washing - Weight- 0.2 t
AG-023 Agitator of the sodium hydroxide mixing tank	-type : hydrofoil - diameter 800mm - no. of rotors 1



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	<ul style="list-style-type: none"> - maximum torque 280 Nm - drive power 2.2 kw - material stainless steel 316L
TK-060 Sodium hydroxide mixing tank	<ul style="list-style-type: none"> -type : vertical, cylindrical closed top - capacity 10m³ - diameter 2.4m - total height 3.3m - material: stainless steel 316L with 3 deflectors
BH-006 Large bag handling system with caustic soda	<ul style="list-style-type: none"> - equipped with valve system to reduce the dust amount in the reservoir and seal the discharge hole of the bag - drive power 0.37kw - material : parts in contact, of stainless steel; the others, of carbon steel
CH-039 Sodium cyanide feed trough	<ul style="list-style-type: none"> - made of proper uncoated normal stiffened steel
CN-018 Caustic soda bag lifting tackle	<ul style="list-style-type: none"> - capacity 2t - drive power 2.2kw
PM-28 Caustic soda dosing pump	<ul style="list-style-type: none"> - type : progressive capacity - flow rate 10 m³/h - delivery height 20 m - drive power 1.1 kw, - fixed rotation speed - typical temperature 80⁰ - fluid 20 %NaOH
PV-036 Caustic soda sump pump	<ul style="list-style-type: none"> - type : horizontal centrifugal with wet parts of chrome/iron alloy - flow rate: 14m³/h - delivery height 24 m -drive power 5.5 kw, - fixed rotation speed - fluid 20 %NaOH
5	<p><i>CIL thickener</i> – teh construction is developed at the ground level and consists of the construction of a concrete ramp of 9,00 x 9,00, forming thus a yard area with reinforced concrete plate fence of 1.25m high, inside the ramp is the foundation of the tank of recycled water to the water tank of CIL TMF (volume of 216 c.m) and the thickener overflow tank (volume 70 c.m) – equipments of circular shape with diameter of 4.50 m and 5.50m high. The foundation of this tank has an annular shape , it is made of reinforced concrete and is 15cm above the floor level</p>
Concrete retention basin	<ul style="list-style-type: none"> -Volume 1,428 c.m – Volume of the biggest equipment: 800 c.m – Total volume of equipments associated to the basin: 854 c.m
TK-026 CIL tailings thickener	<ul style="list-style-type: none"> - diameter 17 m
TH-004 CIL tailings thickener mechanism	<ul style="list-style-type: none"> -flank elevation 3.5m



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	<ul style="list-style-type: none"> - rotation driving 4 kw - up/down driving 0.75 kW - instrumentation: layer level, rpressure, couple - Volume 800 c.m
TK-027 Overflow basin of the CIL tailings thickener	<ul style="list-style-type: none"> - solution capacity 54 m³ - diameter 5 m - headroom 0.4 m - total height 4.4 m - material : not lined carbon steel
XM-005,005A Flocculant box for Albion and CIL tailings	<ul style="list-style-type: none"> - feed rate 2.9kg/h solid flocculant in 0.3% solution - automatic mixing and transfer system - polyurethane tank and stainless steel agitator - basin capcity 320l and screw feeder - transfer pump and dosage pump - mixing ratio : 9kg/h solid flocculant in 0,5% solution - fed through 25 kg bags
PV-029 Electric driven pump at the CIL thickener zone sump	<ul style="list-style-type: none"> - flow-rate 15 m³/h - density 1.6 kg/l - delivery height 14 m - driving power 5.5 kw - fixed rotation speed
PC-029, 029A Electric pump for CIL thickener tailings washing	<ul style="list-style-type: none"> - flow-rate 130 m³/h - density 1,6 kg/l - delivery height 11 m - driving power 11kw - size 100/75
PC-30, 030A Electric pump of the CIL thickener overflow	<ul style="list-style-type: none"> - flow-rate 139 m³/h - delivery height 36 m - driving power 30kw - fixed speed - size 100/75

DETOX 1 Treatment Plant

1	<p><i>Detox 1 Treatment Plant</i> – platform for the treatment plant is surrounded by a reinforced concrete 2.20m high enclosure and the access inside the ramp is provided by concrete steps which are higher than the enclosure; there are provided collecting channels and sump with pumps for emergency cases and meteoric waters .</p> <p>Within this yard there is located the DETOX 1 neutralization tank on a circular annular concrete foundation at 15 cm above the floor level, inside a concrete enclosure with H =2.2m taking over the whole tank content.</p> <p>There are designed metal stairs for the access to the technological ramps at the upper part of the neutralization board. The plant ramp is situated in an open space with no perimeter</p>
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enclosures and no roofing	
Concrete retention basin	-Volume 353 c.m – Volume of the biggest equipment: 270 c.m – Total volume of equipments associated to the basin: 487 c.m
TK-028 Detox 1 neutralization tank	Type – vertical cylinder shape open at its upper part with <i>agitation system</i> Made of carbon steel , wearing liner at the bottom of acid resistant 100mm concrete. -Useful capacity – 270 m ³ - Diameter -6,9 m -Total height – 8.9 m (guard elevation = 1.6 m) - Weight = 17,6 t
AG-013 Detox 1 tank agitator	Made of carbon steel lined with rubber - Number of agitators -2 - Driving – 90 kW - Weight = 4,1 t
BX-017 Detox 1 feed box	Made of steel sheet lined with rubber - Weight = 1,5 t
SP-012 Air sprayer at Detox 1	Type – Air rod at the nozzles beneath the lower blade - Air consumption – 2,207 Nm ³ /h -Air pressure at the sprayer = 1.5 Bar g - Weight = 0.15 t
SM- 019/ - 020 Detox 1 feed/ discharge sampler	- Driving – 0.37 kW - Construction: Stainless carbon steel - Weight = 0.2 t
SM-026 Cyanide analyser of Detox 1 discharge	Analysis of the WAD and pH at Detox 1 discharge to the TMF Type – Picric acid titration - Driving – 0.37 kW - Weight = 0.1 t
TK-068 Tank for CIL recycled water	Type – cylinder shaped , vertical, open at the upper part Made of carbon steel - useful capacity – 216 m ³ - Diameter - 8,7 m - Total height – 5.0 m - Weight = 9 t
PC-057 & 057A Pump for the CIL TMF recycled water	Type – Horizontal metal centrifugal pump lined Pompă centrifugală orizontală metalică, căptușită - Flow-rate - 300 m ³ /h - Delivery heght - 51m - Driving– 90 kW -Weight = 1.5 t



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Str. Aurel Vlaicu nr. 25, Deva, Jud. Hunedoara, Cod 330007

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PM-040 Copper sulphate feed pump	Type- Peristaltic variable speed dosage pump with inverter -Flow-rate: 0 -200 l/h - Driving – 0.35 kW Variable speed - Weight = 0.3 t
TK-104 – 106 IBC for copper sulphate	Type – Container transported with the stower (Material – Stainless steel 316L or plastic) - Capacity – 1 m ³ - Weight = 0.1 t
PV-030 Pump at the sump of the Detox 1 zone	Type- Vertical centrifugal slurry pump for difficult conditions - Capacity – 35 m ³ /h Delivery height – 11 m - Driving – 5.5 kW , fixed speed - Weight – 0,6 t - Densitate turbureală- 1,6 t/ m ³
CN-031 Pulley block at the CIL TMF tailings discharge pump	Type – manual pulley - Capacity– 1 t - Weight – 0.5 t
PV-060 Recycling pump of the emergency pond	Type – Submersible slurry pump Capacity – 36 m ³ /h - Delivery height– 16 m - Driving– 7.5 kW , fixed speed - Weight – 0.2 t - Slurry density – 1.6 t/ m ³
SE-001 Safety shower Detox 1	Type – Hot safety shower for outside use and fioot pedal control , eye and face washing sinks
PU- 20 Pump of the sump from the CIL tailings pump zone	Type- Vertical centrifugal slurry pump - Capacity – 100 m ³ /h - Delivery height– 32,7 m - Driving – 15 kW
2	<i>DETOX 1 pump station</i> – The ramp of the pump station is near the treatment plant and is provided with an enclosure of 0.50m high and the access is provided by reinforced concrete steps which are higher than the enclosing wall elevation. In the yard there will be mounted a metal basin wherefrom the slurry is pumped to the network. On both ramps. The floors are made of reinforced concrete 15 cm thick plate with safety reinforcement of □ 10/15cm, and a 10% gradient to a marginal collecting channel provided with pumping sump. The station ramp is situated in open space with no perimeter enclosures and without roofing.
Concrete retenion basin	-Volume 412 c.m. – Volume of the biggest equipment: 157 c.m – Total volume of equipments associated to the basin: 157 c.m.
TK-03 Feed box of CIL tailings pumps (to the CIL TMF)	- Take over capacity -157 m ³ /h - Flow retention time - 5 minutes - Dimensions: 3,5x3,5x2 m - Minimum volume: 13 m ³

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	- maximum volume – 32.67 m ³
PU- (12 ÷ 16) CIL tailings pumps - (pumping to the CIL TMF)	Type- Slurry pump - Capacity – 157 m ³ /h - Delivery height – 236 m -Driving – 110 kW
Treatment plant of CIL TNF clarified waters – DETOX 2	
1	<p><i>Treatment plant of CIL TMF clarified waters– DETOX 2</i> – it is a construction at the ground level and consists of a concrete ramp with the dimensions of 23.50 x 16.50 m, forming an yard enclosed with a reinforced 1.50m high wall. The enclosure wall of 1.5 m high will retain inside the paint , 330 c.m of mixture , this solution not being aggressive for the wall and floor concrete.</p> <p>The access inside the yard is provided by two stairs passing over the enclosing wall and thus the equipment placed there can be reached: a Detox 2 tank (diameter 5,.0 m) and a thickener of 12.0 m diameter.</p> <p>The foundations and supports of these equipmeys are made of reinforced concrete as follows: For the thickener there will be carried out an annular circular foundation on the–1,20 m level , with a 1.30m width while continuing vertically , 0.70 m wide and over 1.60m height and thus it gets to the +1,0 m level wherefrom the foundation continues to the inside with a 30 cm thick reinforced concrete plate and a 15% slope , at the central part of the plate there is a taper shaped hollow of 2.10m for fixing the rotation mechanism of the thickener rake.</p> <p>This structure constitutes the lower part of the thickener.</p> <p>For Detox 2 tank there will be built a reinforced concrete 30 cm thick base with an octangle shape included in a square with a 5.90 m side.</p> <p>Inside the enclosed yard with sides of 23.50 m and 16.50 m there will be provided a reinforced concrete 15 cm thick floor from the ground level inclined to the collector channel which discharges in a sump.</p> <p>There are also provided metal access stairs at the upper part of the Detox 2 tank and for passing from it to tje ramp above the thickener.</p> <p>The metal stairs are built with laminated profile stair horses and expanded sheet stairs and they are fixed on the concrete stairs of the broadsteps on the +1,50 level at the entrance to the yard and on metal ramps from the + 4,00 and +6,50 m levels.</p>
Concrete retention basin	-Volume 500 c.m – Volume of the biggest equipment: 440 c.m – Total volume of equipment associated to the basin: 566 c.m
TK-043 Detox 2 tank -neutralization	Type – cylinder shaped vertical, open at the upper part , provided with <i>agitation system</i> Made of carbon steel , with 4 deflectors -Useful capacity – 126 m ³ - Diameter - 5,5 m - Total height – 5.8 m - Weight = 10.2 t
AG-021 Detox 2 tank agitator	Made of carbon steel - Agitator diameter -1600 mm -Agitators -1 - Maximum twist - 670Nm - Driving– 3 kW -Weight = 0.6 t



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TK-055 Detox 2 clarifier basin	Type - Eimco HRB reactor clarifier – Settler with mechanism mounted in scraper – bridge , turbine, scraper arms, feed pipe to the central tube. The access walkway to the driving unit and to the flocculant pipe. The tank includes lateral carbon steel walls on a concrete base. - Diameter - 12 m - Laterlal wall height – 3.9 m - Volume 440 c.m
TH-007 Detox 2 clarifier mechanism	Includes the driving unit (scrapers, turbine, scraper arms) - Scraper driving – 0.55 kW - Turbine driving 0.75 kW -Weight = 18 t
SM-021 Detox 2 discharge sampler	Type – Automatic water sampler with sampling pump in a heated room with sample bottling - Driving – 0.37 kW -Weight = 0,1 t
PC-044&044A Pump for thickened discharge Detox 2	Type- Horizontal centrifugal pump - Flow-rate - 14m3/h - Delivery height – 8 m - Driving – 2.2 kW , fixed speed -Weight– 0.3 t
BX-019 Effluent flow box (Tank)	- Weight– 0.2 t
PV-058 Detox 2 sump pump	Type-Vertical cdentrifugal pump - Flow-rate - 36 m3/h - Delivery height – 16 m -Driving – 7.5 kW , fixed speed - Weight– 0.6 t
SE-011 Safety showers Detox 2	Type –Safety shower suitable for <i>inside utilziation</i> foot pedal controlled , face washing sink - Weight – 0.2 t
2	<i>Reagent preparation for DETOX 2</i> – the construction os a metal hall for industrial purposes, used to prepare the flocculant solution required for settlement of precipitates resulted at the CIL TMF clarified water treatment. The construction has only one storey – groundfloor and the modular dimensions are 12.0 x 10.0 m, S = 120.0 sq.m and the height to the cornice is 4.50 m. The structure is made of steel frameworks with modular span of 10.0m with 4.0m spacing in modular axes .
Concrete retention basin	-Volume 125 c.m – Volume of the biggest equipment: 4 c.m – Total volume of equipments associated to the basin: 6 c.m
PM-025A & 025B Hydrogen peroxide dosage pump	Type – peristaltic pump - Flow-rate: 0 - 30 l/hour - Delivery height – 7 m



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	<ul style="list-style-type: none"> - Driving– 0.35 kW, varyable speed - Weight– 0.2 t - Fluid density – 1.19 t/ m³
TK-04 Hydrogen peroxide transport and storage tank	<ul style="list-style-type: none"> Type – IBC container (Material – Stainless steel) - Capacity – 1 m³ - Fluid density (50% hydrogen peroxide) = 1.24 t/ m³
PM-026 & 026A Copper sulphate dosage pump	<ul style="list-style-type: none"> - Flow-rate: 0 - 80 l/hour - Delivery height – 7 m - Driving – 0.35 kW, varyable speed - Weight – 0.2 t - Fluid density – 1.17 t/ m³
TK-107 - 109 IBC for copper sulphate	<ul style="list-style-type: none"> Type – Container transported with the stower, with filler, drain and outlet nozzles Material – Stainless steel 316L or plastic - Capacity – 1 m³ -Weight = 0.1 t
XM-014 Detox 2 flocculant package	<ul style="list-style-type: none"> Type – Automatic system of flocculant dissolution and transfer. Includes : <ul style="list-style-type: none"> - XM-014A - silo - XM-014B – worm feeder - XM-014C - pump - XM-014D – dissolution tank (with agitator and level probe) - XM-014E - stainless steel spiral agitator Including a PM036 transfer pump and PM027- 027^a dosage pump - Maximum solid flocculant flow-rate 3.4 kg/h, as 0.5% solution - Driving– 5.5 kW - Weight – 1.5 t
PM-036 & 036A Flocculant transfer pump at Detox 2	<ul style="list-style-type: none"> Included in XM-014 - Driving – 2.5 kW - Weight – 0.3 t
TK-049 Detox 2 flocculant storage tank	<ul style="list-style-type: none"> Type-Cylinder shaped vertical tank opened at the upper part Made of carbon steel /GRP - Useful capacity – 4 m³ - Diameter – 1.8 m - Total height– 2.8 m - Weight– 0.9 t
PM-027 & 027A Flocculant feed pump of Detox 2	<ul style="list-style-type: none"> Included in the XM-014 Type – Stainless steel progressive cavitation pump - Flow-rate : 0 - 2 m³/h



	- Driving – 0.55 kW , varyable speed - Weight – 0.2 t
Substations of the yards	
1	<i>CIL Command and control room (MCC 008+MCC 010)</i>
2	Power unit– power 1600 kVA/400 V
Emergency sump	
1	<i>Emergency sump – 16,6 x 7,6 x 1,8m profile, made of monolith concrete, calculated so as to take over the content of the CIL tailings pipeline in case of emergency</i>
GPL warehouse	
1	GPL tank – capacity 5,000l, the weekly consumption is the equiovalent of 2 tanks content , that is 20 t/ month
Sewage treatment	
1	Sewage treatment plant ECO CLEANER VFL AT 100 type, capacity of 13.5 c.m/day. Discharge parameters acc. to NTPA001/2002, the equipments are installed in a polypropyelene basin mounted underground. Treated water discharge in Coranzii stream



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2. TECHNOLOGICAL FLOW-SHEET

The technological flow-sheet is detailed for each objective of the project.

1. MINING TECHNOLOGY OF CERTEJ OPEN PIT

Production capacity of 3,000,000 t ore/ year.

The exploitation method proposed for Certej open pit is „*Exploitation method with descending benches and rock transport to the outer waste dump*”.

The maximum designed depth of the open pit was established at 290 m, the open pit bottom being on the + 440 m level in the West zone and + 310 m in the other three zones. The general slope angle of the open pit was determined between 35-50°.

There will built 16 benches in the Western zone of the open pit and 29 in the central , intermediate and East zone. The width of the working bench was determined at 30m and the safety berm width is 2 - 5 m. The average stripping ratio is 3 t/t for the total mining bulk extracted.

The open pit exploitation of Certej with benches with H = 10m, the mine hole with $\phi = 165\text{mm}$, hole blasting with nitramonia explosive (mixture of ammonia nitrate and diesel fuel), loading of blasted material, mining bulk transport to the crusher plant on the +618m level and belt conveyed to the processing plant on the +548m level, transport of waste to the North waste dump and South waste dump.

2. DUMPING TECHNOLOGY

The waste resulted at the stripping operations and exploitation operations of Certej open pit will be hauled and stockpiled on the North waste dump and South waste dump, the dumping process consisting of the following stages:

- Waste unloading from the trucks;
- Waste spreading;
- Levelling and consolidation of waste with the cylinder to prevent the pluvial water to penetrate easily in the dump body

North waste dump – cota +585m

- surface 326,000sq.m
- bench slope angle 35°
- overall slope angle 20°
- four benches of 30m high each
- waste dump volume 20.5 mil c.m; 48.7 mil t
- berm inclination 3%

South waste dump –+610m level

- 402,200sq.m
- 35°
- 26°
- three benches of 60m high
- 15,1 mil c.m; 36 mil t
- 3%

3.PROCESSING TECHNOLOGY

The ore processing is carried out in 3 stages:



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- stage I – **Ore flotation** obtaining a gold concentrate
- stage II – **Gold-pyrite concentrate oxidati*on (Albion process);**
- stage III – **Cyanidation (CIL process)** of the oxidized concentrate and the electrolyte recovery of gold and silver eluted on carbon – and Dore alloy pouring.

Stage I – Ore flotation obtaining a gold concentrate

Ore flotation stage include the following operations:

- *ore crushing*, in a gyratory crusher;
- *crushed ore stockpiling*;
- *ore grinding* in a SAG mill working in circuit with a cone crusher for the critical fraction comminution;
- *coarse fraction wet grinding* in a ball mill working in circuit with the cyclone battery, the cyclon supplies the conditioning agitator and further on, the flotation;
- *flotation reagents*: Copper sulphate, Sodium silicates and potassium amyl xanthates;
- *ore flotation* obtaining a gold pyrite concentrate and final flotation tailings;
- *flotation tailings thickening* in a high capacity thickener. The thickened tailings is delivered to the tailings management facility, and the clarified water resulted at the thickening stage is introduced in a storage basin, wherefrom is recycled in the grinding process.
- *concentrate filtering/pumping* resulted at the thickener. The concentrate is filtered (solid pat being deposited for beneficiation as such – the first two years of activity or further processing and the liquid phase is recycled in the process), or directly pumped to the Albion plant for further processing.

Ore crushing and grinding

The ore is delivered for the open pit in 65t trucks for 24 h/day, 7 days / week, 360 days/year.

The ore is unloaded in the crude ore bin, but it can also be unloaded in the crude ore stockpile nearby. The oversized remaining on the grate are broken using a hydraulic hammer mounted on a rotary joint support covering the whole workin surface. From the stockpile the ore will be fed to the bin by a front loader. From the bin, the ore passes thoruhg a vibrating bar feeder, and refuse is discnahred on a lined trough and taken to the jaw crusher. The passage is controlled through lined troughs directly to the belt beneath the crusher. The bar feeder has a manually adjustable speed to control the feed flow rate. The jaw crusher is able to take over the rocks of maximum 1000 mm and after crushing, the size is reduce dto 100 mm; the crusher productivity being 434 t/h. The crusher has the role to produce a crushed material of about 80% - 100mm.

The crushed rock is directe through a lined through, on the collecting belt conveyor . All the equipments of the technological flow-sheet are mounted on a metal structure ensuring the cascade mounting of the equipments. The whole structure is mounted in a concrete basin, with steps and a base plate with inclination towards a sump for colleting the flowing waters. The discharge of this sump is performed by means of a vertical pump in the drainage channels from the site.

From the belt conveyor no 1 the rock is discharged through a lined trough on another belt



conveypr conveyng the ore to the crushed ore stockplie. Along this belt, there is mountd a single roller belt weigher provided with load cells and accurate voltage measurement instrument supplied in an pre-assembled integrator in the weigh frame with digitals ensors of the belt speed and rollers for weighing which monitor the amount of processed rock. Along this belt, there is mountd a single roller belt weigher provided with load cells and accurate voltage measurement instrument supplied in an pre-assembled integrator in the weigh frame with digitals ensors of the belt speed and rollers for weighing which monitor the amount of processed rock.

For the monitoring the running of the equipments of the flow-sheet there are provided several equipments connected to the control system of the process or to the distributed control system as follows:

- Video camera on the crude ore bin.
- Control system of the level in the crude ore bin indicating by means of a traffic light system the time when the unloading of the truck and start up of the bar feeder is allowed.
- Video camera above the crusher feeding zone.
- Switching off cables, detectors for the sliding and alignment to the belt conveyor.
- Videocamera at the belt unloading at the crushed ore silo
- The signalling system and remote transmission of the blocking of transporter discharge troughs.

To prevent the dust pollution of the working zone a system of dust removal has been designed using water jets at:

- The truck unloading location
- Entry to the crusher
- Crusher outlet
- Discharge of the colecting transporter
- Discharge of the transfer transporter of crushed ore in the stockpile.

The system for dust removal, with spraying system automnatically operated. The water supply to the dust removal sites is done through zinc carbon steel pipes with discharging downstream outlets of Dn 40 to Dn 25. The water flow rate is adjusted by means of adjusting air operated valves.

Crushed ore stockpile

The crushed ore stockpile has a circular shape ensuring the reserve for 18 hours for the SAG mill. Beneath the stockpile there is a tunnel . The base plate of the tunnel is inclined towards a colleting sump of the flowing waters. The sump is discharged using a vertical pump in the collection system of the flows from grinding. The plate feeders mounted at the holes take over the ground ore through the troughs and deliver it to a belt conveyor discharging in the feeding troughs of the semi – autogenous mill. The plate feeders with variable speed, controlled through the mill feeding rate measured with a belt conveyor weigher and commanded by the cntrol program of the mill.

For the monitoring of the flow-sheet equipment running there are provided equipments connected to the process control system or to the distributed control system as follows:

- Video camera of the ground ore stockpile.



- Video camera of the running area of each feeder.
- Switching off cables, sliding and alignment detectors at the belt conveyor.
- Signalling and remote transmission system of the blocking of the feed troughs of the feeders.

To prevent pollution with dust of the working zone a dust removal system has been designed using water jets at the discharge points of the feeders. The dust removal system with water spraying operates automatically with the associated feeder running.

The primary grinding includes a semi – autogenous mill –SAG with a variable speed motor for the Recovery of the Sliding Energy (SER), a fixed speed ball mill operating in a close circuit with the cyclones and a recycling system of the coarse material. The SAG mill is fed from the crushed ore stockpile by two plate feeders with variable speed and hydraulically operated. The semi-autogenous mill feed rate is controlled by a control program of the mill by modifying the feeders speed. The ore which is not ground at the suitable size is recycled. The semi-autogenous mill– SAG is designed with a critical fraction recycling system. The ground ore is discharged in the Trommel screen, where from the screen passage is discharged through a system of troughs in the feeding basin of the pulp centrifugal pump, while the screen refusal consisting of the fraction not ground and with particle sizes over 12 mm, is discharged in the crushing circuit and redirected in the mill feed.

The pulp resulting at the milling is taken over by the troughs for each mill, it is discharged in a collecting trough which in its turn discharges directly in the pump basin provided with 2 compartments. The collecting trough is designed with 2 rubber lined valves which allow to discharge in both compartments or successively in each compartment of the basin. All the troughs are rubber lined. The connection from each compartment of the basin to the pump is performed through a short sector of Dn 500, carbon steel pipe lined with rubber or HDPE.

The maintenance of a constant level in the pump basin is adjusted by the adjusting loop of the pump rotation speed. The floor of the surface on which the semi-autogenous mill and the ball mill are mounted is inclined towards a sump where from the flows are taken by a vertical pump and fed to the mill discharges or directly to the basin of the feed pump of the tailings thickener. Likewise, the surface floor where the regrinding mill is mounted is inclined towards a sump where from the flows are taken over by a vertical pump and fed directly to the basin of the feeding pumps of the tailings thickener.

The mills are operating in a closed circuit with 8 cyclones of 500mm, 7 in operation and one in standby. The coarse material from the cyclones is recycled to the ball mill which was designed for a recycling load of 250%. The cyclone overflow gets by gravity to the conditioning agitator of the rough flotation. The pulp resulted at the ball mill grinding is discharged in the same collection basin like for the SAG mill. At the ball mill sodium silicate is added and it plays the part of a depressant of the gangue minerals in the flotation process. The balls are added in both mills from the barrels.

Control system:

The SAG mill is equipped with a load detector by the pressure in the bearings and noise detection. The mill running is controlled through the data transmission through a PLC connected to control the system of the DCS plant. The mill speed will be adjusted manually. The dilution of the SAG mill feed will be controlled automatically, proportionally to the ore feed rate of the SAG mill.



The dilution water of the pump basin is controlled by maintaining a value of the pulp density at the cyclone inlet, and the level of the main pump basin is controlled by adjusting the pump rotation speed.

For the cyclone feeding, there are designed 2 pumps – 1 in operation and 1 in standby (in case that one of them is failing).

The cyclones are equipped with controlled valves. The cyclones are manually online adjusted for the inlet pressure in the cyclone which is monitored in the DCS.

The central computer is measuring both the ore fed to the SAG mill and the feed flow rate with recycled boulders.

The overflow particle size of the cyclone is measured by a continuous flow sheet particle size measuring device.

Technological connections

The grinding mills circuit is fed with recycled water (resulting at flotation tailings settlement), reagent (sodium silicate) for the ball mill and grinding balls. The recycled water is dosed at the semi-autogenous mill feed and ball mill feed, at the water spraying of Trommel screen, in the basin of the main pumps. The feed circuits are provided with flow-rate adjustment systems and control and remote transmission system of the working parameters.

Ore flotation obtaining a gold pyrite concentrate

The classified ore in the cyclone plant is discharged by gravity through a PE 80 (8 bars) pipe in the conditioning agitator, rubber lined, retention time of 11 minutes existing in the flotation room. The particle size both of the primary feed (cyclone overflow from primary grinding) and the cyclone regrinding overflow is sampled and measured with the particle size continuous. There are installed transfer pumps of the samples to the particle size analyser. There will be provided a filtering system to provide composite samples for laboratory analyses.

From the agitator, the pulp is discharged by gravity in the first cell of the rougher flotation line which consist of 5 flotation cells, mounted in cascade and grouped 1+2+2, with discharge box after each step. The concentrate (froth) collected in troughs is discharged by gravity in a basin, wherefrom it is pumped and fed to the upgrading cell line 1. The tailings collected in the discharge box of the last step is discharged by gravity in a 11.5 m³ basin and from there it is pumped and delivered to the basin of the feed pump of the tailings thickener.

The upgrading cell line 1 includes 4 flotation cells, mounted in cascade and grouped 2+2, with discharge box after each step. The concentrate (froth) collected in the troughs, is discharged by gravity in a basin of 7.8 m³, and from there it is pumped and delivered to the upgrading cell line 2. The tailings of the discharge box of the last step, is eliminated by gravity in a 11.5 m³ basin and from there it is pumped and delivered to the cyclone feed of the mill located in the grinding hall.

The upgrading cell line 2 consist of 4 flotation cells, mounted in cascade and grouped 2+2, with the discharge box after each step. The concentrate (froth) collected in the troughs is discharged by gravity in a 7.8 m³ basin and pumped and delivered to the upgrading cell line 3. The tailings collected in the discharge box of the last step is removed by gravity to the feed of the upgrading cell line 1.

The upgrading cell line 3 consist of 3 flotation cells of 20 m³, mounted in cascade and grouped 1+2, with a discharge box after each step. The concentrate (froth) collected in the troughs



is discharged by gravity in a 3.0 m³, basin and pumped and delivered to the concentrate thickener feed. The tailings collected in the discharge box of the last step is removed by gravity directly into the feed box of the upgrading cell line 2. The reground and classified pulp in the regrinding mill cyclones is fed by gravity in the feed box of the cleaning cell line.

The cleaning cell line consists of 4 flotation cells, mounted in cascade and grouped 2+2, with discharge box after each step . The concentrate (froth) collected in the troughs, is discharged by gravity in 3.0 m³ basin and pumped and delivered to the upgrading cell line 1. The tailings collected in the discharge box of the last step, is discharged by gravity in a 11.5 m³ basin and pumped and delivered to the 11.5 m³ basin of the feed pumps of the tailings thickener.

The flotation reagents are dosed in the feed boxes.

For tailings grinding from the upgrading cell line 1 the conventional tower mill type was selected. The pulp is fed to the upper part like the grinding balls with 12mm diameter and the grinding at 0.045mm is carried out by centrifugal spreading. The ground pulp is discharged at the upper part of the basin of the vertical pump and from there the coarse material is pumped and recycled to the mill and the fine part collected by the basin trough is discharged by gravity in a basin and pumped and delivered to the cyclones .

The coarse fraction from the cyclones is fed by gravity to the tower mill and the cyclone overflow (80% -0.045 mm) is delivered by gravity to the cleaning cell line.

From the basin of upgrading cell line 3 the concentrate is pumped to the concentrate thickener together with the sample returns and flows of the flotation sump. The concentrate is thickened in a high productivity thickener. The pulp fed from the feed box in the thickener is distributed centrally, and by slow agitation of the basin, the pulp concentrate is thickened by settlement. To allow the settlement flocculant is dosed in the thickener and the flocculant is prepared in the plant feeding the flotation plant. The resulting water is collected at the upper part in a trough and discharged by gravity in a basin and then pumped and delivered to the recycled water basin. The thickener overflow pump is provided with variable speed controlled by the level of the thickener overflow tank.

The thickened material is collected to the centre of the basin and discharged through the central cone of discharge where from it is pumped with 2 pumps and fed to the ISAMILL mill and the amount is controlled the excess amount being bypassed back to the basin.

The pump speed for the thickened from the thickener is controlled by the thickened pulp density measured by a density measuring device. The thickener bed thickness, the bed level and torsion are monitored with sensors provided by the thickener supplier. The bed level can be used to control the flocculant flow rate through the DCS of the plant using the variable speed pump of the flocculant feed.

The agitation mechanism can be lifted automatically, vertically adjusting the discharged fluid concentration. The rack impeller is supported by a supporting bridge and is provided with a service bridge for personal access to the central part. There is a system for measuring the adjustment height of the racks against the basin bottom, with remote transmission system to the distributed control system of the plant. There also exists a measuring and remote transmission system torsion moment of the driving shaft for preventing the blockage.

The floor of the surface where the thickener will be mounted, will be inclined towards a sump located at the end of the mounting surface near the settled water basin and from there the



flows are pumped with a vertical pump directly to the thickener feed box.

From the tailings basin of the rough flotation the flotation tailings are pumped to the feed basin of the thickener together with the returns of samples and different pump leakages. To help the settlement, the flocculant which is dosed from the thickener is prepared in a plant feeding the flotation plant.

The settled water is collected at the upper part in a trough and discharged by gravity in a steel basin. The recycling water basin can ensure the storage for 0.5 hours to ensure the required flow rate in case of short time stoppage of the water recycled from the tailings facility located at remote distance. With the expected flow rate of returned water from the tailings management facility, the tank level will lower at a rate of about 0.6 m/h if the pump from the tailings facility stops.

From the basin the water is used as recycled water, being pumped by 2 pumps, on 2 independent circuits, one feeding the primary grinding, Isamill mill, reagent preparation, flotation TMF and 2 other pumps, feeding the flotation lines.

The thickened material is collected to the centre of the basin and discharged through the central discharge cone and from there it is pumped to the flotation TMF.

The thickened pump speed is controlled by the thickened pulp density measured by a nuclear density device. The thickness of the thickener bed, the bed level and torsion are monitored with the sensors supplied by the thickener supplier. The level of the bed can be used to control the flocculant flow rate through the DCS of the plant using the variable speed pump for the flocculant feed.

There exists a measuring system of the adjustment height of the racks from the basin bottom and the system is also designed with a remote transmission system to the distributed control system of the plant (DCS). There also exists a measuring and remote transmission system of the torsion moment of the driving shaft for preventing the blockage.

The surface floor where the tailings thickener is mounted is inclined towards the sump located at the far end of the mounting surface near the basin of collected water, and from there the flows are pumped with a vertical pump and pumped directly to the thickener feed box.

Compressed air flow

To achieve the suitable flotation of the concentrate in the flotation cells air is blown in by 2 blowers, one for the 130 m³ cells and one for the other cells. All the pipes where technological fluids are circulating (air blowers, reagents, technological water) are provided with adjustment valves with remote control operated by instrumental air. The instrumental air is produced by 2 compressors (one in standby) with a flow rate of 935 Nm³/h, at 8 bars.

Stage II – Oxidation of gold pyrite concentrate (Albion Process)

The concentrate resulted at flotation must be ultrafine ground from 80% -45 microns to 80% -9 microns, this being a requirement of Albion process. This grinding fineness is obtained in an



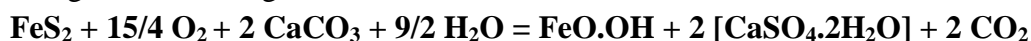
ISAMILL mill prior to Albion oxidation.

The Albion process can be developed under acid or more alkaline conditions at a pH of 5.5. The alkaline process is used where base metal recovery from the concentrate is not necessary like for example at Certej. The alkaline process is suitable for the minerals such as pyrite, arseno-pyrite and selenides.

The refractory gold bearing sulphides like for instance, pyrite releases both the iron and sulphuric acid when oxidized. In the alkaline process, the iron and sulphuric acid are neutralized continuously and precipitate as leach by lime addition. The permanent removal of the reaction products from the solution means that the leaching is advancing rapidly and very high oxidation levels of the sulphides can be reached. The mineral ultrafine grinding at minus 10 microns or even less, prevents the passivation with these precipitated leaching products because the leaching minerals are consumed prior to the formation of a sufficient layer for precipitation.

The oxygen is blown in the pulp to control the oxidizing rate and the neutralization of the sulphides produced is carried out by adding finely ground limestone through an annular network.

The general leaching reaction is:



The oxidizing rate is variable and the tests performed so far indicated an oxidizing rate of 70% which was determined as optimal. It means that 30% of the pyrite entering the Albion leaching circuit will get out as sulphide.

The process key is to ensure the maintenance of the reaction above by monitoring and control of the pH (acidity $\text{pH} \approx 5-5,5$) and redox potential. This is obtained by monitoring the pH and Eh and using the oxygen measuring devices of each tank, and such devices will control the oxygen and limestone addition. The oxidation reaction takes place in 5 continuous where the oxygen is blown in.

The oxygen amount which is blown in the pulp is controlled depending on the sulphide oxidation rate using an electro-chemicals sensor, the neutralization of the sulphates produced during the reaction is carried out by adding finely ground limestone.

The oxidation of the gold pyrite concentrate consists of the main operations:

- *Gold pyrite Concentrate grinding* to obtain advanced finess;
- *Oxidation of gold concentrate* (Albion oxidation) is carried out under atmospheric pressure by gaseous oxygen maintaining the pH between 5.5 - 6 by adding ground limestone;
- *Thickening the oxidation product in a ϕ 20 m thickener*. The thickened product is directed to the neutralization, and the clarified water from the thickener overflow is pumped and recycled to the grinding and oxidation of the gold concentrate (Albion Process);
- *Neutralization and cooling of the thickened material resulted at concentrate oxidation.*

a. Concentrate grinding

Thickened flotation concentrate with 60% solids is pumped at a flow rate of 39.1 m³/h using a transfer pump of the concentrate to the feed tank of the IsaMill mill. In the feed tank of the IsaMill the pulp is diluted at 45% solids with recycling water. The grinding media of the IsaMill including Keramax 2mm ceramic balls are continuously fed at a rate of about 34 kg/h from the



feeding bin for the grinding media of the IsaMill by means of a spiral feeder in the IsaMill feed tank. The ball feed bin is located beneath the IsaMill so that it acts as a receiver when the mill charge is emptied allowing the balls to be recovered easily. The IsaMill is fed from the IsaMill feed tank using the feed pump. The pulp resulting at the mill discharge flows in the feed basin of the Albion leaching process from where it is pumped in the leaching tanks with the feed pump. This pump has a variable rotation speed controlling the level in the Albion feed tank.

b. Albion oxidation

The Albion leaching oxidizes the sulphides of the concentrates by blowing in oxygen at atmospheric pressure. Complete oxidation is not required.

Further to Albion leaching there are treated 40 t/h of grinded concentrate with a fineness of 80% -9 microns with 30% solids in 5 agitating tanks at atmospheric pressure for a total retention time of 30 hours. The leaching operates at 90° C and sulphide oxidation is carried out by means of oxygen blowing in by numerous nozzles placed close to the tank base to maintain the necessary concentration of dissolved oxygen in the solution. Further to oxidation, sulphuric acid is released and the pH is controlled in each tank maintaining the pH at 5.5 by adding grinded limestone. The reaction is an exothermal one but the temperature is controlled by the water vapours of the gas leaving the tank together with the heat loss through the tank walls. The released gas at a temperature of about 96° C, from the tanks contains little oxygen and much carbon dioxide resulted at the reaction of the limestone with the sulphuric acid. For safety reasons, the tanks are covered and each of them is equipped with a fan and 7 m high draught chimney above the tanks to control the release of the gases discharged far from the personnel area. Each tank has a diameter of 11.5 m and is 15.4 m high and has a useful capacity of 1500m³. The tanks are made of carbon steel with three deflecting devices and are manufactured of LDx2101 for acid protection. The tanks are emptied in some covered U shaped troughs made of LDx2101 with hinged covers so that the material settlements are easy to remove. All the tanks may be short-circuited by means of the trough slide valves for maintenance purpose. Each tank is provided with a double 225kW propeller. The basic propeller is the highest one to improve the oxygen transfer and the upper propeller maintains the solids in the suspension. The oxygen is blown in at a rate of 3.2570 Nm³/h in each tank through 24 nozzles of oxygen at 6.5 bars. The purity of the oxygen supplied is 95% O₂ and it is supplied from the oxygen plant at a rate of 533 t/day. The 5% of the gas which is not oxygen contributes to the exhaust gas and consequently at the pulp cooling from the tanks by water evaporation.

The pH is measured in every tank and controlled by limestone addition from an annular pipe for limestone. For the neutralization and pH control at 5.5 a total amount of about 30t/h limestone is required.

The leaching process operates at 30% solids and the IsaMill feed is diluted with process water from Albion thickener overflow. The CIL thickener overflow containing 200-300 ppm CNT will not be used as dilution water in Albion process because there is a risk of safety due to the presence of HCN in leach. For this reason, the completion with water in Albion process is done only with water recovered from the CIL TMF which is assumed to have a content of up to 4 ppm CNT depending on the natural degradation in the TMF.

Because of the limestone addition and sulphide oxidation there is an increase of the solid mass in Albion process. The solid tonnage in the Albion residues is 2.16 times the tonnage of the



fed concentrate and 1.22 times the tonnage combined of concentrate and added limestone. There is a water loss in the ventilation gases from Albion leaching. It is replaced by the water contained in the slurry with limestone and by addition of process in each tank.

The hot surfaces will be protected either with handrails or insulated to avoid getting burnt.

c. Thickening of the Albion oxidation product

The residue of the last tank in operation at the Albion leaching flows to the discharge basin and from there to the Albion thickener feed basin together with the leakages if any. The residue is thickened in a thickener and to which Magnafloc 1011 is added at a rate of 40g/t of residues. The flocculant is prepared in a special flocculant preparation room and it is dosed from there to the CIL thickener. The flocculant is dosed to the thickener by pumping and it is diluted in the flow with recycled water from the CIL TMF to obtain the dosed solution of 0.05% flocculant concentration.

The solution of the thickener overflow is pumped using the overflow pump to the leach feed to maintain the correct dilution while the heat is retained. The water completion is made with recycled water from the CIL TMF. This water is added to the thickener trough to reduce the gypsum saturation as soon as possible so that the crusts of the water pipes are diminished. The thickened of the thickener with 60% solids is pumped to the cooling tower of the pulp.

The thickener and tank surfaces in contact with the solution are of LDx2101. The pulp pipelines are made of rubber lined steel. The hot surfaces will be protected either by handrails or by insulation so that to avoid burning injuries.

d. Neutralization and cooling of Albion thickened material

The thickened residue for Albion leaching has a pH of 5.5 and a temperature of about 98⁰C. For CIL, the pH of slurry must be raised to about 10.5 and the temperature lowered to about 45⁰C and the diluted pulp to 40% solids. The dilution is made with the overflow from CIL thickener which contains usually 100 – 300 mg NaCN/l. Consequently, to avoid the release of HCN, the slurry must be neutralized prior to dilution. Dilution must be done before the slurry flows in the CIL refusal circuit.

The thickened from the thickener is neutralized with lime supplied by an annular pipe with lime milk in the agitator tank for neutralizing the Albion slurry. The pH is raised to 10.5 approximately.

The neutralized residue at Albion leaching is pumped to the cooling tower of Albion slurry. The slurry cooled at a temperature lower than 45⁰C is diluted to 40% solids for the CIL using the water from the CIL thickener overflow added to the cooling tower. The cooled slurry diluted flows from the tower to the refusal screen with 600 micron meshes and then to the feed pump basin of the CVIL. From this basin, the slurry is pumped through the sampling device of the CIL feed to the first CIL tank. At the bottom of the cooling tower there is a slide valve for sealing and avoid air loss at the base.

The slurry is distributed in the tower through a annular pipe with nozzles resistant to clogging.



The crust will accumulate in the cooling tower both on the drop separators and on the walls. The upper separators can be raised at the outer part of the tower with a movable crane on a frame support where the solids from their surface are washed away from time to time. There is designed a backup set of separators on a second support frame near the colling tower to replace the set taken out for cleaning purpose. To clean the walls a special descaling installation is lowered in the tower. The deposited material is cleaned manually from the walls from this installation. The crust is falling at the tower and is discharged through the pipe in a skip. The cooling tower the support frames of the drop separators and the skip for the crust are located in a special fenced area to locate the crust in a single zone. As this crust contains precious metals it is periodically re-introduced in the SAG grinding circuit. All the equipments of Albion process are located in concrete basins to avoid leakages outside the yards and the accidental leakage are recovered in the sumps located in every yard and repumped in the flow – sheet.

Stage III – CIL Process

The CIL process consists of the following main operations:

- a. *Cyanide leaching of the pulp* resulted at the Albion;
- b. *Tailings thickening and pumping* resulted at the leaching;
- c. *Acid washing, elution and active carbon regeneration, precious metal recovery*
- d. *Detoxification of the cyanidation tailings (Detox 1) and pumping on the tailings management facility*

a. Cyanide leaching

The oxidized thickened pulp neutralized and cooled resulting at the Albion process is directed to the CIL feed pump through a sampling device across the CIL feed to the first tank, with a rate of 87 t/h solids, 40% solids and 45⁰C. The CIL feed content is averaging 8 g/t Au și 45 g/t Ag but during the years when high silver grade ores pare processed it can change to about 6 g/t Au and 81g/t Ag. The chemical reaction that takes place in the cyanidation process is shown below:



CIL includes 6 carbon steel tanks with agitators mounted in series. Each tank has a useful capacity of 830 m³, a diameter of 10.1 m and a total height of 11.1 m, 4 deflecting devices and retention time of 5 hours. The total retention time in the CIL is 30 hours. Each tank is provided with a double 55kW agitator with both agitators being rubber lined. The oxygen is added at the agitator base through low pressure nozzles.

Each tank is equipped with an inter stage MPS (P) screen with 0.8mm mesh of stainless steel blades. The slurry is dissharged through the inter stage screens of each tank in the troughs provided with slide valves which allow to short circuit any tank for maintenance purpose. The carbon travels between the stages by means of the vertical carbon pumps with encased rotor. These are sized to pump up to 22 t of carbon by day using all the pumps operating simultaneously. This travel will be required during the periods with high silver ore and then two elutions by days will be performed, 6 days a week. Then the carbon travel will take place 20 hours/day, 6 days /week.

During the average grade periods it will be necessary to perform only 1 elution a day and



the carbon movement can take place within a shorter period of time or it can be pumped discontinuously, rather than to operate all the pumps simultaneously, allowing the carbon to get more loaded. The carbon pump of the tank 1 or if it is shortcircuited, the pump of the tank 2 delivers to the tank 1 or if tank 1 is shortcircuited the pump of tank 2 delivers to the vibrating carbon screen loaded and with 0.5mm meshes. The screen pass returns to the first CIL tank and the refusal is collected in a loaded carbon tank. This tank is a rubber lined, cone tank opened at its upper part where 11 tons of carbon can be stored. From this tank the carbon is pumped in charges of 11 tons to the acid washing column with the transfer pump of the carbon because at 2 elutions a day there will not be enough time to discharge the loaded carbon directly in the acid washing column. Lime can be added at the upstream CIL tank to adjust the pH to 10.5 if required although most of the lime will be added in the neutralization tank of the slurry cooling zone. The sodium cyanide solution will be added to any of the CIL tanks as required. The cyanide flow rate is measured and monitored by the plant DCS. **In the CIL process it is provided a continuous analyser which measure the pH and free cyanide concentration in the tanks 2 and 6. The data supplied by this analyser are monitored by the plant DCS and used to optimize the cyanide dosage.**

The residues from the last tank flows on a vibrating control screen of the carbon with 0.6mm meshes to recover any coarse carbon escape. The passage of the control screen flows to the feed basin of the CIL tailings thickener.

The recycled solution from the elution and electrowinnign stages and different leakages are pumped to the start of the CIL. As the solution flow rate from elution is higher compared to the fresh feed flow-rate of the CIL the maximum flow rates of these leakages are comparable to the average flow-rate through the CIL. Consequently, to avoid the shocks and the need for higher inter stage screens, the recycled solutions are collected in a recycling tank of the CIL solution and from there, they are pumped at a constant flow rate to the primary CIL tank. A low level switch of this tank stops the pump. The pump rotation speed is manually fixed by the DCS operator depending on the tank level.

The air for the CIL and for the neutralization of the cyanide is supplied by the CIL compressors. There are provided 3 cvcompressors of which 2 in operation and 1 in standby condition.

It is equipped with a stand-by carbon pump and an inter stage stand-by screen. It is also equipped with a submersible pump for the leaching tank drainage to remove as much as possible the tank contained material in a tank in operation when the said tank is emptied for maintenance purpose.

The main CIL controls are:

- Device for the CIL feed sampling operated at certain time intervals
- Lime addition controlled by means of pH
- The addition and measurement of the cyanide flow rate controlled by the manual adjustment, but with potential to be controlled from the cyanide analyser
- The measurement of the cyanide and pH in the tanks 2 and 6
- The level warning system of each CIL tank
- The flow rate of air at each tank measured and controlled by the manual adjustment



- The flow-rate of the recycled solution controlled by the variable speed pump for the solution recycled to the CIL with a manual adjustment point
- The carbon level monitored in the loaded carbon tank.

b. CIL tailings thickening and pumping

The CIL tailings thickener is designed on the flow – sheet to recover the cyanide for its re-use at the CIL by recycling the thickener overflow and to reduce the consumption of reagents for the cyanide neutralization. The carbon control screen passage of the CIL flows to the feed basin of the CIL tailings thickener together with the leakages and occasionally with Detox 2 mud. The tailings are thickened in a 17m diameter thickener of high productivity adding Magnafloc 1011 at a rate of 36 g/t of concentrate. The flocculant is prepared in a special installation for the flocculant preparation located near the thickener. The flocculant is delivered in bags of 25 kg at the feed cone of the flocculant preparation plant and then dosed automatically to a mixing tank with raw water to obtain a 0.5% solution. The flocculant solution is stored in a storage tank. The flocculant is dosed through the pipes from the thickener with the feed pump and dilution is carried out with water from the overflow of the thickener to obtain a 0.05% solution of flocculant. This flocculant dissolution installation is feeding the Albion thickener, too.

The thickener overflow is pumped with the overflow pump first to the CIL as dilution water of the CIL feed, but it is used also for spraying the control screen of the CIL carbon screen and for flocculant dilution. If water for completion is required for the thickener overflow, it will be supplied as water recycled from the CIL TMF. However, the water balance – sheet indicate there will be excess water in the overflow and this excess water will be pumped to the INCO Detox 1 for cyanide neutralization.

The thickened from the thickener is pumped at 60% solids to the INCO Detox 1 for cyanide neutralization. The slurry density of the thickener/ thickened material is not critical because it is diluted at the INCO Detox 1 feed.

The pump rotation speed for the thickener/ thickened material is controlled by the slurry density measured by a density meter. The thickener bed thickness, the bed level and the torsion are monitored by sensors supplied by the thickener supplier. The bed level can be used to control the flocculant flow-rate through the DCS of the plant using the variable speed pump for the flocculant feed.

The thickener overflow pump has a fixed speed. The level of the thickener overflow tank is controlled below the maximum level by opening the a control valve from the pipeline to the Inco Detox 1 and above a minimum level by controlling a valve on the pipeline for the completion with water recycled to the CIL TMF.

All the CIL process equipments are located in concrete basins to prevent leakages outside the yards and the accidental leakages are collected in the sumps of each yard and repumped to the flow-sheet as shown on the corresponding drawings.

c. Acid washing, elution and regeneration of acid carbon

The elution section has been designed to process two charges of loaded carbon per day at 11 t of carbon by charge. The design is based on a 24 h running, 6 days/week. Considering the



production taken into account for the design purpose, there will be processed 624 charges by year with up to two charges a day during the period with high silver grade. Throughout the project life there will be processed 411 charges / year at average, with an average of 1.3 charges by day so that during the low silver grade periods only 1 charge /day will be processed.

Because of the high silver grade and the necessity to handle several charges a day there was selected a divided circuit of AARL elution. With this circuit, the last portion of the eluate of the elution column is recycled to the solution tank for pre- moistening. This reduces the volume of loaded solution which has to be recovered by electrowinning, increases its contents and reduces the heat consumption. Because of the high number of charges, to try to reduce the drinking water consumption, there is possible to use a part of the spent electrolyte for the stripping cycle in the elution circuit. To this aim, the spent electrolyte is stored in the spent electrolyte tank. There will always be used drinking water for the last part of the stripping circuit to wash the carbon and cool the column. However, the design allows the use of drinking water instead of solution throughout the elution cycle if preferred.

The overall cycle of acid washing and elution including the carbon transfer inside and outside last up to 12 hours briefly, the sequence is as follows:

- Pumping up to 11 t of loaded carbon from the loaded carbon tank in an empty acid washing column
- Acid washing of carbon with diluted hydrochloric acid at the environment's temperature and atmospheric pressure.
- Depleted acid washing
- Transfer of the acid washed and flushed carbon to the elution column
- Pre- moistening of the carbon at 130⁰C with a cyanide and caustic soda pre-moistening solution followed by the stripping at 130⁰C with spent electrolyte and treated water
- The storage of the loaded solution from the elution stage in one of the two tanks for loaded solution for electrowinning purpose
- Regeneration of eluted carbon in the carbon furnace at 750⁰ C
- Recycling the eluted and regenerated carbon at the tank CIL 6 together with the fresh carbon required
- The electrowinning of the electrolyte charge, the spent electrolyte recycling to the spent electrolyte tank for re-use or to the buffer tank for recycling the CIL solution as required

The acid washing, elution and carbon transfer operations are programmed in automatic sequences of the plant DCS. The semi-automatic and manual operation through the DCS is also possible.

Acid washing

The acid washing is carried out in charges of 11t of carbon.charge. The acid washing can be performed on a charge while the charge washed previously is at elution. The acid washing column is a cone bottom carbon steel vessel with plastic inserted rubber lining to retain the carbon. The acid washing is carried out at environment temperature using a 3% solution of hydrochloric acid (HCl). The washed carbon is transferred from the acid washing column to the elution column using the carbon pump. HCl is supplied to the plant as 32% solution and delivered in road tanks. The selected volumes of concentrated acid are pumped to the acid circulation tank as part of an operation



programmed in time. The automatic cycle of acid washing including the carbon transfer from the column takes 5.5 hours and operates as follows:

- The loaded carbon is pumped in the acid washing column using the transfer water. The water engaged by the carbon flows at the column base in the transport water tank. The nominal duration is 0.9 hours.
- At the same time, there is prepared a charge including 1 volume of bed (BV) of 3% HCl by pumping a fixed volume of concentrated acid in a charge of raw water in the acid circulation tank. The water and acid amounts are controlled by the DCS by measuring the level in the acid circulation tank. The volume of added water is controlled by the increase of the level in the acid circulation tank. The volume of the concentrated acid added is controlled by the pumping time of the concentrated acid transfer pump and a pump calibration factor. This complete stage takes 0.6 hours.
- The acid circulation pump is in operation and delivers diluted acid at a constant rate of 2 BV/hour for 1.5 hours through the column and back in the circulation tank until the acid washing has been completed.
- The acid circulation pump is switched off and the carbon is washed at a constant rate of raw water supplied at the base of the acid washing column. Some of the spent acid can be returned to the acid circulation tank if it is noticed that the spent acid can be re-used. The remaining solution which was not recycled is delivered to the acid neutralization tank. The raw water flowing continues for the determined period until the carbon was completely cleaned of any residual acid. (2BV/hour flow for about 2 hours)
- The carbon is pumped from the acid washing column with the transport water as dilution to the elution column for a pre-set period of time until the acid washing column is empty (nominal duration 0/9 hours).
- The acid washing and elution columns will drain back to the transport water tank (nominal duration 0.5 hours).

The acid washing equipment is located in a dyked acid resistant zone served by a special leakage pump. A safety shower has been provided. The concentrated HCl tank is located outside and is aerated through a column scrubber. The acid circulation tank is aerated from outside the building using the acid washing fan.

The spent acid is not directed to the CIL tailings because the Inco Detox 1 plant has been designed to remove the cyanide only up to <10mg/l and there is a risk of HCN release if acid is added. Instead, the spent acid is neutralized with, lime from the annular lime pipeline with pH control system. The acid discharge pump delivers the neutralized acid to the flotation tailings thickener for eventual discharge in the flotation TMF. Moreover, this procedure prevents the exceeding of the admissible emission values in the water courses of 500 ppm Cl⁻ for the water recycled to the CIL TMF which would apply if Detox 2 was used.

The acid washing is periodically controlled by the plant DCS.

Elution circuit

Divided AARL elution circuit has been designed. It has been designed for the elution of a charge of 11 t of carbon at 130⁰C, although 110 – 120⁰C is expected to be enough. The elution



cycle duration including the carbon transfer from the column is about 6/5 hours.

The elution column is a pressure stainless steel vessel with stainless steel screen inserts to retain the carbon. The elution column is made of stainless steel. The elution column, the hot pipe, the pre-moistening tank, the spent solution tank and the loaded solution tank are sealed and lined with stainless steel to reduce the heat loss and to protect the workers.

The elution agent is indirectly heated with a LPG heater heating either the thermal fluid or the water under pressure recycled through a plate of the heat exchanger. A fuel operated heater is used instead of an electric one to avoid the addition of installed power which can be seized by the power system. A recovery plate of the heat exchanger cools the loaded solution that leaves the elution column heating the input solutions. Double screen filters are provided as traps for the carbon after the elution column.

The pre- moistening solution includes the low content loaded solution prepared at 2,0% NaOH and 3,0% NaCN from the end of the previous cycle. The stripping solution for the first part of the stripping cycle includes the spent electrolyte from the spent electrolyte tank. . For the final part of the stripping circuit, elution water for the carbon cooling is used. This water comprises also low chlorine drinking water. The elution zone is in a basin provided with a pump sump. There is also a safety shower.

The elution cycle is completely automatic, the valve operation, the switch on/off and control of the elution agent heating, elution pump, elution water distribution, water pumps for the elution agents and the transport water being pre-set by the plant DCS.

Here below, there is a brief presentation of the operations performed throughout the elution cycle:

- 1.3 BV solution is prepared of the low content loaded solution from the end of the previous cycle. A solution of Na OH is added using the dosage pump of the cyanide and caustic soda and the cyanide dosage pump to obtain a solution with the concentration of 2% NaOH and up to 3% NaCN. The actual required amount of cyanide will be determined in the plant. In practice, a smaller concentration is often required. The preparation of the solution is part of the sequence controlled by the DCS. The tank filling with water, if low content loaded water of the previous cycles has not been retained, takes one hour.

- *Filling the column, heating and pre-moistening (nominal duration 1 hour)*

The pre-moistening solution is pumped through the elution column using a pump from the pre-moistening tank through the heat exchangers, the elution heater being switched on. During this operation, the automatic valves are set to recycle the solution leaving the heat exchanger to the pre-moistening tank and thus there is a closed circuit. The circulation continues for, 1 hour at 2 BV/hour. Throughout heating stage, the pressure adjustment valve on the exit side of the circuit controls the pressure in the column to prevent the spraying.

- *Stripping (nominal duration 2 – 2.6 hours)*

Once the temperature of the moistening solution resulting at the heat exchanger is



sufficiently high (usually 110 – 120°C), the carbon stripping starts using the spent solution of the spent solution tank and the same elution pump and the solution heater which controls the elution temperature. The valves modify the route of the loaded solution to the selected tank of loaded solution. There are provided two loaded solution tanks to allow the completion of two electrowinning a day allowing a tank to receive the elution agent while the other feed the electrowinning cells. The stripping is carried out by pumping up to 5BV of spent solution at 2 BV/hour by a system of the loaded solution tank. There was provided a certain flexibility of the total volume of stripping solution to allow the modification of the elution kinetics due to the variations of the Au: Ag ratio. At the end of the stripping the elution heater is switched off. This stripping stage can be done with elution water instead of spent solution if required. It is not expected to exist sufficient drinking water from municipal sources to replace completely the use of the spent solution, not even for 1 elution /day.

▪ *Column cooling (nominal duration 1 hour)*

The elution heater is switched off and the elution pump is used to pump the treated elution water (cold drinking water) through the column and following the circuit to the loaded solution tank. Based on a pre-set time the valves modify the orientation of the loaded solution to the pre-moistening tank. A total volume of about 2 BV of elution water is circulating through the elution column at a rate of 2 BV/h. After a certain time that ensures the sufficient use of elution and provided that the temperature in the loaded solution decreases below 95°C prior to the closure of the adjustment valve, the elution pump is switched off and the elution column is aerated.

▪ *Transfer of the elute carbon (nominal duration 0.9 hours)*

The elution column is pressurized with the transport water and the carbon transferred under pressure to the drainage screen of the eluted carbon at the beginning of the carbon regeneration circuit. The screen passage gets to the transport water tank by gravity. The eluted and drained carbon is discharged by a screen in the eluted carbon tank.

▪ *Drainage of the elution column (nominal duration 1 hour)*

After enough time has elapsed, so that the carbon of the elution column has been emptied, the transport water pump is switched off and the column is drained. The drained transport water from the elution column goes to the sump of the elution pump and is delivered to the buffer tank of the CIL solution recycling at the beginning of the circuit. The elution is controlled in sequences by the plant DCS. The elution column is protected in case of high pressures both by the pressure valve and the explosion membrane. The elution heater will be controlled by the supplier PLC connected to the plant DCS by serial connecting to monitor the emergency warning system and to allow the heater switching on and off as part of the elution sequence.

Carbon regeneration

The carbon transferred from the elution column is drained on a vibrating screen with 0.6mm meshes prior to its discharge in the eluted carbon basin.

The eluted carbon basin contains 17 t (1.5 BV) of carbon ensuring a buffer capacity in the elution and regeneration circuits.

The carbon is recovered from the eluted carbon basin at a flow rate of 1,000 kg/h by a spiral feeder with variable speed. The carbon is discharged from the feeder in a horizontal regeneration



furnace electrically heated at 1100kW with continuous running. The furnace is provided with an emergency DC motor driven by a battery. The furnace contains a pre-heating section of the carbon and zheating zones operating at 750⁰C. The temperature in the furnace is controlled by the supplier PLC and monitored by the plant DCS. The gases discharged from the furnace go to a scrubber to remove the dust.

The regenerated carbon is discharged at < 450⁰C from the furnace directly in a cooling tank filled with water which can receive up to 2t of carbon. The fresh carbon will be also added occasionally in this tank at a rate of about 100 kg/zi. The carbon will be pumped from the cooling tank on a screen with 1mm opening in discontinuous charges controlled by the time sequence. The passage of the screen containing low content fine carbon will be discharged using a carbon slurry transfer pump to the Inco Detox tank and then it is discharged in the CIL TMF. The grain regenerated carbon which is discharged from the screen refusal passes to a tank for regenerated carbon with a capacity of 11 t. The carbon will be pumped discontinuously from this tank to the end of the CIL circuit using a regenerated carbon transfer pump as part of the overall sequence of the carbon movement. The furnace can be bypassed by directing the eluted carbon leaving the absorption column directly on the classifying carbon screen.

The transport water tank is fed with treated elution water for completion, through a floating valve. Occasionally, the fine carbon accumulated can be drained from the tank and because these slurries may contain loaded carbon it is collected in a bag for the carbon recovery if required. The regeneration is controlled in sequences by the plant DCS. The regeneration carbon will be controlled by the supplier PLC with connection to the plant DCS by serial connecting to monitor the temperatures and the running condition.

Electrolysis and melting

The loaded solution produced in the elution process is collected in one of the two loaded solution tanks for eletrowinning. There will be usually 5.5-6 BV of loaded slution per charge, but the loaded solution tanks ensure only up to 8 BV of solution per charge. The eletrowinning cycle is expected to take between 8 and 10 hours per charge. The two loaded solution tanks are designed so that the eletrowinning process may run with a tank while the elution circuit fills the second tank.

The circuit is designed to operate either with the electrolyte recycling through the cells back in the loaded solution tanks or with a single pass.

The precious metal eletrowinning is performed in four „sedimentation” type eletrowinning cells of 340 l arranged in two parallel rows of 2 cells in series located in the gold room. The cells are made of stainless steel with polypropylene linings and are equipped with 33 cathodes each made of stainless wool. The cell hoods are connected to a fan for discharging outside the building. Each cell is fed by a dedicated rectifier.

At the completion of the elution cycle there will be in total 5.5 – 8 BV of solution at 90 – 95⁰C in the loaded solution tank. The loaded solution is pumped through the sampling device in the eletrowinning circuit. The solution flow-rate is monitored and the valves are set so that the solution is distributed evenly among the two cell batteries. At the eletrowinning cell leaving, the spent eletrolyte flows by gravity to the transfer pump and from there it is pumped through the sampling device of the spent eletrolyte to the loaded solution tank. The eletrowinning will continue



by recycling until the spent electrolyte content reaches a value which ensures the expected depletion rate. The spent electrolyte is then directed to the spent solution tank until it is filled up and then to the recycling solution tanks from the beginning of the CIL circuit. If the single pass running is used, the spent electrolyte fills up first, the spent electrolyte tank and then the remaining material is pumped to the tank for the solution return from the beginning of the CIL plant.

The gold and silver recovered by electrowinning from a sediment which is easily removed from the cathodes and a mud at the bottom of the electrowinning cells. The cells will be cleaned twice a week.

The cell cleaning assumes for the beginning the removal of the electrolyte solution prior to the precious metal mud removal. Most of the electrolyte is removed from the cell through a emptying valve on the precious metal mud filter and pumped with a pump to the electrowinning mud tank. It allows the access to the cathodes for washing. The precious metal mud is then washed „in situ” from the cathodes with a pressure water jet and pumped to the precious metal filter.

The cake resulting at the precious metal filter is dried and then melted in an induction furnace with fusing agents and an amount of slag from the previous melting process. The dore is poured in 1,000 oz ingots using the cascade arranged moulds. The ingots are cleaned, sampled, weighed and then stored in the treasury room. The melt slag is manually crushed and a part of it is returned to the SAG mill. As the cathodes are made of stainless steel there will be little iron oxide in the melt and the slag amount will be small.

The electrowinning and melting sectors are located inside the gold room which is a security zone with CCTV controlled and monitored access. Two pulley blocks are provided to handle the anodes and cathodes of the electrowinning cells. The gold room floor beneath the cells and the gold filter is inclined to a sump where there is a pump. Any leakage and water of the floor washing are pumped to the first CIL tank or to the mud tank.

d. Detoxification of the cyanidation tailings (Detox 1)

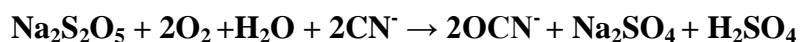
The thickened tailings resulted at the CIL thickener is pumped to the DETOX 1 plant for the cyanide neutralization, prior to their discharge in the CIL TMF.

Detox 1 treatment plant consists of:

- INCO neutralization plant which removes the cyanide from the CIL tailings by air oxidation and SO₂ (supplied with the sodium meta-bi – sulphite) using copper as a catalyst. The neutralized tailings are then directed to the CIL TMF through the CIL tailings pumping station;
- Sodium meta-bi – sulphite dissolution plant dosed as solution.

The Detox 1 treatment plant was designed to reduce the CN_{WAD} level below 10 mg/l.

The INCO process for the cyanide neutralization is based on the oxidation reaction of the free and complex forms of the cyanide with the sodium meta – bi – sulphite as per the following reaction:

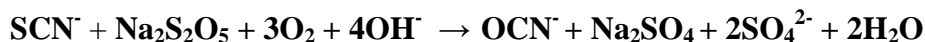


The INCO process can remove the iron cyanide compounds of the solution. The ferricyanides are reduced to insoluble salts of ferricyanide and precipitated of the solution.

The thiocyanate is removed continuing the addition of the meta-bi – sulphite after the

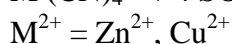
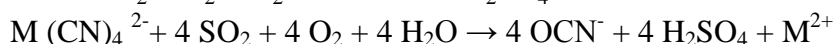


complete oxidation of the cyanide free and complex forms. Under typical operating conditions, only 10-20% of the thiocyanate is removed. This results in an additional requirement of meta – bi – sulphite and ensures the removal of some more toxic forms of the cyanide. The additional removal of the thiocyanate is possible continuing to add SO₂ or meta – bi – sulphite after the complete oxidation of the free and complex cyanide forms as per the reaction:

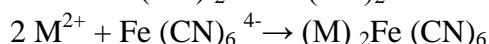
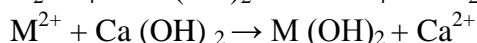
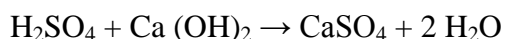


The main stages of the treatment process by the INCO method are:

- Oxidation of free and easily releasable cyanides with SO₂/air, as per the reactions:



- Neutralization of the sulphuric acid formed and the metal precipitation with Ca (OH)₂:



Where M = Zn, Cu etc, the heavy metals precipitate as insoluble hydroxides or cyan compounds with Fe.

- Cyanate hydrolysis:



- The INCO neutralization plant is located near the CIL tailings thickener

The thickened of the CIL tailings thickener containing about 60% solids is pumped to the *neutralization* Detox 1 plant provided with *agitation system*, through the *feed box* (basin) of Detox 1 plant where it is diluted to a content of 40% solids, using recycled water from the CIL TMF, as well as any possible leakage of the preparation – storage zones of the alkaline reagents used in the gold recovery flow-sheet by CIL process. The tailings are diluted, it will have a cyanide concentration of (CN_{WAD}) about 175 mg/l.

In the feed box the copper sulphate is dosed as solution to ensure the copper ion concentration (about 0.3 g Cu/g CN_{WAD}) necessary for the oxidation reaction catalysis, it is also in the box that lime dosage is carried out (if required) from the annular lime pipeline of the plant to maintain the pH at 9 - 10 units. The lime dosage is included as precaution measure although further to the tests it is expected that lime dosage is not necessary. The copper sulphate solution with 23% concentration, prepared in the plant for the reagent dissolution of the flotation plant, is supplied to the INCO plant, with *containers* of 1 m³, handled with a stocker. The copper sulphate solution dosage in the feed box is carried out by a *peristaltic pump* ensuring the daily requirement of about 2 m³ of CuSO₄ solution.



The dilution water of the CIL tailings , mainly – recycled water from the CIL TMF, is supplied from the *CIL recycled water tank (basin)* with the *CIL recycled water pumps* . The CIL diluted tailings mixed with the copper sulphate solution and lime milk are directed to the *Detox 1 neutralization tank*, provided with a *mechanic agitator* and air blow in system. Sodium meta- bi – sulphite is added in the neutralization tank as solution using the dosage pumps located in the meta – bi – sulphite dissolution installation , the sodium meta – bi – sulphite flow rate (MBS) is adjusted so that to ensure a supply of 9.9 g SO₂/g CN_{WAD} destroyed (14.65 g MBS/g CN_{WAD}), indicated by the tests. The Flow – rate of sodium meta – bi – sulphite solution with 20% concentration is averaging 1.2 m³/h, and may reach 2.4 m³/h, depending on the flow rate and cyanide concentration of the CIL tailings.

The Detox 1 neutralization tank with a useful volume of 270m³ ensures a retention time of the tailings and reagent mixture of 1.5 hours sufficient to reduce the cyanide concentration of the CIL tailings.

The air supplied by the CIL compressors is added at a flow rate of 2.207 Nm³/h through the spray nozzles beneath the propellers, at a controlled and measured flow rate.

The neutralization tank is equipped with pH measuring and control device as well as with *sampling devices* for sampling the tank feed and discharge and a *CN_{WAD} continuous analyser*. All the data supplied by the measuring and control devices will be displayed in the control room and will be recorded.

The CIL detoxicated tailings with a CN_{WAD} content below 5 mg/l (about 3.9 mg/l), are discharged from the neutralization tank and directed to the tailings pumps for pumping them to the CIL TMF.

For emergency cases (different failures of the tailings pipeline to the CIL TMF) the tailings can be discharged in the emergency pond and after the emergency situation removal they are pumped using the *recycling pump* to the CIL tailings feed pumps. The submersible recycling pump is handled by a *pulley block*.

The INCO neutralization plant is provided with a *safety shower*. The floor of the neutralization zone will be made concrete and inclined towards a sump from where the *vertical centrifugal pump*, pump them to the Detox 1 neutralization tank.

- Sodium meta – bi – sulphite dissolution installation (SMBS)

The preparation of the meta – bi – sulphite solution is carried out in a reagent dissolution installation (elution reagents) located in a building near the INCO neutralizing plant.

The sodium meta – bi – sulphite Na₂S₂O₅ (MBS) is supplied in batches (bags) of 1,000kg which are handled with a pulley block and are discharged in a *dissolution tank* provided with an agitator and *feed trough* through a *batch handling system* (bag handling) is designed so that the bag opening is put at the feed trough of the dissolution tank using a sealing device, and thus the bags are emptied without any release of dust powder . The 20% meta – bi – sulphite solution is pumped using a *transfer, centrifugal pump*, to a *storage tank*. The MBS solution releases SO₂ gases and consequently both the storage tank and the dissolution tank are closed vessels aerated using a



fun outside the building. The metabisulphite solution of the storage tank is directly dosed to the Detox neutralization plant of the INCO process with the *dosage pump* .

The MBS dissolution installation is provided with a *centrifugal pump at the sump* taking over the possible leakage collected from the sump of the MBS solution preparation zone and delivered to the Detox 1 tank.

Controls

The main controls of the zone are:

- Lime addition to control the pH
- Control of the copper sulphate flow-rate added to the dosage pump
- Control of the sodium meta – bi –sulphite flow-rate through the control valve
- pH measuring and control by lime addition
- The dilution water flow-rate of the Detox feed through the control valve
- Analysis CN_{WAD} of the Detox tank content
- Measuring and control of the air flow at the adjustment point

3. OXYGEN PRODUCTION TECHNOLOGY

Description of an air separation unit

Air compression and purification

The process air that is to be separated gets into the compressor through a filtering device and then, it is compressed by a multi-stage non-oil compressor. The compressed air passes through a purification unit (to remove water, carbon dioxide and other components) composed of two reversible exchangers. While one of the two vessels is operating, the other one is reactivated with the residual nitrogen that comes from the cooling tower. During the heating cycle, an electric radiator heats up the regeneration gas.

Cold production and distillation

The compressed and purified air gets into the cooling tower where it is cooled with the help of the cold gaseous oxygen and residual nitrogen in a counterflow heat exchanger. All the air that comes from purification is further compressed in a booster combined with a turbine. Part of the air compressed by the booster is decompressed by the turbine to generate the “cold” necessary to start off the plant and compensate for the thermal losses and then it is sent into the distillation columns. The other part, before being sent to the distillation columns, is condensed in the main heat exchanger by the cold products.

After passing through the heat exchanger, the air reaches the dew point and is further sent to the distillation columns (double column distillation). The distillation columns release high-purity oxygen at average pressure (10 barg) GOX (gaseous oxygen).

Liquid oxygen storage system

In order to ensure the oxygen delivery in case of oxygen plant shut down as well as to ensure the consumption peaks, there will be installed liquid oxygen tanks (LOX).



The liquid oxygen (LOX) will be partially produced (~ 3% of the GOX production) by the air separation unit (ASU). The LOX will then be temporarily stored in some dedicated storage units for it to be vaporised when necessary.

4. TAILINGS DEPOSITION IN THE TAILINGS MANAGEMENT FACILITIES

The flotation tailings pipeline from the flotation processing plant to the tailings management facility consists of metal pipes mounted above the ground on racks. The discharge points of the tailings will be located throughout the two dam crest of wave starting with the crest of wave of the starter dam.

FLOTATION TAILINGS MANAGEMENT FACILITY

The tailings pumping station to the flotation TMF will be located on the processing plant pad on the + 575 m level . For the piping route of the tailings consisting of steel pipes with diameters of 200 and 250 mm, the total pressure loss was calculated at 381 mCA.

Five centrifugal pumps in series will be used, the first two will be mounted in the flotation tailings thickener and the other 3 in the basin of the station itself.

The clarified water after the sedimentation of the solid fraction in the tailings management facilities, they are delivered to the pump station from the floating barges and will be transported to the tank for the water recycled from the Clarified water treatment plant of the Flotation TMF, located inside the processing plant yard. From there a part of the water will be introduced in the technological flow-sheet while the excess water will be directed to the treatment plant and then discharged in the emissary.

CYANIDATION TAILINGS MANAGEMENT FACILITY – CIL TMF

The tailings pump station to the CIL TMF will be located on the processing plant pad on the + 575 m level. The tailings piping route consist of steel pipes with diameters of 150 and 200 mm. The total pressure loss was calculated at 437 mCA.

Like for the flotation tailings there will be used also 5 centrifugal pumps in series, all being mounted in the basin of the plant itself.

The clarified waters after sedimentation of the solid fraction in the TMF's will be delivered to the pump stations located on floating barges and will be directed through the pipes to the recycled water tank of DETOX 2; then it will be re-introduced in the technological flow-sheet; in case of high flow rates (because of heavy rains) when the necessary amount of the flow-sheet is exceeded the water is treated in the DETOX 2 and discharged in the emissary .

5. DISCHARGE OF USED WATER

Throughout the exploitation life, the following used water categories will result:

1. acid water from the open pit and waste dumps;
2. clarified waters discharged from the flotation tailings facility;



3. clarified water discharged from the cyanidation tailings facility (CIL);
4. sewage

5.1. Acid water from the open pit and waste dumps

a. Potentially acid water of Certej Open Pit

The acid water collected in the Open Pit will be pumped to the acid water treatment plant located inside the processing plant yard.

b. Potentially acid water collected from the waste dump slopes

The potentially acid water collected by the guard channels of the waste dumps in the collecting basins will be piped to the acid water treatment plant together with the water from the open pit and using the same treatment process.

The treatment of this water (potentially acid) will be carried out using the classic technology of “active” neutralization of the acidity and heavy metal precipitation with lime while the resulting water is used in the technological process, and the excess water is discharged in the emissary.

Main technological stages of the treatment flow-sheet consists of:

- ◆ *precipitation of metals with lime (lime milk);*
- ◆ *sedimentation of precipitates formed, by sedimentation and treated water clarifying;*
- ◆ *discharge of the thickened sludge.*

Description of the acid drainage treatment flow-sheet

By means of a carbon steel pipe the acid drainage will be directed over a stationary screen feeding the acid drainage treatment plant; it will be equipped with mechanical agitating system. The pH control and measuring in the treatment tank between 8.5 – 9, will be carried out by adding the lime milk. In the treatment tank of the acid drainage the acid water will be conditioned with lime milk for about 30 minutes carrying out the neutralization of the acidity and heavy metal precipitation.

The overflow– neutralized water of the treatment tank will be directed to a Clarifier – Settler Tank for acid water. In this tank provided with a scraper bridge the sedimentation of the formed precipitate and water clarification takes place.

For making easier the sedimentation/ removal of the precipitated mud, flocculant (17 g/mc) is added in the clarifier as solution of 0.05 % of the flocculant storage tank.

The floor of the zone of the water treatment plant and of the settler will be made of floor and will be inclined to allow the collection of the eventual leakage in the sump and their pumping to the settler feed box.

The overflow from the settler (clarifier) is collected in the overflow reservoir/tank of the acid drainage settler for use in the processing plant .

In case of the treated water neutralization the tank overflow together with the water from the settler (clarifier) will discharge in the environment . The treated water from the acid drainage treatment plant will be completely recycled to the process except for the emergency cases when the



treated water will be discharged in the Grozii stream. The mud will be considered as flotation tailings and will be pumped with the tailings to the flotation TMF.

The plant is designed to be built in the first year of exploitation and will be running as long as acid drainage is collected, including during the post closure stage. It will ensure the treatment of collected waters from the open pit and the two waste dumps.

5.2. Clarified water discharged from the flotation tailings facility

The clarified water after the solid fraction sedimentation in the tailings facility, is recycled to the processing plant and stored in a buffer tank placed above the flotation plant ramp. From this water tank the water is directed by gravity and most of it will be recycled in the technological process of the processing plant while the excess water will be treated in the treatment plant of Flotation yard and after that it will be discharged in the emissary (Coranda stream).

The main stages of the treatment flow-sheet are:

- ◆ *precipitation of metals with lime* (lime milk);
- ◆ *sedimentation of precipitates* formed by sedimentation and *treated water clarification*;
- ◆ *thickened mud discharge*.

Description of the technological flow-sheet

The water supplied from the flotation TMF passes on a *stationary screen* to remove the vegetation and then flows in a *treatment tank* with useful capacity of 85m³ – provided with *agitation system* ensuring a retention time of 30 minutes necessary to precipitate the heavy metals with lime.

In the water treatment plant, the pH is maintained between 8.5 and 9 by adding lime which is doised in a *lime milk storage tank* (equipped with an agitating system -9), using a *centrifugal pump* which lead the lime milk solution through an annular pipe to the water treatment plant.

The water treated with lime flows from the treatment plant in the *settler* where the precipitate sedimentation takes place, flocculant being added in the settler as solution with a concentration of 0.05%.

The settler overflow – the clarified treated water is discharged either directly in the emissary – Coranda stream, or directed to the overflow tank of the acid drainage plant settler - ARD (open pit water + water from the waste dumps), and from there it is pumped to the raw water tank. The thickened mud from the settler will be recycled using a thickened mud pump to the water treatment plant to ensure a recycling load of the solids to assist flocculation. The thickened mud will be pumped together with the flotation tailings to the flotation TMF.

The floor of the water treatment plant and of the settler as well as the zone of the lime storage tank will be made of concrete and inclined to allow the collection of the eventual leakages in the sumps and their discharge using the vertical centrifugal pumps corresponding to each zone, *pumps to the sumps*. The two pumps of the sumps direct the collected leakages to the water treatment tank respectively to the lime storage tank.

Controls



- The input flow-rate is measured
- Flocculant dosage is controlled by the input flow-rate
- Lime dosage controlled by the pH
- Common warning system for the clarifier
- The levels of the lime and flocculant tanks are monitored

The plant will be erected during the first year of exploitation and will be running throughout the project life until the tailings facility closure stage when the water discharge in the emissary without any prior treatment is allowed

5.3 Clarified water discharged from the CIL tailings management facility(Treatment Plant DETOX 2)

The clarified water after the sedimentation of the solid fraction in the tailings facility is entirely recycled to the processing plant and stored in the buffer tank (300 c.m capacity) located above the limestone grinding system. From this tank, the water will be directed by gravity and entirely recycled to the processing plant process (CIL plant, DETOX 1 treatment plant). Under special circumstances (heavy precipitations resulting in the increase of water level in the tailings facility over the admissible levels required for the dam safety) the excess water will be discharged in the emissary. Because of the heavy metal and eventually cyanide contents, it is necessary to treat them prior to their discharge in the natural emissary and such treatment is performed in the treatment plant (DETOX 2) located within the processing plant yard , downstream the CIL plant and near the limestone silo. The treatment process of the water discharged from the CIL tailings facility consists of the oxidation of cyanides with oxygenated water in the presence of a catalyst (copper), and formation of cyanate under specific operating conditions (Degussa process).

The neutralization method of the cyanides with hydrogen peroxide (oxygenated water) is based on the cyanide oxidation reaction (free and/or complex cyanides) as per the reaction



The hydrogen peroxide method removes from the solution the stable iron cyanide compounds, the ferricyanide are reduced to insoluble ferricyanide salts and precipitate of solution in the presence of copper as per the reaction (2):



The thiocyanate is removed by adding oxygenated water, after the complete oxidation of the free and complex forms of cyanides, as per the reaction (3):



The cyanate resulted at the cyanide and thiocyanate oxidation (sulphocyanates) finally hydrolyses as per the reaction (4):



Detox 2 treatment plant consists of:

- *Neutralization plant* removing the cyanide of the treated water by hydrogen peroxide oxidation using copper as a catalyst , the detoxicated water being then discharged in the emissary;
- *Flocculant preparation plant*, dosed as solution.

DETOX 2 neutralization plant is located near the INCO plant of the DETOX 1 treatment plant.



The Detox 2 treatment plant is designed for a maximum flow rate of 126 m³/h .

The flow-rate of the water recycled from CIL TMF for the Detox 2 is supplied from a pipeline of water recycled from the TMF, controlled prior to the basin of recycled water situated in the INCO neutralization plant.

The Detox 2 treatment plant includes as main equipments **A Neutralization tank (vessel) (with agitator)** where the hydrogen peroxide and copper sulphate is added and a Clarifier – **Settler**, with the diameter of 12 m for clarifying the treated water and precipitate removal adding flocculant. The settler was introduced because this unit incorporates the internal recycling of the mud improving the sedimentation rate of the mud . The combined flow-rate us used to control the flow rate of the hydrogen peroxide, copper sulphate and flocculant. The feeding water passes through the *neutralization tank*, the neutralization tank capacity is 126 m³ and ensures a retention time of 60 minutes , when the cyanide treatment takes place by adding hydrogen peroxide and copper sulphate. The pH of the agitator is not measured or controlled because the feed water has the required pH (8,5 -9) and lime addition is not necessary.

The overflow of the neutralization tank flows in the *settler* provided with a *mechanism with scrubber bridge* . Flocculant as 0.05% solution is added in the settler to increase the sedimentation rate of the precipitate (mud) resulted at the neutralization of the treated water. The clarified water is discharged through the settler overflow and flows in the environment (emissary), on the discharge pipe it is continuously sampled using *sampling device*, mounted in *effluent flowing box*.

The thickened mud from the settler will be recycled using the *centrifugal pumps* to the treatment tank (neutralization) to ensure the circulation load of the solids and to assist flocculation. The thickened mud, at a suitable consistency, will be discharged to the CIL tailings thickener in charges by opening a valve from the thickened mud pipe of the settler. By pumping a charge with the *centrifugal pump form the Detox 2 sump*, the mud will finally get to the CIL TMF.

Hydrogene peroxide at 50% H₂O₂ is dosed in the neutralization tank with the *peristaltic dosage pumps* .

The copper sulphate is transported from the copper sulphate dissolution installation of the flotation plant using the *containers of 1m³*, and from there it is supplied to the neutralization tank using the *dosage pumps*.

Flocculant is prepared in a special flocculant preparation installation located in a building near the neutralization plant settler.

The neutralization plant is equipped with *safety shower*.

As this plant produces an effluent in the environment all pumps have been designed with backup units.

Flocculant preparation installation Detox 2

The flocculant preparation installation consist of a *cone bin* where the flocculant 25kg bags are discharged using a *worm feeder* and the flocculant is automatically directed and dosed to the *dissolution tank* (with agitator), where the mixing of the raw water – supplied by *pumping* takes place to result a solution with a concentration of 0.5%.

The flocculant solution of 0.5% is *pumped with the flocculant transfer pumps* to a *storage tank*, where it can be stored for 24 hours. From the storage tank the flocculant solution is *pumped with the flocculant feed pump* to the settler of the Detox 2 neutralization plant with continuous dilution



with water from the overflow of the settle to obtain a solution with a concentration of 0.05% flocculant.

Controls

- Input flow-rate controlled at the adjustment point
- Dosage of copper sulphate, hydrogen peroxide and flocculant controlled by the input flow-rate
- Common emergency warning for the settler (clarifier)
- Level of the flocculant level controlled

The plant is designed for construction starting at the time when the concentrated ore cyanidation starts (CIL process) and will be running after the tailings facility closure, too, so that to maintain the capacity of detoxication until the diminution of cyanide concentrations in the water discharged from the CIL tailings management facility (including the seepage through the dam body) below the admissible limits of the rules in force.

5.4. Sewage

The sewage will be treated in three Treatment Plants with active mud of BIO CLEANER type :

- **The BC-4 type sewage treatment plant of the explosive magazine – the clarified water** will be discharged in Ciongani stream.

- **The ECO CLEANER VFL AT 100 sewage treatment plant** – the treated water will be discharged in the diversion channel of Grozii, Ciongani and Borzei streams.

- **BIO CLEANER 50 sewage treatment plant of open pit yard** – after treatment the clarified water is discharged outside the platform in the diversion channel of: Grozii, Ciongani and Borzei streams.

INFORMATION ABOUT THE RAW MATERIALS DANGEROUS SUBSTANCES, PRODUCTION

Production		Resources used for production completion		
Name	Annual amount (average)	Name	Annual amount (average)	
Processed ore	3,000,000 tons	Diesel fuel	5,400,000 l	Romp petrol
Gold concentrate	315,000 tons	GPL	240 t	Romp petrol
Gold in Doré alloy	5,512 kg	Electric power	145,194 MWh	ENEL
		Process water	1,848,960 m ³	r. Mureş
		Drinking water	29.376 m ³	Source catchment

Capacities of processing plant process

	U/M	year 1	year 2	year 3	year 4	year 5	year 6	year 7	year 8	year 9	year 10	Total
Processed ore	mil. t/an	3,0	3,0	2,99	2,99	3,00	2,99	3,01	3,03	3,06	1,12	28,20
	mil. mc/an	1,27	1,27	1,26	1,26	1,27	1,26	1,27	1,28	1,29	0,47	11,90

Raw materials, chemical substances used in the process

Name of the raw materials, of the chemicals or chemical substance	Annual quantity / Existing in the stock	Classification of the chemicals and chemical substances *		
		Dangerous / Non dangerous (P/N)	Danger *	Risk phases *



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Ammonia nitrate	3697 t/year, stock 90 t	N		
Priming explosive – dynamite	229 t/an, stock 10 t	D	Explosive	R2-6-44
Amyl xanthate	390 t/year ; stock 20 t	N	-	-
Dowfroth frother	150 t/year ; stock 5 t	N	-	-
Aero 3477 - collector	120 t/year ; stock 10 t	N	-	-
Copper sulphate	955 t/year ; stock 25 t	D	Poisonous, irritating dangerous for environment	R22-36/38-50/53
Sodium silicate 40%	4120 t/year ; stock 160 t	N	-	-
Hydrated lime (including lime milk)	7791 t/year ; stock 219,5 t	D	Irritating	R34-36-37-38-41
Limestone	241605 t/year ; stock 250 t	N	-	-
Sodium cyanide (solid and solution)	1653 t/year ; stock 276 t	D	Very toxic, dangerous for environment	R26/27/28-32-50/53
Active carbon	35 t/year ; stock 55 t	N	-	-
Hydrochloric acid (solution)	898 t/year ; stock 87 t	D	Corrosive	R 35-36/37
Sodium hydroxide	328 t/year ; stock 27 t	D	Corrosive	R 35
Sodium meta – bi – sulphate	1909 t/year ; stock 159 t	D	Toxic, irritating	R22-31-41
Flocculant	171 t/year ; stock 28 t	N	-	-
Oxygenated water (50 % solution)	12 t/year ; stock 1 t	D	Oxidizing, corrosive	R5-8-20/22-35
Oxygen	183.901 t/year ; stock 154 t	D	Oxidizing	R 8
Diesel fuel	5.400.000 l/year; stock 153 mc	D	Very inflammable	R10-40-65-66-51/53
Oils (engine oil, hydraulic oil/ lube oil)	63.000 l/year	D	Irritating, toxic, environmentally dangerous	R38, R41, R43, R45, R36/38 R51/53, R52/53
GPL	240 t/year ; stock 10 t	D	Very inflammable	R12
Flux (borax)	0,607 t/year	N	-	-

Materials for dam construction

a. Materials for dam construction

Rockfill amounts necessary for dam construction:

Main dam of flotation TMF	6,990,000 c.m
Lateral closure dam of flotation TMF	83,000 c.m
Upstream closure dam flotation TMF	77,500 c.m
Dam of CIL TMF (CIL)	763,000 c.m

Materials ensuring the protection against the erosion consist of 2-200 mm gravel the necessary dams being:

Main dam of flotation TMF	93,000c.m
Lateral closure of flotation TMF	4,800c.m
Upstream closure dam of flotation TMF	2,550 c.m
Dam of CIL TMF	46,000 c.m



AGENCY FOR ENVIRONMENT PROTECTION HUNEDOARA

Str. Aurel Vlaicu nr. 25, Deva, Jud. Hunedoara, Cod 330007

E-mail: office@apmhd.anpm.ro; Tel: 0254/215445, Fax: 0254/212252

b. Filtering elements

The fine filter consisting of classified sand layer with 20-0.6 mm particle size and 1.5 m thick. Coarse filter placed beneath the fine filter with particle size of 200-2 mm and 1.5 m thick layer. The filtering material volumes necessary for dam construction are::

	<i>Fine filter</i>	<i>coarse filter</i>
Dam of flotation TMF	119,000 c.m	122,000 c.m
Lateral closure dam of flotation TMF	5,000c.m	5,000c.m
Dam of CIL TMF	56,000 c.m	53.000 c.m

c. Sealing materials

The clay is used for the impermeabilization of the lateral closure dam on the left hillside both for the starter dam and the rises (27000 c.m).

DHPE – 2 mm geomembrane is used for the impermeabilization of the upstream parament of the dam of the flotation TMF up to the +625,00 mdM level (about 20,000 sq.m), at the downstream parament of the upstream closure dam of the flotation TMF (about 2, 700 sq.m) and CIL TMF up to +780,00 mdM level (about 9,700 sq.m), placed on a fine filtering layer.

Geotextile is used for the arrangement of benches at dam rises.

II. REASONS AND CONSIDERATIONS ON WHICH BASIS THE ENVIRONMENTAL PERMIT WAS ISSUED, AMONG OTHERS RELATED TO THE QUALITY AND CONCLUSIONS /RECOMMENDATIONS OF THE REPORT ABOUT THE ENVIRONMENTAL IMPACT AND PUBLIC PARTICIPATION

a) The Project complies with the provisions of the Government Decisión no. 1213/2006 about the establishment of the procedure – frame assessment of the environmental impact for certain public and private projects , in the **Annex I.1, activity with significant environmetnal impact**

-point 4.2 of the annex to the GD no.1213/2006, at plants obtaining the non-ferrous raw ores , concentrates or secondary products further to the metallurgical, chemical or electrolytical processes;

-point of 5.2 of the annex to the GD no.1213/2006- open pit and surface mining exploitation when the site surface area is bigger than 25 ha;

- point 9.7 of the annex 1 of the GD no. 1213/2006- storage facilities for dangerous waste or installations for the removal of the waste by incineration or chemical treatment;

The new elements notified by S.C DEVA GOLD SA referring to the change of the processing plant site – against the original data of the project and on which basis the Environmental Permit 8 of 05.07.2012 was issued , are included at:

➤ Point 13.a) Annexe II of GD 445/2009 , respectively – any modifications or extensions, others than those stipulated at point 22 of the annexe no.1, of the projects stipulated in the annex no.1 or in the present annexe , that have already been permitted or under progress, with potential significant negative impact on environment;



Based on the provisions of art 22, paragraph (3) letter b) of GD no.445/2009 about the impact assessment of certain public and private projects on the environment with further amendments and completions , the public authority for the environmental protection together with the consultation of the commission for technical analysis, decided the partial resuming of the environmental impact assessment and consequently the review of the originally issued environment permit,

b) The destination of the land according to the GUP of Certeju de Sus mentioned in the Certificate of Urbanism no. 15/24.10.2013 is: mining works zone (waste dumps, open pit), constructions serving the mining operations, communication ways, appointed in the ZUP as main industrial zone (open pit with outbuildings, processing plant, waste dumps, soil dumps, access roads, urban works, explosive magazine) and a secondary industrial zone (flotation TMF no.1 and CIL TMF no.2);

c) The Zonal Urban Plan was approved through the Local Council Decision no.11/14.05.2010 for the Project site and it stipulates the construction of an industrial zone of 300.52ha surface area and a contour protection zone of 155.7 ha.

d) The project is included in the Annex 1 to the Convention about the environmental impact assessment under trans-boundary context adopted at Espoo on 25th February 1991, ratified through the Law 22/2001.

- **Basic reasons / criteria for the selection of options, including the site and technological ones;**

For the selection of the project option to be implemented there have been investigated the following cases:

Options referring to the location of the mining objectives:

- The location of the ore processing plant – close to the mining operations on a land which utilization rate is very low, at an elevation which reduces the haulage slope. There has been also provided a sufficient distance from the tailings management facility location site. This location site ensure also the maintenance of suitable distances from the vulnerable zones (residential zone, water courses), easy access to the haulage infrastructure and power grid existing in the zone.
- Waste dump location site – The reliable alternative selected for the project includes the storage of cyanidation tailings in the dumps situated close to the mine , by extending the existing ones .
- Location of the tailings management facilities – In accordance with the economic, topographic , geological and ecological restrictions there was adopted the option of valley tailings management facilities situated as close as possible to the processing plant.
- Certej open pit will be developed on the old site of Coranda-Certej open pit with West and East oriented development.
- Explosive warehouse– use of the existing one
- Location of the oxygen plant– as close as possible to the processing plant to avoid accidents which may occur at oxygen trucking



The technological alternative has been selected based on the recommendations of the Reference Document On Best Available Techniques *for Management of Tailings and Waste-Rock in Mining Activities* :

- Primary crushing of the ore mined out of the open pit – jaw crusher
- Grinding - as the finess that is required at the grinding process is 80% -0.074 mm, for Certej project , there was selected a semi –autogenous mill for the first stage of grinding and a ball mill for the second stage of grinding
- Classification – with cyclones
- Concentration- Because the precious metals of Certej deposit are bound to different minerals and they have sizes up to microns, their recovery rates are quite low when using the gravity method , this is not profitable from economic point of view and thus for Certej ore processing, there was selected the precious metal and sulphide flotation.
- Leaching recovery – for Certej Project the CIL method was selected because of the precious metal dissolution of the flotation concentrate. This method provides the highest recovery rates and the neutralization process of cyanide is well controlled and there are known worldwide method to reduce the cyanide concentration in the discharged waters required by the European rules in force.
- Dewatering – thickening
- **The pre-treatment of the floated material – Cyanide solubilization of the flotation concentrate was selected , after the ultra fine grinding and pre-oxidation as the concentrate represent 7-10% of the processed ore mass (250,000 – 315,000 t/year), so it requires a much lower processing capacity;**
- Oxygen was preferred as reagent for the Certej concentrate oxidation and it will be produced on site in a dedicated plant and thus the transport concerns will be eliminated.
- Cyanide neutralization – by treating the cyanidation tailings with meta – bi –sulphite – solid state reagent , easy to handle and which do not involve trucking and storage concerns like the liquefied SO₂ does.
- The cyanide recovery from the slurry by recycling it represents a beneficial method from economic and environmental point of view, because it reduces the cyanide input to the processing plant as well as the reagent and power consumption of the detoxication plant.
- Acid water treatment - the proposed process for the acid water treatment (with lime) is the optimal alternative and one of the most largely used processes at industrial scale providing good environmental performance.
- The treatment of the clarified waters discharged from the flotation TMF – designed technology for the treatment of the waters discharged from the flotation TMF consists of the lime precipitation of metals and precipitate sedimentation with flocculant. To establish the treatment technology and to design the treatment plant the expected composition of these used waters was considered.
- Treatment of cyanide containing waters – for the cyanide containing water treatment , there were proposed several treatment stages:
 - **primary stages:**
 - stage I of treatment** – by the INCO process in the DETOX 1 plant, prior to the tailings discharge in the CIL TMF; The INCO process indicate the following advantages:



- high treatment efficiency ratio for all the types of cyanide containing waters (slurries, leaches, used water) mostly eliminating all cyanide forms;
- the technology has been tested in Europe and worldwide at industrial scale and it has been accepted by the Reference Document On Best Available Techniques For Management Of Tailings And Waste-Rock In Mining Activities;
- it is efficient, flexible (works out significant fluctuations of the influent quality). The process can be modulated by reagent dosage and catalyst dosage;
- reagents required are easily supplied;
- the operating costs are comparable or smaller than for other chemical treatments (alkaline chlorination, oxygenated water Caro acid) for the detoxication of the cyanide containing water systems , used or under utilization at industrial scale;
- the plants used in the process are easily restarted and they reach the optimal parameters after a temporary shutdown of the plant.
- the plant can be easily adapted for the other process implementation during the closure stage, if required

- **stage II** – self treatment of the cyanidation TMF.

- **secondary stage**

- it is necessary under extreme meteorological conditions (exceptional rainfalls) when the excess cyanide containing used waters that cannot be recycled to the process have to be discharged – it consists of the oxygenated water oxidation in the presence of a copper catalyst forming cyanate under specific operating conditions (Degussa Process).

Within the cyanide containing water management, both the selection of extraction technologies (ALBION –CIL) and the water treatment technology (DETOX 1, tailings management facility, DETOX 2) the following main considerations were made:

- **a. Extraction technology (ALBION –CIL process)** provides the partial detoxication of the slurry by thickening and cyanide recovery from the clarified water recycled to the process by means of which:
 - the fresh cyanide consumption for ore processing is lower
 - the cyanide concentration of the slurry treated in the DETOX 1 plant is reduced (INCO process)
 - allows the recycling of the cyanide containing water to the process
- **b. Treatment technology (DETOX I)** by destructive detoxication of the cyanide in the slurry,
- **c. The treatment technology (DETOX 2)** by the destructive detoxication of the residual cyanide of the clarified waters discharged from the tailings facility (only in case of emergency or seepage), using the oxidation process with peroxide (Degussa process) indicates the following advantages:



- high treatment efficiency for all aqueous systems containing cyanide (slurries leaches, used water) removing most of the cyanide forms metals by oxidation – precipitation reactions .
- the technology has been tested at industrial scale in Europe and worldwide , it has been accepted by the *Reference Document On Best Available Techniques For Management Of Tailings And Waste-Rock In Mining Activities*
- the process is efficient and flexible (works out the significant fluctuations of the influent quality). The process can be optimized by reagent and catalyst dosages.

- **Compliance with BAT, BREF, as required**

The final option of the project provides the implementation of technologies recommended by the best available techniques concerning the production process, cyanide management, extractive waste management, water management , dam construction, monitoring the mine closure and post-closure ecologization in accordance with the following provisions:

1. Reference Document on Best Available Techniques for Management of Tailings and Waste – Rock in Mining Activities, January 2009.
2. Reference Document on Best Available Techniques on Emissions from Storage, July 2006;
3. Reference Document on Best Available Techniques in the Non Ferrous Metals Industries, December 2001;
4. Draft Reference Document on Best Available Techniques in the Non Ferrous Metals Industries, July 2009;

- **Compliance with the community requests transposed into the national legislation;**

✚ *Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 about the assessment of impacts caused by certain public and private projects on the environment transposed through the GD no.445/2009 about the assessment of impacts of certain public and private projects on the environment with further amendments and completions*

and

✚ *Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 concerning integrated pollution prevention and control, transposed through the Emergency Government Ordinance 152/2005 approved by law 84/2006 regarding the integrated pollution prevention and control*

- the results and the conclusions of the environmental impact report, the safety reports, dedicated studies and of the conclusions of the trans-boundary procedure reveal the measures for the prevention, mitigation, and reduction of the environmental adverse impacts by each project stage; for each environmental component there were identified and assessed both the possible impacts and the measures provided by the project for the prevention, diminution of all potential negative impacts on the environment.

- the activity provided by the project is subject to the legislation about the prevention and integrated control of pollution. By comparing the reference documents in the field resulted that there will be



AGENCY FOR ENVIRONMENT PROTECTION HUNEDOARA

Str. Aurel Vlaicu nr. 25, Deva, Jud. Hunedoara, Cod 330007

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observed the specific requirements including those referring to the levels of emissions associated to the best available techniques or, if need be, the parameters or equivalent technical measures.

SEVESO II Directive transposed into the Romanian legislation through the Governmental Decision 8/04/2007 on the major-accident hazards involving hazardous substances.

-the activity involves the use of dangerous substances and to this aim, the Safety Report and Internal Emergency Plan elaboration was required. The Safety Report was approved by the Secretariate of Risk Hunedoara meeting the requirements of the GD 804/2007 about the control on the major accident risks involving dangerous substances, with its further amendments and completions.

✚ *Directive 2006/21/EC of the European Parliament and of the Council of 15 March 2006 on the management of waste from extractive industries, transposed by the Government Decision no. 856/2008 regarding the management of waste from extractive industries*

- it was developed and approved the Plan of Extractive Waste Management in accordance with the Government Decision 856/2008 about the management of extractive industry waste and this document revealed the followings:

- the waste management was reviewed from the designing stage by selecting the method used for the ore mining and processing;
- there were reviewed the modifications which the extractive waste might undergo as a result of the storage surface area extension and their exposure to the surface storage conditions;
- there were characterized all the extractive waste installations as per directive 2006/21/CE completed by the Decisions 2009/359/EC, 2009/360/EC and 2009/337/EC, according to the Decision 2000/532/EC, as per the Directive 91/689/EEC, Directive 1999/45/EC and Regulations (EC) No. 1272/2008 as per below:

- North and South waste dumps are the extractive waste management facilities which ARE NOT CLASSIFIED in the „A” category as per the dangerous waste content
- The flotation tailings facility is a management facility of ore processing tailings which *re not classified* in „A” category from dangerous content point of view, but they are classified in “A”category if a failure occurs (failure of structural stability of the TMF dams) and a major accident happen (rapid and uncontrolled loss of the flotation tailings facility material, which may cause death , environmental impact and material damages), according to the annex III first dash of the Directive 2006 /21/EC.
- The CIL tailings Management Facility is a facility for the cyanidation tailings which are classified in the „A category” taking into account the dissoluble / dissociable inorganic cyanides (CN_{WAD}) classified as very toxic substances (category H6) according to the Directive 91/689/EC annexes II and III.




AGENCY FOR ENVIRONMENT PROTECTION HUNEDOARA

Str. Aurel Vlaicu nr. 25, Deva, Jud. Hunedoara, Cod 330007

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- In accordance with the provisions of the Directive 2006/21/EC, of the Decision 2009/359/EC for the completion of the inert waste definition, for the application of art.22 paragraph (1) letter (f) of the Directive 2006/21 and Decision 2009/360/CE, the soils of Certej perimeter are classified as inert waste / non-dangerous waste which can be eliminated in a storage facility which IS NOT CLASSIFIED in the category „A”.
- there will be placed the vegetal soil layer after the closure of the waste facilities;
- there will be used substances less dangerous for the mineral resources treatment where possible;
- there will be ensured the safe removal of the extractive waste by the suitable management throughout the exploitation and the post-closure of the waste facilities;
- there will be implemented monitoring, control and management of waste facilities during the post-closure stage, too;
- there will be ensured on long term, the geotechnical stability of the dams and dumps.

 *Water Framework Directive (2000/60/EC) of 23 December 2000 establishing the community framework of action within the policy of water transposed in the national legislation through aw no. 107/1996 with further amendments and completions.*

-the project presents a strict management of the water environmental component, revealed by the issue of the water administration approval considering the following measure implementation :

- implementation fo modern technologies requiring a minimum water consumption and maximum recycling / reuse of used waters
- Entirely recycling the clarified waters collected from the CIL TMF
- Under normal operating conditions, there will be ensured a percentage of 75% of general used water recycling (clarified water from the two tailings facilities and potentially acid water after collection and neutralization).
- Construction of a contour guard channel system , galleries and drains and diversion channels of streams from the waste dump and tailings management facilities area
- Impermeabilization of the gallery system within the tailings facility area
- Impermeabilization of a collection and retention system of waters flowing from the dam bodies of the two tailings management facilities
- Treatment of excess clarified water collected from the flotation and CIL TMF's in treatment plants adecquate for each type of sued water and to the discharge in the emissary
- Collection and treatment of acid waters of the open pit and from the waste dumps in the acid drainage treatment plant
- Placement of a 1 m thick limestone layer on the TMF's bottom
- Monitoring the surface and underground water quality
- Impermeabilization of the upstream slope of the starter dams for the 2 TMF's with 3 filtering layers
- Impermeabilization of the downstream parament of the closure dam of the flotation TMF
- Impermeabilization of the lateral clay core closure dam



AGENCY FOR ENVIRONMENT PROTECTION HUNEDOARA

Str. Aurel Vlaicu nr. 25, Deva, Jud. Hunedoara, Cod 330007

E-mail: office@apmhd.anpm.ro; Tel: 0254/215445, Fax: 0254/212252

- Placing a geotextile layer at the bench arrangement in case of dam rises
- Protection against infiltration of the upstream parament of the rockfill centreal line rise benches of both dams
- Cyanidation tailings detoxification in DETOX I to values below 5 ppm CN
- Monitoring the underground , process, used , seqage, acid drainage and surface waters on site; monitoring the quality of Valea Certej water course before its flowing out in Mures river and of Mures river water quality downstream and upstream Valea Certej flowing out in Mures , will be done by D.A Mures

- The design diligence review was pwerformed using the following laws, standards and recommendations:
 - ❖ European Commission (2002). Reference Document on Best Available Techniques for Management of Tailings and Waste-Rock in Mining Activities. Directorate General JRC. Seville.
 - ❖ EPA - US Environmental Protection Agency (1994). Design and evaluation of tailings dams. Technical Report, Washington.
 - ❖ ICOLD/UNEP (2000). Improving tailings dam performance. Common dificulties revealed by case histories. Draft bulletin. Paris.
 - ❖ ICOLD Committee on Mine and Industrial Tailings Dams (1982). Bul etin 45. Manual on tailings dams and dumps. Paris.
 - ❖ ICOLD Committee on Mine and Industrial Tailings Dams (1989). Bulletin 74. Tailings dam safety. Paris.
 - ❖ ICOLD Committee on Mine and Industrial Tailings Dams (1994). Bulletin 97. Tailings dams. Design of drainage . Paris.
 - ❖ ICOLD Committee on Mine and Industrial Tailings Dams (1995). Bulletin 98. Tailings dams and seismicity . Paris.
 - ❖ ICOLD Committee on Mine and Industrial Tailings Dams (1995). Bulletin 101. Tailings dams.. Transport, placement and decantation. Paris.
 - ❖ *ICOLD Committee on Mine and Industrial Tailings Dams (1996). Bulletin 104. Monitoring of tailings dams. Paris.*
 - ❖ ICOLD Committee on Mine and Industrial Tailings Dams (1996). Bulletin 106. A guide to tailings dams and impoundments. Paris.
 - ❖ ICOLD Committee on Mine and Industrial Tailings Dams (2001). Bulletin 121. Tailings dams. Risk of dangerous occurrences. Lessons learnt from practical experiences. Paris.
 - ❖ Finn,W.D.L. (1990). Seismic analysis of embankment dams. Dam Engineering, Vol.1, issue 1, January.

It was also used a synthesis work developed by:

- ❖ STEMATIU, D.,Tailings Management Facility. Risk Management., Ed. MATRIX ROM, Bucuresti, 2002

The following national regulations were considered:



AGENCY FOR ENVIRONMENT PROTECTION HUNEDOARA

Str. Aurel Vlaicu nr. 25, Deva, Jud. Hunedoara, Cod 330007

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- ❖ IPROMIN. Rules for the designing, construction and exploitation of the tailings management facilities of the mining industry. MIR, 2001, Bucuresti.
- ❖ NP 076- 002. Design, execution and seismic safety evaluation rules of water works of the dam site. Bulletin of Constructions no. 19 / 2003.
- ❖ NP 090 – 2003. Rules for the seismic instrumentation of the dams. Official Journal, PI, nr. 771/ 2003.
- ❖ *** Technical department instructions regarding the design, execution , maintenance and exploitation of the tailings management facilities of the mining industry - 1988.
- ❖ HGR 766/1997. Regulations concerning the behaviour during operation, interventions with the time and post – closure stage of the constructions – Official Journal, Year IX nr.352
- ❖ MEE – ISPH. PE 729/ 1989. Department rules for the classification, grouping and evaluation of actions for the water works.
- ❖ CNA-ICPGA technical instructions for earth dam constructions - 1978.
- ❖ MAIAA – Department of Land Amelioration Works and Agricultural Constructions Technical Guidelines for the design of earth dams P.D. 19-72.
- ❖ MLPAT. Regulations concerning the time behaviour of the constructions. P 130 –1997, Bulletin of Constructions, Vol. 4, 1998.
- ❖ NTLH-021/2002 Methodology for the determination of the dam importance classification
- ❖ NTLH-023 Methodology concerning the evaluation of the safety condition of the operational dams and dikes for industrial waste storage facilities.

- The tailings management facilities were approved through the approval 58/2/18.07.2013 concerning the technical auditing documentation called Report of the auditing – approval of the technical project “Dams of the Gold-silver ore exploitation of Certej perimeter , Hunedoara county”, respectively the approval no. 58/2/25.07.2013 for the safe functioning based on the Technical Solution provided by the technical Project “Dams of the gold-silver ore exploitation of Certej perimeter, Hunedoara county”, located along valea Macris(tributary of Certej river), Mures water basin, within Certeju de Sus , Hunedoara commune.

- The technical solution provides the constructive and safe exploitation rules of the dams of each TMF by:

- their construction of rockfill (non-degradable andesites),
- location of the tailings facility was selected further to the geotechnical and geological study completion, review of the hydrogeological conditions, hydrological conditions site seismicity , further to the investigations of the zone restrictions, , of the distance to the processing plant, of the environmental impact and local community location.
- construction of 40 open shafts (manual boreholes, geotechnical drilling) and 20 drill holes within the two tailings facilities and dams area. In accordance with the tests and measurements performed on the samples from the drill holes, visiting shafts, the values of the physical – mechanic characteristics of the rocks found on the tailings facility site indicate the existence of rocks (andesites) suitable for foundation works.




- completion of hydrogeological tests indicating that the rock mass is not very fractured and the permeability is below 10^{-9} m/s.
- construction of starter dams of the tailings management facilities with two filtering layers – coarse filtering layer of broken stone and fine filter of sand and gravel and geomembrane and geotextile impermeabilization.
- protection above the starter dam level of the upstream slope with 3 filtering layers to prevent the slurry flowing through the rockfill.
- for the vertical dam rises there will be used a separation geotextile layer between the rises.
- selection of the construction method – pervious dams above the crest of wave of the starter dams to allow the maintenance of the depression curve at lower levels improving the stability.
- impermeabilization of the lateral closure dam of the whole clay layers
- construction of a closure dam between the CIL TMF and the flotation TMF, made of rockfill with the whole upstream slope impermeabilization

There has been developed the Risk Study for the dams of the tailings management facilities of Certej mining exploitation which aims at the quantifying and review of the probabilities of occurrence of negative consequences downstream the tailings facilities of Certej gold – silver ore mining, as a result of some major failures or breakage of the dams. The quantifying and review of the probabilities is useful for the evaluation of the extent to which the safety of these tailings management facilities comply with the currently admissible values of the retention dams and tailings management facilities.

The study also establishes to which extent the dams corresponding to the two tailings management facilities – flotation and CIL TMF's – provides the safety freeboard against the uncontrolled discharge of water and reveal the exploitation measures to avoid such events.

- The 2 dams – main and final works of category 1, class of importance I – constructions of exceptional importance were calculated at a probability of annual overrunning of the natural flow-rates of 0.1% and checked with probabilities of annual overrunning of 0.01% (once in 10,000 years)
- the process waters will be collected and discharged in compliance with the BAT including the clarified water recycling from the 2 tailings facilities (from the CIL TMF , under normal climate conditions, they will be entirely recycled)

 *Directive Habitats 92/43/EEC about the preservation of natural habitats and wild fauna and flora species of community interests and Directive Birds 79/409/ EC about the preservation of birds amended and completed through the Directive Birds 2009/147/EC transposed in the national legislation through the GUO no.57/2007 about the regime of the protected natural areas, the preservation of natural habitats of wild flora and fauna with further amendments and completions approved through the Law no. 49/2011*

Whereas:

- The distances between the project zone and the national reservations are:



AGENCY FOR ENVIRONMENT PROTECTION HUNEDOARA

Str. Aurel Vlaicu nr. 25, Deva, Jud. Hunedoara, Cod 330007

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- Limestones of Dealul Măgura 8.5 km
 - Boholt Reservation 6.8 km
 - Măgurile Săcărâmbului 3.1 km
 - Cheile Măzii 7.5 km
 - Cheile Glodului 9.6 km
 - Cheile Cibului 12.4 km
- Until November 2011 the nearest Natura 2000 site was ROSCI0029 Cheile Glodului, Cibului and Măzii situated at about 7.5 Km East from the project and it is supplied by a different water micro-basin.
 - The Natura 2000 ROSPA 0132 site of Metaliferous Mountains appointed by the Government Decision 971 of November 2011 (for the modification of GD 1284/2007 about the declaration of the special aqua –fauna protection area of Romania), is proposed to overlap the project footprint area along Măcrișului stream representing about 0.4% of the total site area.
 - The due diligence review of the impact assessment documentation related to the project implementation and the impact on Natura 2000 ROSPA 0132 Metaliferous Mountains
 - Out of the 15 species of birds which determined the appointment of Natura 2000 SPA Metaliferous Mountains site , only two species were found on the tailings facility site and the number of nesting pairs is very small; the birds will not leave actually their habitats outside the area and it has been demonstrated by their presence in the zone, despite their destroyed habitats, polluted waters and current major impact.

Implementation of the measures for the mitigation of the impact on the biodiversity determines a non-significant impact

- the conclusions of the documentation „Cumulate Impact Assessment for Rosia Montana and Certej Projects and the consequences of a simultaneous accident with possible trans-boundary impacts” indicate that the maximum values of the polluting element concentrations in the air foreseen within the protected areas (national reservations and parks) and of NATURA 2000 sites included in the modeling matrix are much lower than the threshold value or the targeted values required by the legislation in force. The cumulated impact and the trans-boundary impact on the surface waters and aquatic ecosystems indicate that the highest cyanide concentrations (established considering the worst scenario occurring at the most inappropriate location, that is near the site) resulting at the tailings/ water overflowing with a magnitude and duration determined by the accident circumstances that had been assessed, are as follows:

- much lower than the concentrations and/or duration of exposure which could impact the population, the birds and other terrestrial animals.
- Safe for the aquatic flora which is able to stand exposure to much higher concentrations and time duration than the modeled cyanide levels for the river water even if the overflowing takes place under low flow-rate circumstances;
- below those of a concentration that can influence most of the invertebrates species of the aquatic environment; the duration of exposure will be so low that if there is an impact, it would be insignificant.



✚ *Directive 2004/35/EC of 21 April about the environmental responsibility referring to the prevention and removal of environment damages, transposed through the GUO no.68/2007 about the environmental responsibility referring to the prevention and removal of the environment prejudices with further amendments and completions.*

- there is the Internal Emergency Plan and the Plan for Prevention and Fight against Accidental Pollution meant to prevent the accidental pollution and to ensure the optimal management of the crisis situations, documents which provide intervention procedures and stoppage of accidental pollution.

- in accordance with the principle "the polluting agent is paying" the holder must , in acse of pollution, assumes all the responsibilities about the removal of the eventual pollution and environmental rehabilitatiin impacted by the baseline condition.

- the operator , in acse of prejudice on water and species or natural habitats must remove any prejudice by bringing them to their baseline condition , by primary or complementary rehabilitation and compmensation .

✚ *Directive 2007/60/EC of the European Parliament and of Council of 23 October 2007 about the assessment and management of flood risks transposed through the GD no. 864/2010 for the approval of the National Strategy of Flood Risk Management on medium and lon term*

-meteorological dangerous events with space and time variability (high precipitations, electric discharge , storms etc) can be forecast and warned with a maximum 12 hour anticipation which allows the holder to apply the Plan for the Prevention and Fight against the accidental pollution

✚ *Directive 2006/118/EC of the European Parliament and Council of 12 December 2006 about the protection of underground water against pollution and deterioration – transposed through the National Plan for the protection of underground waters against pollution and degradation approved by the Governement Decision 53/2009 and the Order of Ministry Of Environment no.137 of 26/2009 about the threshold values for the underground water bodies of Romania.*

- no significant aquiferous occur, the depth circulation of underground waters takes place only at the level of fractures. The drillholes of the proposed location sites of the TMF's have not intercepted the hydrostatic level of underground water up to the hole depth. The underground aquiferous of the project site zone are very likely of small sizes and do not consitute drinking water sources

- the project provides the necessary measures to prevent any polluting discharge in the underground waters.

✚ *Directive 2004/107/CE of the European Parliament and Council of 15 December 2004 about the arsenic, cadmium, mercury, nickel and aromatic polycyclic hydrocarbonsin the air and the Directive 2008/50/EC of the European Parliament and Council of 21 May 2008 about air quality and a cleaner air for Europe transposed in the national legislation through the Law no 104/2011 about the air quality*



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- the results of the comparison with the best available techniques reveal that the techniques to be used in the processing plant for gold and silver production of the ore, for the storage and handling of materials, as well as the control of effluent emission in the environment determined within „Gold-silver ore exploitation of Certej perimeter” Project comply with the applicable best available techniques
- the maximum concentrations resulting at the cumulated impact of all polluting sources at local and regional levels are below the admissible values / targeted values for all polluting agents analysed for all mediation periods

Decision no.1403 of 19/11/2007 about the rehabilitation of the soil , subsoil and terrestrial ecosystems which were impacted

- there were finalized the closure plans as per the law requirements in force
- at the activity closure the holder will rehabilitate the zones where the soil and subsoil were impacted

+ Directive of European Parliament and Council 2003/87/EC of 13 October 2003 about the establishment of a sales scheme of the certificates of green house gas emissions in the Community amending the Directive 96/61/EC about the prevention and integrated control of pollution amended through the Directive 2009/29/EC transposed through the GD 780/2006 about the establishment of a sales scheme of the certificates of green house gas emissions, with further amendments and completions

None of the green house gas emissions sources of Certej mining project is not subject to such legal requirements,

+ Directive of the European Parliament and Council 2003/4/EC about the public access to the information regarding the environment and repeal of the Directive of the Council 90/313/EEC,transposed through the GD 878 / 2005 about the public access to the environmental information

+ Law no. 86/2000 about the ratifying of the Aarhus Convention concerning the information participation of the public to the decision making process and access to court for environmental issues

+ Directive 2003/35/EC about the participation of the public to the development of certain plans and programmes referring to the environment and amendment of the directives 85/337/EEC and 96/61/EC about the public participation and access to court

+ Law no. 22/2001 – about the ratifying of the Convention regarding the environmental impact assessment under transboundary context , adopted at ESPOO on 25.02.1991



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- Throughout the procedure there were observed the terms of public consultations and there were made available for the public the documents on which basis the environmental permit was issued.

TRANSBOUNDARY

In Romania, based on the Order of the Ministry of Environment 223/2006 for the approval of the Regulations for the organization and functioning of the alarm system in case of accidental pollution of waters from Romania (SAPA-ROM) and of the main information centre for accidental pollution on the Danube in Romania (CIPA-ROM), there has been operating the **Warning System for Accidental Pollution Events (SAPA - ROM)**, with the sub-system called International Centre for Warning the Accidental Pollution Events (PIAC) for major trans-boundary accidental pollution. The system is coordinating and/or implementing monitoring operative measures of the pollution wave, limitation of the expansion, collection, neutralization and destruction of polluting agent, the implementation of measures for the re-establishment of the normal condition and rehabilitation of the ecological balance as well as the prevention of other consequences.

At the level of Danube basin, there is an Accident Emergency Warning System - AEWS, which general purpose is to enhance the safety and protection of environment in case of accidental pollution by rapid supply of information to the impacted riparian countries.

As for the bi-lateral relations with the neighbouring countries, there have been enforced the Agreements for water administration under trans-boundary context which regulates from methodological point of view, the specific actions and activities which are developed in order to prevent, limit the accidental pollution area and remove the already caused major pollution as well as their stoppage.

To this aim, there has been established the joint framework with Hungary and it consists of:

- "Agreement between the Romanian Government and Hungarian Government about the collaboration for the protection and sustainable use of boundary water courses" signed at Budapest on 15th September 2003;
- "Regulations concerning the procedure to be implemented in case of accidental dangerous pollution that cannot be avoided".

The Project is subject to the compliance with the provisions of the Helsinki Convention regarding the trans-boundary impact caused by industrial accidents (Convention on the Trans-boundary 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 trans-boundary water courses, thus have the potential to generate trans-boundary effects.

According to the "Guidelines to facilitate the identification of hazardous activities for the purposes of the Convention", PARAGRAPH 5 "Location criteria" and taking into account that the distance to the closest border is over 130km, it should not result in any transboundary impacts air; Also, the distance on water course corresponds to flow duration of average flow conditions of approx. 4 days



for Certej Project. So, this project should not generate trans-boundary impacts on water ways either.

Comparing the indicator values for water of the Romanian regulations with the Hungarian ones it can be noticed that the Romanian ones are more restrictive than the Hungarian's.

There exists the monitoring program of Mures Water Directorate which will continue the monitoring the ecological condition of Mures river both in the Gelmar sector (upstream the confluence with Certej river), at 317 km from the flowing out point in Tisa river and in Branisca sector (downstream the confluence with Certej River), at 263 km away from the flowing out point in Tisa.

As for the quantity, the industrial water supply will be only little impacted by Mures river flow – rate taking into account the average water flow rate proposed to be caught from Mures River is 2.2 l/s, and it represents less than 0.0015 % of the average multi – annual flow rate and less than 0.008 % of the minimum multi –annual flow rate.

In accordance with the provisions of art. 17 paragraph.(1) of GD no. 445/2009 corroborated with the art.20 of Order of Ministry no. 864/2002 about the approval of the procedure for trans-boundary environmental impact assessment and public participation at the decision making process for projects with trans- boundary impact and the review of the modifications notified by the project holder, the Ministry of Environment and Climate Change decided that the modifications proposed by the project holder, that is the change of the processing plant site, within the approved ZUP boundaries, do not represent modifications that could result in a negative trans-boundary impact on the environment of another state and consequently, the application of the provisions of the Espoo Convention about the request of reviewing the Environmental Permit issued under the no. 8/05.07.2012 for Certej Project is not required.

- **Compliance with the environment objectives of the zone, by air, water, soil etc;**

The project site is not close to sanitary protection areas and hydrogeological protection perimeters.

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.

The simulation of the worst scenario for the Cumulated Impact of Rosia Montana and Certej projects and the trans-boundary impact on the surface water and aquatic eco-systems indicate that the impacts of second overflow will increase the concentrations close to the overflowing point, near Deva, but these concentrations decrease quite rapidly, below the 0.1 mg/l much more rapidly than the wave reaches the Hungarian border.

The course of surface waters will be subject to some corrections (for instance Valea Băiegi, Valea Măcrișului, Valea Corânzii), some water courses will be caught, channeled and/or diverted on other directions than the natural ones in order to optimal development of activities in progress. By means of these measures, an additional protection of water courses against pollution is ensured



taking into account that currently, some streams get into direct contact with the older waste dumps which are a permanent pollution source.

Under the circumstances of collecting and treating the waters generated from the open pit, waste dump zones, the new investments will contribute to the mitigation of the negative impact which is generated at present on the surface waters of the zone.

All the used waters will be treated prior to their discharge in the emissary.

By putting in place the BAT technologies for the project implementation, the evaluation of the existing condition concerning the emission sources and air quality within the project implementation zone, the assessment of the cumulated impact on the air quality generated by the emission sources related to Certej project and existing source, , assessment of the cumulated impact on the air quality of the emission sources related to Rosia Montana project and existing sources in Hunedoara county as well as in its neighboring counties indicated that the contribution of Certej Project to the impact on the air quality during the construction stage, at the level of this county expressed in percentage of the admissible value/ targeted value, consisting of the difference between the maximum value of the concentration for a certain polluting agent and the time of remediation in case of the cumulated impact and the maximum value of the concentration for the same polluting agent and the time of remediation in the existing case, is generally very low or insignificant, and during the operating stage it is noticed that the impact area of Certej project is limited to the site zone of the project and its neighboring zone. At the level of Hunedoara county the maximum concentrations obtained as a result of the cumulated impact are below the admissible value / targeted value for all the polluting agents and for all the remediation times.

Further to the re-arrangement of waste dumps, potentially acid water catchment from the mine site, the soil will be also protected. As a result of the ecologization works during the post closure stage, there will be forestry and farming parts of land which are currently polluted and are not rehabilitated from environmental point of view, that will be re-used.

- **Compliance with the protection objectives of Natura 2000 sites, as required;**

The study for adequate assessment elaborated for the bird species of community interest for which the RO SPA 0132 Metaliferous Mountains site was appointed as protected area in 2011 contains the same conclusions like the Report to the environmental impact assessment study on which basis the environmental permit no..8/05.07.2012 was issued. The implementation of the measures for the mitigation of the impact will determine that the mining project impact on the integrity of Natura 2000 ROSPA 0132 site, Metaliferous Mountains is insignificant.

- **Consideration of the direct, indirect and cumulated impact with the other existing activities of the zone**

There was investigated the cumulated impact of Certej and Rosia Montana projects, for the worst scenario, and the conclusions of the study revealed an insignificant impact both for the air and for water.



There has been completed the assessment of the cumulated impact on the air quality of the emission sources associated to Certej project and existing sources at the level of Hunedoara county and its neighboring counties and further to such assessment, it was noticed that the impact area of the project during the construction stage is limited to the project site zone , the contribution of Certej project to the impact caused to the air quality during the construction stage in Hunedoara county is generally lower or insignificant and during the operating stage the impact produced by Certej project on air quality is in general reduced.

III. MEASURES FOR THE PREVENTION, MITIGATION AND WHERE POSSIBLE, THE COMPENASATION OF THE SIGNIFICANT NEGATIVE IMPACTS ON THE ENVIRONMENT

a) MEASURES FOR THE PREVENTION OF WATER POLLUTION DURING THE CONSTRUCTION STAGE

- completion of proposed works by sectors as per the execution schedule;
- designed works will not be completed during the periods where the water flow rates are very high;
- work sites will be provided with ecologic toilettes
- all the equipments will not be washed in the streams and neither close to the water streams;
- collection and orientation of pluvial waters from the andesite quarry from the hillside through 2 guard channels which flow out in Avram stream
- the berms of the benches will be provided with 3-5% slope to allow the pluvial water flowing outside the waste dump territory and their orientation to the guard channels
- sewage will be collected and taken to a treatment plant
- construction of ditches to collect the rainfall waters washing the work site pad and providing settling sumps and discharge in the nearest stream course;
- avoiding the location of the work site on the water course obanks or along the torrents;
- supply of absorbing materials (sand, saw dust) for immediate intervention in case of accidental fuel, lubricants leakage (immediate application, collection of material in polyethylene bags or metal vessels and their disposal by authorized companies);
- to mitigate the risk of accidental pollution, the equipment maintenance and repairs will be periodically performed as per the schedules and technical specifications at the company head – office and the fuel supply for the transport means will be performed only at the fuel stations; the fuel supply to the equipments used on the work sites will be performed in areas particularly provided for this purpose; The fuels will be stored in sealed tanks provided with retention vessel so that to avoid spillage, and the oils will be collected only in tanks and further on they will be taken over by authorized units;
- After the investment completion the entrepreneur will remove the temporary works and the materials left there to avoid the pollution of water streams, channels or underground water;
- the washing of equipments or trucks as well as the maintenance and repairs works in the work development area is not allowed;
- after the completion of deforestation works the following vertical arangement works will be performed to collect the waters and their orientation outside the territory through drains and sealed ditches which discharge in a collector;



- the works will be carried out so that to avoid the modification of the water quality by increasing its turbidity;
- the works performed on the water course riverbeds for canalization, diversion channels regularization (water diversion, bank protection, earth or stone depositions) will comply with the specific requirments for such works avoiding the increase of fllooding risk alon the water streams where these works are performed;
- protection of works against flooding during the execution period to avoid the high floods on the water courses where the works are under progress and the flows from the boundary areas as a result of heavy rains
- no used waters or waste will be discharged in the permanent or temporary water courses
- appointment of responsibilities regarding the implementation of the Plan for accidental pollution prevention;
- implementation of the Plan for accidental pollution prevention
- putting in operation and exploitation of works built along the water courses based on the water administration permit;
- monitoring the functional parameters behaviour at dams and immediate data processing and interpretation and the adoption of necessary measures in case of noticing differences between the initial estimation of parameters and characteristics required;
- monitoring the meteorological conditions: precipitations, temperature, wind direction and intensity;
- follow up the dam construction stages: levels of crest of waves, slope, construction material quality, their behaviour, etc;
- compliance with the consolidation conditions at dam construction
- construction of the water discharge system for heavy precipitations as per the technical specifications for the tailings management facility dams;
- observing the dam slope
- seal of the starter dams of the two TMF's;
- construction of colleting channels of the pluvial waters from the hillsides;
- impermeabilization of the starter dams of the tailings facilities using sealing materials so that the upstream slope is protected with 3 filtering layers which prevent the engagement of the slurry through the rockfill. The three successive layers are 1.50 m thick each and are made of:
 - Coarse filter of broken stones;
 - Fine filter of gravel and sand;
 - Erosion proof filter of 2÷200 mm gravel.
 - construction of twin benches on the slopes

b) MEASURES TO PREVENT THE WATER POLLUTION DURING THE EXPLOITATION STAGE

- collection and treatment of used waters in the treatment plants for each category of used water
- treatment of potentially acid waters collected from the waste dump area in the acid drainage treatment plant from the processing plant yard.
- collection of pluvial ater from outside the dumps through the guard channels and their orientation outside the perimeter.



- collection of pluvial waters from the processing plant pad through ditches and their orientation outside the perimeter; on the industrial ramps, a minimum 0.5% slope for water flowing will be provided ,
- collection of pluvial water from the tailings facilities slopes in the guard channels and their discharge outside the perimeter;
- collection and discharge of pluvial waters from the perimeter of Certej open pit;
- collection of pluvial waters (potentially contaminated) from the surfaces where contamination in the retention basins could occur and they will be provided with sumps and their reintroduction in the technological process
- arrangement of berms in Certej open pit for the pluvial water drain off;
- arrangement of berms of the waste dumps for the pluvial water drain off;
- ensuring the suitable maintenance of the concrete channels, drains, ditches, settling basins, grease separators, acid drainage collectors;
- discharge of sludge collected from the treatment plants at the tailings management facilities (sludge from the acid drainage treatment plant and water treatment plant from the flotation TMF will be delivered to the flotation TMF while the sludge resulted at the clarified water treatment plant of the CIL TMF and the sludge resulted at the sewage plant will be delivered to the topsoil dumps).
- partial recycling of clarified waters from the flotation TMF
- treatment of the excess clarified water of the flotation TMF prior to the discharge in the emissary;
- complete recirculation under normal operating and meteorological conditions of the clarified water from the cyanidation tailings management facilities;
- treatment of clarified waters from the cyanidation tailings management facility prior to the discharge in the emissary under extreme meteorological events;
- recovering as much as possible cyanide of the process water by thickening the pulp prior to its treatment in the DETOX 1 plant
- recycling the clarified portion from the thickener to the extraction process of the CIL Plant
- sewage treatment
- construction of a drainage system of the infiltrations to prevent and control the infiltrations through the tailings facility dams
- in case of vertical rises there was provided a geotextile separation material between the rises and this membrane could ensure the stability of the rockfills of the rise bench.
- for the upstream parament of th rise benches of the rockfill developed along the centreline there will be carried out, for both dams, a filtered element –reverse filter (coarse filtering layer placed on the rockfill , fine filtering layer and corosion proof layer).
- collecting and repumping the seepage and water collected downstream the collecting basins
- Safe storage of water in the tailings facilities for a limited period of time. For eache xecution stage of the dam from each tailings management facility there was calculated the water volume corresponding to maximum precipitations and which should be the maximum level of the depositions in the tailings facility so that the water amount could be taken over maintaining a safe guard to the crest of wave.
- Discharge of this water within a limited period of time to ensure the volume necessary for taking over the excess pluvial water and to prevent the environment and if possible, production



disturbance. The time for the discharge of the high flood contained in the tailings facility calculated for a 0.1% return, is maximum 5 days.

- to ensure, under normal running conditions, a general recycling rate of the industrial water of **75%**. The recycled water results at the two tailings management facilities (the pluvial water collected from the two tailings facility surface is also collected) and from the potentially acid drainage collected from the waste dump and open pit, after their neutralization.
- monitoring the flow rates of the process water , the water discharged from the process / discharged in the emissary, surface water
- monitoring the behavior of water works (dams, dumps, etc.)
- monitoring the water quality - refers to the monitoring of process influents and effluents , surface water and underground water (drill holes and wells).

c) MEASURES TO PREVENT THE AIR POLLUTION THROUGHOUT CONSTRUCTION STAGE

- selection of optimal routes for vehicles and equipments used for pollution mitigation;
- utilization of suitable transport means for such activities;
- strict compliance of the working standards to prevent the increase of powder concentration in the air;
- wetting the roads to mitigate the dust engagement;
- ensuring the functioning of equipment and vehicle engines at optimal parameters (avoiding the high speed and excess loads);
- avoiding the idle running of equipments;
- machineries, equipments will comply with the EU regulations in the field of environment protection;
- adaptation of driving speed of vehicles to the road surface;
- wetting the surfaces where the technological processes uses broken stone under strong winds;
- avoiding the stripping of topsoil on large surface areas so that to prevent the formation of large vegetation surfaces exposed to wind and dust generating sources;
- completion of works by sectors according to execution schedules and correlation with the work schedules of equipments from the work site with other production sites;
- drawing up and complying with the work execution schedule considering the local conditions and the meteorological conditions.

d) MEASURES FOR THE PREVENTION OF AIR POLLUTION DURING THE EXPLOITATION STAGE

- Utilization of an explosive (nitramon) producing small amounts of toxic and polluting gases (CO₂, CO, NO) and which ensure a dust removal as soon as a rapid gas cloud removal;
- using the calculated amount of explosives that can be used;
- it is compulsory to use wet drilling, blasted ore wetting and humectation of open pit roads to reduce the powder amounts in the air ;
- determination and compliance with speed restrictions
- implementation of operating procedures and schedules for the regular periodical maintenance of vehicles



- monitoring of correction / prevention measures depending on the requirements
- water spraying of surfaces generating dust (non asphalt roads, reshaped lands, waste dump surfaces etc, etc.)
- utilization of selective tailings deposition in the tailings management facilities to prevent the drying of tailings surface
- for bulk storage outdoors there will be used water spraying of zones with highest potential of dust production.
- supply of filters for the installations where there is a potential risk of dust production (a bag filter will be mounted at the limestone mill to ensure emission of particles below 10 mg/m³)
- the haulage distances designed will be as short as possible
- prevention of dust pollution of the working area using an automatically operated dust removal system based on water jets at:
 - truck unloading
 - Crusher entrance
 - Crusher exit
 - Discharge of the collecting conveyor
 - Discharge of the crushed ore conveyor to the silo
- humectation of crude and crushed ores at the transfer locations
- ore grinding and mixing with other materials will be carried out using wet techniques
- the unloading elevations were designed at minimal values
- the belt conveyors located outside the yard will be encased; the dust release at the loading and unloading sites of the belt conveyors will be controlled by water spraying systems.
- ore haulage to the processing plant site performed on an internal access road from the open pit.
- all the pipes for chemical piping will be mounted on a scaffold.
- pre – processing operations do not require thermal power consumption.
- implementation of a program of discontinuous measurements of emissions to check the compliance.
- the ventilation system from the preparation / storage of the hydrochloric acid will be connected to a scrubber to avoid HCL emissions.
- acid washing equipment is located in an in an acid proof area provided with a special pump for pumping the eventual leakages. Safety shower will be available. The concentrated HCL tank is located outside. The acid circulation tank is provided with aeration outside the building using the acid washing fan.
- Albion oxidation tanks are acid proof , covered and each of them is equipped with a fan and a 7m chimney
- the carbon furnace will be provided with a scrubber located outside for retaining the dust
- the reusable residue resulted at the melting process will consist of slags from the melting furnace which will be recycled inside.
- the induction furnace is provided with a local installation for polluting element catchment and discharge , air filters, gas shell at the furnace and ingot pouring
 - Smoke release hood
 - Hood at the flux homogenization



- Aeration fan at furnace extraction
- Electrowinning aeration fan

e) TECHNOLOGICAL MEASURES TO MITIGATE THE ENVIRONMENTAL IMPACT AT DANGEROUS CHEMICALS ADMINISTRATION

- utilization of an outer storage area – a separate building for the dangerous chemical storage; The storage areas of the packed substances are separated from other zones of the technological flow-sheet
- separation of the zone of buildings destined to the packed dangerous chemical storage, from fire sources, and other buildings within or outside the site by designing a sufficient distance inbetween
- appointing several persons in charge with the exploitation of the dangerous matters storage house
- keeping an updated list of dangerous substances on site
- chemicals will be supplied depending on the daily consumptions to avoid the storage of high amounts on site.
- implementation of a policy to prevent or treat all the emissions resulted at the storage, transfer and handling of dangerous chemicals before their production
- most of chemicals and of other materials necessary for the technological process (sodium cyanide, sodium hydroxide, copper sulphate, sodium meta- bi – sulphite, flocculant, active carbon, potassium amyl xanthate) will be supplied in solid state and packed.
- the sodium cyanide, sodium hydroxide, copper sulphate and sodium meta – bi –sulphite will be stored only as solution in tanks. The solutions will be prepared at the time of their utilization and will be delivered to the storage tanks.
- the sodium cyanide, flocculants, sodium meta- bi –sulphite, copper sulphate, active carbon, potassium amyl xanthate and sodium hydroxide will be stored in the reagent warehouse separately, in their original packing.
- cyanide will be purchased only from manufacturers that use practices and methods suitable for the limitation and prevention of cyanide release in the environment;
- cyanide will be transported by certified transporters who are implementing the emergency plans, take suitable measures for the cyanide management and established the admissible limits concerning the safety, security, prevention of emission, emergency intervention.
- discharge of cyanide will comply with the engineering practices, procedures for the quality control and prevention of overflows.
- there will be implemented clear procedures for the use of cyanide, inspection, maintenance and intervention on the flow sheet using cyanide.
- diminution of cyanide use within the project by means of:
 - operational strategies for the minimalization of the cyanide addition (strict control of water addition, monitoring the cyanide concentration in the circuit and in the tailings facility, aeration improvement)
 - automatic control of cyanide
- application of the following safety measures within the project:



- availability of a spare tank which capacity is equal to the capacity of the tank for the cyanide solution storage.
- incorporating an integrated circuit of cyanide destruction in the leaching plant
- utilization of the tailings management facility system as a second cyanide treatment plant serving as spare system for the cyanide destruction circuit;
- installation of a backup system for lime addition;
- location of the leaching tanks in a concrete basin with surrounding berm acting like a collision barrier. The basin capacity is bigger than that of the leaching tank;
- keeping the leaching tanks open , outdoor;
- installation of backup power generators.
- permanent training of employees in compliance with the requirements regarding the exposures to and emissions of cyanide
- automatic control of the whole technological process monitoring the essential parameters for the normal running of the plants (flow rate, pressures, levels, sliding detectors, reagent dosage, pump speed, agitation mechanisms, pH, Eh, temperature, cyanide amount measuring, automatic dosage of dangerous chemicals used in the flow sheet , suitable operation of valves etc.)
- follow up the technological flow-sheet with video cameras
- alarm systems for the technological process failure
- safety shower
- fuel tanks mounted underground and built with double walls. They will be provided with manholes and aeration tubes.
- fuel storage area will be provided with automatic systems for the fire events by self-ignition
- pipes for chemical piping marked in accordance with the European standards.
- number of flanges will be limited to operational needs.
- prevention of pipe corrosion as follows :
 - utilization of materials resistant to piped products;
 - use of some constructive suitable methods;
 - application of a preventive maintenance schedule;
 - where necessary, corrosion proof protections;
 - prevention of external corrosion by means of one or several primer and paint layers.
- the pipelines will be mounted inside the retention basins where possible.
- for the tank design, there were considered the properties of the chemicals that are to be stored; quality of accessories and equipments will comply with the technological flow-sheet and chemical properties.
- the tanks and equipments will be built of materials resistant to external and internal corrosion (stainless steel, GRP, lined carbon steel)
- suitable paint use
- location of tanks and other equipments on ramps and in the buildings will be selected so that to allow the access for the intervention services for emergency events
- all the tanks operating at atmospheric pressure are located over the ground.
- tanks and equipments are to be located on the impervious surfaces



- all the tanks for the toxic chemical storage will be located in retention basins connected to the sealed drainage systems.
- the tanks will be placed on foundations designed for such purpose.
- the tanks will be placed in concrete basins with surrounding berm acting as a collision barrier;
- procedures for the tank maintenance will be implemented
- there will be used manual and automatic systems for measuring the volume of liquid of the tanks and for preventing the overflows, including alarm systems.
- the design provides the location in the same retention basin of compatible substances only
- the retention basins will be impervious , acid proof protection and resistant to the stored chemicals
- the retention basins will be built without drains. Each basin will be provided with an inner sump
- the retention basins are designed to catch the leakage from the tanks / equipments.
- the retention basins are designed at capacities of 110% bigger than the biggest tank or over 25% of the total capacity of the tanks
- the retention basins will be subject to regular visual inspections and any eventual leakage will be safely pumped .
- the points for the tank filling are placed inside the retention basins or the rooms with concrete flooring and collection sumps.
- only non – volatile substances are stored in open tanks
- the materials and the construction will be selected depending on the process requirements and properties of the chemicals used
- monitoring the highly risk valves based on the inspection and maintenance procedures.
- the dangerous chemicals will be transferred using double wall valves.
- the pumps and the sealing types selected are suitable for the technological process.
- the pumps will be mounted accordingly
- the connections to the pipes will be done in accordance with the producer and designer's recommendations
- the pumps will be operated in accordance with the recommendations of the designer and producer as well as the instructions of the manufacturing regulations
- regular monitoring of the pump technical condition
- implementation of a regular revision and maintenance schedule of the pumps
- all the basins of the pumps are made of steel and are rubber lined.
- all the troughs are rubber lined
- there are provided backup pumps in the technological flow sheet

Backup pumps for the technological flow-sheet of Certej

Location	No of backup pumps
ISAMILL feed	1
Albion plant feed	1
Pumping of thickened from Albion thickener	1
Pumping the overflown from Albion thickener	1
Cooling tower feed Albion product	1
Feed of CYANIDATION TAILINGS MANAGEMENT FACILITY	1
Solution recycling of CYANIDATION TAILINGS MANAGEMENT FACILITY	1



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Pompare ingrosat ingrosator IAZ DE DECANTARE STERILE DE CIANURAȚIE	1
Pumping the overflow of the thickener of CYANIDATION TAILINGS MANAGEMENT FACILITY	1
Electrolysis plant feed	1
Pumping the spent electrolyte from electrolysis	1
Cyanide solution dfeed to the CYANIDATION TAILINGS MANAGEMENT FACILITY	1
Lime milk feed	1
Limestone feed to cyclones	1
Pumping of overflow limestone cyclones	1
Limestone slurry pumping	1
Recycled water pumping CYANIDATION TAILINGS MANAGEMENT FACILITY	1
Pumping tailingas CYANIDATION TAILINGS MANAGEMENT FACILITY	5
Pumping the mdu from Detox 2	1
Hydrogen eproxide dosage	1
Copper sulphate dosage	1
Transfer flocculant Detox 2	
Flocculant fed to the Detox 2	1
Pumping the clarified water of Flotation TMF	1
Pumping of clarified water CYANIDATION TAILINGS MANAGEMENT FACILITY	1
Drinking water feed	1
Industrial water pump station of Mures	1
Industrial water repumping station of Certej	1
Pumping of seepage Flotation TMF	1
Pumping of seepage CYANIDATION TMF	1
Feed of cyclones –flotation grinding section	1
Pumping of rough flotation concentrate	1
Pumping the tailings from rough flotation	1
Pumping of upgrading flotation concentrate 2	1
Pumping the upgrading flotation 3 concentrate	1
Pumping upgrading flotation 1 concentrate	1
Pumping the upgrading flotation 1 tailings	1
Pumping flotation concentrate from cleaning flotation	1
Pumping flotation tailings from cleaning flotation	1
Feed of cyclones flotation regrinding	1
Water recycling from flotation tailings thickener overflow	1
Pumping flotation tailings to the tailings facilities	5
Pumping of thickened from the flotation concentrate thickener	1
Pumping of overflow water from flotation concentrate thickener	1
Lime milk feed to the clarified water treatment plant of Flotation TMF	1

- hydrochloric acid will be the only reagent to be supplied in liquid state and will be stored in a tank.
- frother, collector and oxygenated water will be supplied in their original packing and will be stored within the working zones in specially arranged areas.
- the chemicals will not be stored together at a single storage place, but separately, in zones/especially arranged storehouses situated near the working areas so that there is no possibility of contact between two incompatible chemicals (for instance, between the hydrochloric acid and sodium cyanide).



- the dissolution tanks, solution storage tanks and hydrochloric acid tank will be mounted in individual impervious retention basins (for a certain chemical, the dissolution tank and the storage tank will be in the same basin).
- the reagent storage zones will be provided with mechanic ventilation installations.
- the storage zones will be provided with intervention means for accidental events, and the intervention plan for accidental events is to be implemented.
- the pipeline for chemicals will be located over ground within safe zones – There will not be used buried pipes for chemical piping.
- the tanks and pipes for the pressurized gases (oxygen) will be provided with pressure and loss detection monitoring systems.
- the solid chemicals generating dust will be supplied and stored indoors. For the bulk storage of some materials (limestone, lime) closed systems (bins, silos).
- the technological flow-sheet is so conceived that the direct succession of processes is ensured and the handling operations required are minimum.
- implementation of a program for ensuring the quality, for inspection and maintenance of the impervious surfaces and protection edges which should consider: capacities, thickness, precipitations, materials, perviousness stability/ consolidation , resistance to chemical attack , procedures for the inspection and maintenance , construction quality.
- implementation of suitable organisational measures and training of staff for the responsible and safe exploitation of the installation
- training and requalification concerning the emergency procedures and information of other work site employees about the risks incurred by dangerous packed chemicals and the necessary measures for the chemical safe storage.
- utilization of a safety management system and use of risk based inspection.
- utilization of preventive maintenance

f) MEASURES TO MITIGATE THE ENVIRONMENTAL IMPACT ON SOILS AND SUBSOIL

- accurate delimitation of works on site to reduce the boundary surfaces impacted;
- strict observance of the proposed surface area for any type of proposed works (deforestation, regularization of riverbeds) and of their geometry without impacting the boundary vegetation;
- compliance with the deforestation technologies and the wood transport method;
- the temporary storage of the materials is performed on as small as possible surface areas;
- accidental leakage of fuel / lubricants should be removed immediately by placing absorbing materials (sand, saw dust), by collecting and eliminating them;
- there will be carried out works for fighting the erosion of soil within the working face zone along the water courses where the designed works are performed to mitigate the risk of land slides;
- utilization of drainage and consolidation systems within the zones where soil erosion is likely to occur;
- the waste resulted at the work execution should be collected selectively in containers depending on their nature to establish the solution for removal, storage or beneficiation.



- the fuels will not be stored on the work site ramps until the fuel station construction; the equipment fuelling is performed in fuel stations and those which are requiring fuelling on site will be fuelled from canisters so that to avoid losses;
- observing the boundaries of the approved perimeter for the ore deposit exploitation without impacting other surface areas;
- compliance with the exploitation method, blasting technology and loading method to mitigate the land degradation because of surface vertical and horizontal movements;
- avoid the soil degradation with oil and diesel fuel from the open pit haulage equipment by periodical checking of their technical condition;
- there will be monitored in time the fissures occurred on the bordering surface area as a result of open pit blasts;
- deforestation of the forests from the bordering zone will not be allowed in order to avoid surface erosion.
- collection of meteoric waters percolating the waste dumps and treatment in the acid drainage treatment plant.

g) MEASURES OF BIODIVERSITY PROTECTION

- the tree cutting will be performed gradually allowing the movable elements of the forestry habitats to move towards the similar habitats outside the impact zone.
- maintaining where possible the rows of bushes reeds to make the connection between the habitats which are being impacted and the natural habitats outside the impact zone .
- restricting the surfaces excavated and the depositions of waste
- assignement of protection surfaces around the valuable habitats close to the construction site and their temporary enclosure
- translocation of low mobility species or of those which strictly require a habitat (ex. Amphibians, reptiles, some small mammelians etc.)
- maintaining some sectors a little bit clogged will result in the occurrence of important habitats for the yellow belly and insects with aquatic growth stages, for instance odonates
- where possible, the limitation of the major activities of construction throughout the reproduction of amphibians and bird reproduction
- creation of a base of seeds produced by the species of native and local plants for the revegetation of the degraded zones throughout the post construction stage
- redoing the destoryed habitats, particularly of the wet zones at the end of the construction stage;
- in case of old hollowed trees are destroyed, it is recommended the mounting in the nearby habitats of artificial nests and shelters for bats.
- maintaining in the zone nearby the impact zone a management system of habitats, for instance late mowing of the pastures, to avoid the invasion of wooden species and fern.
- keeping the dead trees in the forests, placing artificial cavities , maintaining the saplings at the periphery of the project impact zone.
- for night lightning within the industrial yard there will be used special bulbs (those with low pressure sodium are preferred to tge mercury vapors ones or high pressure sodium bulbs) to prevent the attraction of night insects and implicitly of the bats.
- organization of meeting for make people aware that workers are not allowed to kill animals;



- construction of weirs on water courses with high turbidity to create settling basins as well as avoiding the deposition of earth and other construction materials on the water course banks so that to prevent the suspension engagement in the streams
- at night, certain „traps” such as holes, ditches, channels will be covered; in case of such small size constructions there will be constructed ramps to allow the big size trapped animals to „escape”.
- maintaining a vegetation belt all around the tailings facilities and other methods to keep animals away will determine this zone not to be attractive for mammals
- utilization of insulated electric conductors
- limitation of driving speed on the roads along Valea Măcrișului
- cleaning the edges of the industrial roads of animal corpses (dogs, birds etc) resulted further to accidents to avoid the attraction of eventual necrophagous species (raptors, foxes, etc)
- *measures for the Peregrine Falcon:*
 - deforestation of the wood vegetation including of the trees isolated and it will be done exclusively between September and May;
 - planting in the protection of the tailings facilities and meadows nearby , tree species,
 - Completion of a conservative management of the meadows near the future nests. The conservative management for the meadow preservation will consist of the late mowing of meadows (in the first decade of July)
- *measures for the oak woodpecker:*
 - deforestation of wood vegetation including of the isolated trees will be done between August – February exclusively.
 - the placement of artificial nests (hollows) in the forests near the impacted zone. This action is useful for the mitigation of the impact on the potentially impacted territory and for the improvement of the species preservation condition on Natura 2000 site. We propose the location of at least 20 artificial nests . These hollows will be built and located under the guidance of an ornithologist.
 - there will be protected all the mature trees nearby from the forests owned by the holder
- the purchase of a surface land of forest situated near the site which is to be integrated in the future site management plan.
- a part of the wood material which is to be deforested will be transported to the afforested zones from the impacted zone neighbourhood to increase the amount of “dead wood” for supporting the insect populations.
- application of the biodiversity monitoring plan;
- the period when deforestation is carried out must not overlap the seasons of mating species on site;
- the deforestation works should be done as much as possible during the period indicated by the specialists;
- observing the work schedule in the sense of limitation of routes and working program;
- utilization of silent transport means and equipments to mitigate the noise;
- for avoiding the accidents both with humans and animals , the deforestation performer will install physical barriers to stop the access to dangerous or exposed places;
- rhythmic collection and discharge of the domestic waste and technological residues is necessary to prevent the risk of sickness and accidents with animals which might occur in the zone;



- location of proposed objectives if the project so that to remain within the perimeter boundaries;
- for wood transportation there will be used light equipments which do not impact too much the soil by creating trenches and ravines dangerous for people and fauna.

h) PROTECTION AGAINST NOISE AND VIBRATIONS

- on the sites where construction works are performed, the working time should be observed at day time(6.00-22.00);
- there will be implemented measures of protection against noise for all the work site staff;
- to avoid as much as possible, the intra muros areas and where it is not possible, the vehicles will drive in full compliance with the speed limits and it will be avoided to stop the vehicles but the engines running, close to the dwelling;
- utilization of transport means and equipments provided with systems for noise diminution;
- permanent maintenance of the access roads;
- use of sound proof panels particularly around the equipments which do not produce a strong noise
- in case of exceeding the noise level, respectively 50db as per STANDARD 10009-88 at the boundary of the neighbouring residential area there will be placed panels for protection against noise

i) MEASURES FOR THE SOCIAL ECONOMIC ENVIRONMENT PROTECTION

- Completion of works based on work schedules observing the working time
- optimization of the routes of construction equipments and transport means so that to avoid the bottle necks and traffic accidents;
- cleaning the transport means before their access to the public roads
- avoiding the storage of the waste within spaces which have not been arranged;
- utilization of silent transport means;
- running of transport means and equipments at optimal designed parameters to reduce the noise and toxic matters;
- signalling the working areas with warning panels;
- working faces will be marked with reflecting tape to mark the boundaries of the perimeters of constructions and panels with the project identification;

j) MEASURES FOR THE WASTE MANAGEMENT DURING THE CONSTRUCTION STAGE:

- the waste will be collected selectively in separate containers indicating the waste type : garbage, construction waste, (separately from metal residues, wood , concrete, etc), packing (except for those which are returned to the manufacturer), used tyres, batteries and accumulators, spent oils which are to be delivered to the certified economic entities for collection/ beneficiation purposes .
- The ecologic toilettes will be scooped by certified companies
- the domestic garbage from the work sites will be collected by the scavenging companies
- the construction waste will be collected and stored in containers placed in special areas and at the end of a construction stage the land will be cleared



k) MEASURES FOR WASTE MANAGEMENT IN THE MINING STAGE

-the non-extractive waste will be collected separately in containers indicating the type of waste garbage, construction waste, (separately from metal residues, wood , concrete, etc), packing (except for those which are returned to the manufacturer), used tyres, batteries and accumulators, spent oils, electric cables which are to be delivered to the certified economic entities for collection/ beneficiation purposes

- the waste resulting at the repairs and maintenance works will be collected separately, depending on their type and will be delivered for beneficiation/ removal to certified entities;

- the sludge from the treatment plants will be stored, depending on their type (sludge from the sewage treatment plant – on the topsoil dumps, sludge from DETOX II on the cyanidation TMF and the rest of sludges on the flotation TMF)

- minimization of land surfaces used for waste storage

- extractive waste management will comply with the specifications of the Extractive Waste Management Plan:

- Compliance with the technologies for the deposition on the tailings facilities maintaining a minimum freeboard both under normal running conditions and extreme ones
- Construction of impervious emergency basins for collecting the pipeline content if necessary;
- Construction of collection and retention system of waters drained off through the dam body of the two TMF's and acid waters from the waste dump area;
- Take over of pluvial waters and torrents by the guard channels of the waste dumps and tailings management facilities and their orientation outside the tailings facilities area;
- Preventing the deforestation of woods of the boundary zone to avoid the surface erosion.
- Avoiding the degradation of soils because of leakage of open pit equipments , by means of periodical checking of their technical condition;
- Construction of retaining walls at the waste dumps;
- Diminution of the overall slope angle by providing intermediate berms at the level of dam rises
- Afforestation of the slopes and ramps with vegetation suitable for the zone
- Observance of measures for the exploitation and maintenance to ensure the waste dump and tailings management facilities: correct construction of waste deposits observing the characteristics of the cyanidation tailings sedimentation; compliance with dumping methods,; execution and maintenance of guard channels, galleries, collection pipes and drains, diversion of streams; construction of retaining walls, weirs etc;
- Designing and construction of tailings management facility dams (during the exploitation stage the dam rise will continue) will comply with the regulations and best available techniques applicable in the field taking into account the specific conditions of the location zone, sizes and characteristics of the cyanidation tailings to be deposited in the tailings management facilities;
- Treatment of processing tailings by detoxication prior to pumping tratarea tuburelii de steril de procesare prin decianurare înainte de pomparea pe iazul de decantare sterile de cianurație them on the cyanidation tailings management facilities



- Follow up in time the stability of the tailings facilities by topographic landmarks, piezometers, telescopic depth columns and consolidation landmarks;
- At the end of the activities there will be carried out planning works and forestry and farming re-use for all the land temporarily occupied – waste dump surface, tailings management facility surface and open pit surface will be arranged and ecologically rehabilitated;
- Prevention of pollution with cyanide by the integral recycling of clarified water collected from the cyanidation tailings facility;
- Exploitation of each tailings management facility will consider the permanent maintenance of the freeboard to allow the accumulation of precipitation at the PMP level for extreme circumstances when the pluvial water amount is in excess of the treatment plant capacity when the maximum level of water againsts the crest of wave level will be 0.70m
- Discharge of the high flood amount retained temporarily within 5 days
- Overflowing when the precipitation amount is higher even than the PMP, excess water overflowing at the contact with the right hillside, by providing a lower crest level and by placing at the contact with this hillside of some rockfill blocks;
- Exploitation of the tailings management facility system in strict compliance with the safety parameters required by the project and considering the precipitation regime
 - Monitoring the meteorological sizes which could impact the tailings facility exploitation (liquid precipitations, air temperature, wind direction and intensity (liquid or solid precipitations, evaporation, air temperature, wind direction and intensity)
 - Monitoring the characteristics of the exploitation elements (flow rate delivered to the tailings facility, flow rates discharged, water balance sheet., eventual damages of the pipelines etc, etc)
 - Monitoring the evolution of the dam construction (crest of wave levels, beach width, level of water within the settling area, slope inclination, ratio between the total surface and water pond surface area, pump condition, etc)
 - Monitoring the quality of the settled material (grain size, humidity, etc)
 - Monitoring the chemistry of the seepage from the two TMF's
 - Monitoring the hydrografhic regime within the impact zone of the TMF's
 - Monitoring the dam behavior (pressure in the pores , tamping condition, etc.)
 - Monitoring the waste dump condition by providing a network of topometry landmarks
 - Monitoring the tailings management facility stability by:
 - a **topometry landmarks grid** – to monitor from topografhic point of view the subsidences and movement of the surface of tailings facility and dam surface;
 - a **piezometer network** – for monitoring the water level in the tailings facility.
 - a **network of depth telescopic columns with subsidence landmarks** – ensures the measuring of the foundation subsidence and dam body with an accuracy of $\pm 2 - 5$ mm.
 - **Water level gauges** – It is mounted on the initial slopes of the tailings management facilities and will be added as the level of tailings facility sediments raise

- monitoring the tailings management facility stability by :



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- ❖ *stage 1*, including the *visual inspections, measurements and annual technical inspections measurements at the topographic landmarks* and primary interpretation of results performed by the own staff
 - ❖ *stage 2*, including the *periodical synthesis of observations, measurements and annual technical inspections and their interpretation* from tailings management facility safety made by the specialists of DEVAGOLD S.A beneficiary.
 - ❖ *stage 3*, including the *analysis and approval of the annual synthesis reports, performed by the Central Commission for the Approval of the Documentation about the Assessment of Safety Condition of Dam Exploitation*
- preparation of "Construction Book" for the flotation and cyanidation TMF's dams
 - ensuring the financial guarantee, as a financial deposit, including a mutual guarantee fund, so that all the obligations of the functioning permit are observed including the dispositions referring to the sot closure stage and provided that at any time, there are funds available for the rehabilitation of the site impacted by the tailings facilities;
 - continuous supervision and visual inspection and by control system of the pipe condition
 - rehabilitation of land polluted with wastes as a result of incidents/ accidents

I) MEASURES TO PREVENT THE POLLUTION DURING THE CLOSURE / DEMOLISHING / DECOMMISSIONING AND LAND REHABILITATION STAGES FOR THEIR FURTHER USE.

- investigation in accordance with the geological environment and mining site and identification of the pollution generated by this activity
- collection and treatment of used water requiring treatment and after the cessation of the actiity until their quality is complying with the legal regulations in force:
 - used water resulted at the plant decommissioning (including DETOX 1) – resulting at the washing of equipment , tank and pipes which were in contact with cyanide products and reagents;
 - potentially acid waters from open pit and waste dump percolation by meteorological water;
 - water discharged from the tailings management facilities until the completion of closure works;
 - sewage
 - infiltration water through the tailings facility dam body
- humectation of surfaces where dust generation is possible in case of construction demolishing
- collection of waste by categories and its beneficiation/ elimination performed by certified companies
- compliance with the transport routes, speed, running hours
- humectation of waste dump surfaces or tailings facility surfaces when the closure and ecological rehabilitation works are performed
- compliance with the noise levels required by STANDARD 10009-88
- placement of coverage layers on the waste dumps to obtain the „oxygen barrier” reducting the possibility of acid drainage within the dump area.



- checking, declogging, reshaping and maintenance of guard channels, settling ponds, acid water collection basins, seepage collection, of all water works
- execution of works for the forestry// farming works in all mining sites
- sealing the surface of the cyanidation tailings facility with geomembrane prior to the execution of ecological rehabilitation and revegetation works
- monitoring the water chemistry on site as per the regulations for the closure stage
- monitoring the stability of the tailings facility dams
- redoing the micro habitats considering the conclusions of the Plan of biodiversity monitoring and management
- application of ecological succession, starting with the grass seeding, tree planting after the soil stabilization and restart of humic processes
- use of seeds of local grass species
- monitoring the extractive waste plants for at least 30 years after the mine closure
- rehabilitation of lands so that they comply with the planned use
- application of the best available technique existing which does not incur excessive costs for the mining site rehabilitation
- implementation of measures that will be included in the cleaning, rehabilitation, remediation and ecological reconstruction works at the end of activity

m) MEASURES FOR ENVIRONMENTAL PREJUDICE REMOVAL

- in case of applying an environmental prejudice removal procedure , at any stage of the project development (construction, operating, closure) the operator is obliged to:
 - o take measures immediately in order to control, isolate or remove or, on the contrary, to manage the respective polluting elements and/or other contaminants so that to limit or prevent the extension of the environmental prejudice and the negative impacts on human health;
 - o take all the necessary reparatory measures which should be proportional with the prejudice caused and to result in the removal of the prejudice considering the precaution principle in making decision process;
 - o to identify the possible reparatory measures in accordance with the provisions of the law and to send them to the county agency for environment protection for approval within 15 days since the prejudice occurrence
 - o to bear the costs incurred by the prevention and reparatory measures for the environmental prejudices caused by the activity developed

IV. THE ENVIRONMENTAL PERMIT IS ISSUED UNDER THE FOLLOWING CONDITIONS:

The compliance with the legislation referring to the environment protection and with all the requirements of other authorities involved with the regulatory procedure;

The performance of the works will be complying with the technical documentation as well as of the specific technical rules and prescriptions of project completion.



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The holder is obliged to apply all the measures for the mitigation of the environmental impact mentioned in chapter III.

The title holder is obliged to comply with the following:

CONDITIONS DURING THE WORK SITE ORGANIZATION

Restrictions and conditions regarding the location of the work sites and production sites:

- ✓ It is not allowed to locate the work sites and production sites in the river beds, on the river banks, in landslide areas and flooding areas;
- ✓ It is not allowed to locate the work sites and production sites in protected areas such as archaeological sites, nature monuments;
- ✓ Limitation to a smallest possible number of locations for work sites and production sites to determine the reduction of emissions into the air;
- ✓ It is not allowed to locate the work sites and production sites close to residential areas;
- ✓ It is not allowed to perform repair works for equipments and vehicles outside the special yards;
- ✓ Circulation of vehicles is forbidden outside the work site roads (access roads, technological roads).
- ✓ Work programs will be established taking into account the time for transportation, installation and putting in place with the aim of synchronizing the working programs of the productions sites with those of the equipments operating in the working faces to reduce pollution by down-time and prevent rejection of processed materials charges;

a) TECHNICAL REQUIRMENTS OF SPECIFIC DOCUMENTS

The title holder has the obligation to request the certifying of the mining personnel with regard to the monitoring activity of dams behaviour in time.

The title holder is responsible for ensuring and maintaining the safe operation of dams.

In case of constructive interventions that may modify the basic parameters of dams provided by the project, the title holder is obliged to obtain the safe operating agreement.

It is forbidden the dam operation by the holders of any title without the safe operating permit.

It is compulsory to comply with the safe operating conditions (approved by CONSIB).

The temporary occupation or definitive take out of use of lands from the forestry fund is allowed only in strict compliance with the legislation in force and provisions of the forestry code. For the lands granted as compensation – for the definitive take out of use of lands from forestry fund – the afforestation will be carried out in maximum 2 seasons of vegetation.

The holder has the obligation to review and update tje specific documents (notification, safety report, internal emergency plan) arising from the framing as object of "major risk " regarding the major accident occurrence due to the dangerous substances held and to permanently take care of the implementation of the best safety measures to ensure the operation of the installations of the site under safety conditions for the human and environment health.



Until the time of the application for the Construction Permit, but no later than 1 June 2015, the holder will submit the notification, the safety report and the internal emergency plan which will consider the provisions of the SEVESO III Directive (Directive 2012/18 EU adopted on 4 July 2012) which entered into force on 13 August 2012 and the due date of the fulfilment of the compliance obligation is 1 June 2015.

b) TECHNICAL REQUIRMENTS ARISING FROM THE REPORT OF THE ENVIRONMENTAL IMPACT ASSESSMENT WHICH INTEGRATE THE ADQUATE ASSESSMENT REQUIREMENTS

CONDITIONS FOR WATER PROTECTION

- The planned works will not be performed during the periods with high floods; throughout the investment execution, there will be requested data regarding the prognosis of water levels and flow rates of watercourses from Mures Water Directorate;
- The norms of sanitary protection of underground or surface water supply sources will be observed;
- Riverbeds will not be used as a source of aggregates to avoid the negative effects due to exploitation, for either the works in progress or the bank consolidation works;
- During the work performance and after the completion of works, the riverbed will be cleared of any materials that could prevent the normal flow of waters;
- The title holder will permanently keep in operation the treatment plants for sewage, acid waters from waste dumps, clarified waters from flotation and CIL tailings management facilities as well as the CIL tailings detoxification plant, during both the operating stage and the period of temporary cessation of activity, closure and post-closure.
- If the waters treated by the treatment plants do not comply with the NTPA 001/2005 requirements at the commissioning, the title holder is obliged to apply an additional water treatment stage in compliance with the best available techniques.

The holder will comply with the requirements for water protection presented below and the requirements stipulated by the modifying water administration approval:

1. The concentration of weak acid dissociable cyanide at the discharge point into the CIL tailings management facility will be **max. 5 ppm (mg/l)**, in accordance with the technical documentation.
2. The investment execution technology will observe the conditions imposed by the general project designer and at each determining stage and especially on completion of the waterproofing works by stages (collection and discharge channels for the exfiltrated waters from the tailings management facilities and related basins, potentially acid water collecting channels, waste dump acid water settling and storage basins, TMFs starter dams waterproofing), the beneficiary will comply with the legislation in force regarding the quality of constructions, drawing up a work completion report in the presence of the authorized representative of S.G.A. Hunedoara (Water Administration System of Hunedoara County).



3. The earth moving works will be performed in strict compliance with the compacted fillings execution technology.
4. Special attention will be paid to the foundation of works and to the compliance with the levels provided by the technical documentation.
5. In extraordinary situations like the discharge of precipitations fallen on the TMFs surface, it is compulsory to monitor the discharge of water into the emissary, the monitored indicators being the ones imposed for the discharge of treated waters from the flotation and CIL TMFs.
6. Before the mine commissioning, there will be performed determinations of the quality indicators from the observation holes - "witness" indicators, which will be submitted to A.B.A. Mureş and S.G.A. Hunedoara.
7. During both the execution stage and the operating stage and then, during the closure stage, it is compulsory to monitor the environmental processes and factors.
8. During the work execution stage and operating stage, the National Agency "Apele Române" reserves the right to modify both the monitoring points and the quality indicators and their determination frequency based on the field conditions.
9. It is forbidden to discharge *untreated waste waters* from the mine perimeter into natural receivers as well as on the adjacent fields.
10. For the final closure of the mine, it will be requested a new approval of water administration based on a technical documentation drawn up in accordance with the specific legal provisions in force.
11. At the mine commissioning, the beneficiary will also present, besides the documents specified in the legislation in force of the water administration field, the following documents "Exploitation Instructions", "Safety Measures in Exploitation" as well as the "Accidental Pollution Prevention Plan".
12. The beneficiary is responsible for the post-closure maintenance, supervision, monitoring and control of the exploitation.
13. The execution technology provided in the technical documentation will be strictly observed.
14. The beneficiary and the designer will closely supervise the execution of works stipulated in the technical documentation, the beneficiary having the obligation to announce any modification to the provisions of the present approval, a week before it takes place.
15. During the works execution period, all necessary measures will be taken to avoid water pollution and to protect the environmental factors and the adjacent areas, including accidental pollution prevention measures especially for accidental pollution due to oil products as a result of the technological equipment operation.
16. In case of any damage caused to the riverside residents and/or to the existing hydrotechnical works as well as to the river beds/banks of the watercourses in the influence area of the project, the beneficiary will bear all the costs incurred by the remediation of the damages.
17. During the entire duration of the investment execution, there will be requested data from the Mures Water Basinal Administration (Mures WBA) regarding the prognosis of the flow-rates and levels of the watercourses within the site.



18. The beneficiary, through the constructor, will permanently be ready to take measures and perform protection works against high floods for the objective under construction.
19. During the execution of works, appropriate measures will be taken to ensure the flow of waters and the beneficiary, through the constructor, will take all work conservation measures during the winter period.
20. The deposition of construction waste and materials and the standing of equipments in the watercourse bed are forbidden.
21. The beneficiary, with the help of the constructor and designer, has the obligation to remake the C.S.A. landmarks system, affected during the execution.
22. During the works execution, in case of necessity, the constructor will allow the access and intervention of the Mures WBA sub-units for the execution of some necessary works or actions in case of high floods, accidental pollution or other situations specific to the watercourses.
23. The beneficiary will inform the Mures WBA in writing about the start date of the work execution, 10 days prior to it.
24. In case there will be modifications of the approved solutions, the investment beneficiary will apply for a modifying approval of the existing approval of water administration.
25. On completion of works, the site will be cleared of any obstacles, materials or other wastes that could prevent the normal flow of waters.
26. The beneficiary will apply for and obtain all approvals and permits required by the legislation in force.
27. The present approval does not refer to the stability and resistance of the planned works.

c) CONDITIONS FOR THE PROTECTION OF AIR

- Keeping the equipments for reducing the emissions into the air in operating condition;
- Locating the reservoirs and other equipments on platforms and in buildings will allow the access for intervention services in case of emergency;
- An inspection system will be developed and implemented by officially recognized experts (independent third parties) for all equipments of the technological process;
- The accidental pollution prevention procedures will be applied according to the accidental pollution prevention plan;
- The designed retention tanks will comply with the provisions of the reference document on best available techniques on emissions from storage (ensure a capacity of over 110% larger than the largest tank or over 25% of the total capacity of the tanks);
- Maintenance, checking and upkeep of all spare equipments (tanks, reservoirs, pumps, etc) in perfect condition;
- Strictly observe, throughout the entire technological process, the optimum values of the technological parameters (ph, flow-rate, pressure, temperature, level, etc.);
- Immediately apply the necessary procedures if the alarms indicating a dysfunctionality in the technological process start (losses of substances from tanks or pipes, emissions of dangerous substances, etc).



d) CONDITIONS FOR THE PROTECTION OF SOIL AND SUBSOIL

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- The work areas will be delimited in order to reduce the impact on the contiguous areas;
- The works will be performed so that to avoid causing landslides;
- The works on site and the technological process will be conducted so as not to modify the levels of the soil quality indicators that constitute the reference condition.

e) CONDITIONS FOR THE PROTECTION OF BIODIVERSITY DURING THE DEFORESTATION WORK PERFORMANCE

- Correlation of the forest vegetation clearing activities with the forest legislation;
- The title holder will submit copies of the documents regarding the removal of lands from the forestry fund to the environmental authority;
- The forest clearing works and the objective execution works can only be commenced after the legal approvals have been obtained, the necessary fees have been paid and the lands delivery-reception certificate has been signed off;
- Limitation of deforestations in the working area in order to obey the protection zone provided in the Zonal Urban Plan;
- Prevent deterioration of the areas adjacent to the cleared zones by strictly obeying the perimeter of the area that is cleared;
- Keep evidence and report the cleared areas on an annually basis;
- Apply the biodiversity monitoring plan;
- The title holder has the obligation to modify the biodiversity management plan at the request of the environmental authority, after the approval of the Management Plan of Natura 2000 ROSPA 132 Metalliferous Mountains site.

f) CONDITIONS FOR PROTECTION AGAINST NOISE AND VIBRATIONS

- Compliance with the admissible limits for vibrations stipulated by the Romanian standards STAS 12025-1 / 81 (Effects of vibrations produced by the road traffic on buildings or parts of buildings – Measuring methods), SR 12025-2 / 94 (Effects of vibrations on buildings or parts of buildings – Admissible limits).
- When initiating the blasting activities, the descriptor parameters of vibrations will be carefully monitored for progressive loadings in order to determine the real constants of the ground where the open pit is located.
- In the case when the noise level is exceeded in the residential areas, over 50 dB according to STAS 10009-88, there will be taken measures to reduce the noise, including by installing sound absorbing panels.

g) HAZARDOUS SUBSTANCE AND WASTE MANAGEMENT

The extractive waste will be managed so that:

- the population health will not be endangered;
- the used technological processes or methods will not constitute a risk for water, air, soil, fauna and flora.



The operator will take all necessary measures to prevent or reduce as much as possible any side effects on the population and environmental health, as a result of the extractive waste management (including during the post-closure stage) as well as to prevent major accidents involving the waste/tailings facility and mitigate the consequences on the population and environmental health.

The measures for preventing or reducing as much as possible any side effects on the population and environmental health as a result of the extractive waste management will be based on the best available techniques, taking into account the technical characteristics of the CIL tailings management facility, geographical location and local environmental conditions.

The operator will comply with the objectives of the waste management plan.

The management plan will be revised every 5 years and/or modified accordingly, in case there are substantial changes of the tailings facility operation or technical characteristics. Any modifications will be communicated to the territorial environmental protection agency and to the National Agency of Mineral Resources.

The operator will implement the safety management system for the application of the major accident prevention plan for extractive waste management and the internal emergency plan.

The operator will inform the territorial authorities for environmental protection if the manager responsible for the implementation and periodic supervision of the major accident prevention plan is changed.

The operator has the obligation to provide the necessary information to the County Inspectorate for Emergency Situations in order to allow the development of the external emergency plan.

In case of a major accident, the operator has the obligation to immediately provide all necessary information to the county inspectorate for emergency situations and to the territorial authority for environmental protection in order to minimize the consequences on the population health and to assess and minimize the actual or potential extension of damages on the environment.

The waste facility operation is forbidden without an integrated environmental authorization.

The operator has the obligation to:

- a) ensure the stability of the extractive waste facilities;
- b) prevent pollution of soil, surface and underground water;
- c) ensure the monitoring of the extractive waste facilities and of the excavation voids;

In case of events that can affect the waste facilities stability or in case of significant negative effects on the environment, found based on the waste facility monitoring and inspection procedures, the operator will bear the costs of the measures that will be taken.

The waste facility closure procedure can start only if one of the following conditions is fulfilled:

- a) The operator applies for and obtains the decision of the National Agency for Mineral Resources for this purpose;
- b) The National Agency for Mineral Resources issues a motivated decision for this purpose.

The operator will apply for the closure approval for any of the waste facilities to the National Agency for Mineral Resources after completing the site rehabilitation works and obtaining the approvals from the territorial authorities for environmental protection.

The operator is responsible for the maintenance, monitoring, inspection and corrective measures for the post-closure stage over the entire period established by the National Agency for Mineral Resources, taking into consideration the nature and duration of the hazard.



The operator is not allowed to deposit the extractive waste in solid or liquid state or as slime in any other receiving water body than the one destined to the discharge of these wastes, if the operator does not ensure the compliance with the relevant provisions of the Law no. 107/1996, with subsequent modifications and addenda and of the Government Decision no. 351/2005, with subsequent modifications and addenda.

The operator ensures the reduction of the weak acid dissociable cyanide concentration to the smallest level possible by using the best available techniques in order not to exceed 5ppm.

The operator is obliged to ensure available funds at any time for the rehabilitation of the site affected by the waste facilities;

The title holder is obliged to treat the levigate resulting from the tailings facilities.

There will be kept records with the waste amounts administrated in accordance with the provisions of the GD no 856/2002 about the records of waste administration and for the approval of the list including the dangerous waste with further amendments and completions;

The lands polluted with wastes due to some incidents/accidents will be rehabilitated.

The title holder is obliged to ensure the cyanide management according to the reference document on the best available techniques in the field "Management of Tailings and Waste-Rock in Mining Activities".

The cyanide will be transported by transporters authorized for this activity and which implement emergency intervention plans, take adequate measures for cyanide management and establish clear limits for safety, security, prevention of emissions and emergency interventions.

The title holder has the obligation to ensure the permanent training of the employees in accordance with the necessities to respond to cyanide exposure and emission situations.

The title holder has the obligation to monitor all operations, cyanide discharges and the environment in order to detect any cyanide loss and intervene for minimizing the effects.

The title holder is obliged to know and obey the provisions of the Regulation (EC) no. 1907/2006 concerning the registration, evaluation, authorisation and restriction of chemical substances (REACH) and of the Regulation (EC) no. 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and abrogating Directives 67/548/CEE and 1999/45/CE and amending Regulation (EC) no. 1907/2006.

When purchasing dangerous substances and preparations necessary for the activity performance, there will be requested the updated material safety data sheets from the producer, drafted in compliance with the provisions of the Regulation (EC) no. 1907/2006 of the European Parliament and of the Council of 18 December 2006 (REACH), which will be submitted to the Environmental Protection Agency of Hunedoara County – Risk Secretariat (SRAPM Hunedoara), together with the notification on the activity commencement.

In case of incidents/accidents involving cyanide leakages/emissions, the title holder has the obligation to immediately remediate the situation even if the actions constitute the basis of some decisions regarding the application of corrective measures, of partial or total cessation of activity or even starting the alarm and intervention procedures with informing the authorities.

It is compulsory that the material safety data sheets be explained to the employees as part of the training session before they get into contact in any way with the dangerous substance.



The title holder is obliged to provide the personal protective equipment to the workers, which has to be consistent with the provisions of the applicable legislation regarding the design, production and delivery, with a view to ensuring the health and safety.

The title holder is obliged to ensure all the conditions for protecting the health and safety of the workers against accidents, incidents and emergencies related to the presence of some dangerous chemical agents at the workplace.

In case of incident/accident, the title holder is obliged to provide to the workers, who are allowed to work in the affected area, the personal protective equipment, the special security equipment and the installations that they have to use as long as the situation requires.

The title holder has to forbid the unprotected persons to stay in the affected area.

The title holder is obliged to ensure the safety marking and signalling for all pipes and containers that contain dangerous chemical agents used at the workplace.

Storage, usage and handling of large quantities of dangerous materials will only be performed in conditions that do not lead to situations of major risk that necessitate chemical alarm.

The administration of waste resulted at the project implementation (waste resulting at the construction activity) will be carried out by the collection and temporary storage on site, at special arranged places, in compliance with the provisions of Law no. 211/2011 about waste regime.

h) CONDITIONS FOR THE PROTECTION OF TERRESTRIAL AND AQUATIC ECOSYSTEMS AND OF LANDSCAPE

- Maintaining the protection zone approved through the ZUP in order to mitigate the visual impact;
- The compliance with the rate of land occupation with the arrangement of green spaces and tree/ bush planting in the parking areas as approved through the ZUP;
- Performance of works stipulated in the Environmental rehabilitation Plan and the Technical Design for the Environment Rehabilitation;
- Observance of methods for open pit mining operations and mining waste dump operation (dumps, TMF's) and performance of specific works based on the technical exploitation design;
- Suitable maintenance of pluvial water collection channels of the yards;
- Observance of the staged deforestation conditions as per the approvals issued by the entitled authorities;

The holder has the obligation to obtain the regulating documents for the performance of the closure and ecological rehabilitation works for the entire mining site and to ensure the performance of rehabilitation works of the impacted areas as well as their harmonious integration in the landscape.

i) CONDITIONS FOR SOCIAL AND ECONOMIC ENVIRONMENT PROTECTION

- It will be aimed to protect the existing monuments, historical vestiges, constructions and facilities; during the works execution, it will be carried out the historical discharge of the site.
- It will be avoided as much as possible to affect the works of public interest existing in the area.



- The lands will be rehabilitated so as to be suitable for the planned use.
- The areas impacted by the mining activity will be ecologized in the shortest possible time, in correlation with the territorial sistematization program with a view to identify and develop new opportunities in the interest of the economical development of the area.

The holder will make aware and disseminate, among the local community, the specific issues which could generate emergency events ensuring the population training for immediate response.

The observance of the emission levels required by the regulating documents issued by entitled authorities.

j) CONDITIONS FOR RISK PREVENTION

The title holder has the obligation to obey the provisions of the *Law on the regime of explosive materials no. 126/1995, with subsequent modifications and supplements*, as well as of the *technical norms in force* regarding the possession, preparation, experimentation, destruction, transport, storage, handling and usage of explosive materials used in any other operations specific to the activities performed as well as the authorization of the shot-firers and pyrotechnists.

Before the project commissioning, the title holder will notify the Risk Secretariat of EPA Hunedoara (SRAPM Hunedoara) about the presence of dangerous substances on site (factual or anticipated existence of these substances on site).

The title holder will immediately inform SRAPM Hunedoara, in case of:

- Significant increase of quantity or significant change of nature or physical state of the present hazardous substances, in proportion to the notification submitted by the operator or in case of occurrence of any modification in the processes in which the substances are used;
- Modification of a site or of an equipment/installation that could lead to an increased hazard of causing a major accident;
- Definitive closure of the installation/site.

The title holder is obliged to obey the provisions of the Directive 96/82/EC on the control of major-accident hazards involving dangerous substances (SEVESO II) transposed into the national legislation by *G.D. no. 804/2007, with subsequent modifications and addenda*. The title holder will ensure the compliance with the requirements of the specified normative act, the drafting and/or revision (as appropriate) of the specific documents, as well as their submission within the terms legally established, to SRAPM Hunedoara.

The title holder will be aware of and disseminate in the local community the specific problems that could generate emergency situations, preparing the population for an immediate reaction.

In the case of the occurrence of some events that necessitate the activation of the emergency state, the operating personnel in the workplace will alarm the site to initiate the intervention procedures.

The title holder will immediately warn the population about the hazards of pollution and contamination of the areas adjacent to the unit and will intervene to protect the population and remove the pollution effects with all available means.

The title holder must reduce to the minimum the potential environmental hazards.



The title holder is obliged to instruct the whole personnel with regard to the knowledge of the environmental hazards that their activity implies.

The emergency situation plans will be periodically checked by exercises together with the intervention teams of the inspectorate for emergency situations based on a plan established by mutual agreement and informing the Risk Secretariat.

The title holder will apply an active monitoring in relation to the major hazard control activity, including:

- systematic inspection of installations, equipments, control instruments and systems that are important for the continuous and effective operational control, in relation to the prevention of major accidents;
- systematic and direct observation of work and behaviour of employees in order to evaluate the compliance with those safety procedures and rules that are important for the major accident control;
- periodical examination of the recording documents of the operational and environmental monitoring results to check whether the safety standards are obeyed;
- verification by managers of the quality of the monitoring activity performed by the subordinated personnel.

At each workplace, there will be posted the “Work Instructions” containing all normal operating parameters of the respective installation or equipment.

The equipment maintenance will be ensured based on a maintenance program.

The operator has the obligation to take all the measures required to prevent the major accidents and to limit their consequences on environment and human health.

The operator has the obligation to prove in front of the public authorities in charge with the application of the provisions of the GD no.804/2007 with further amendments and completions at any time and particularly within the inspection and control activities that he took all the necessary measures according to this decision.

The management system of safety and the policy of the major accident prevention will be audited throughout the construction, exploitation and closure stages and prior to the decommissioning stage an external audit performed by an independent auditing group is recommended . The internal and external audit reports will be delivered to the entitled authorities immediately after their elaboration.

The final decision regarding the construction, exploitation and closure under safety circumstances as well as the solutions to be applied will be taken considering the conclusions of the safety report (systematic risk analysis) , the documents / monitoring reports and updating of the reference documents.

k) CONDITIONS FOR THE CLOSURE AND POST-CLOSURE STAGE

- Apply for the regulating acts for closure, decommissioning and rehabilitation.



AGENCY FOR ENVIRONMENT PROTECTION HUNEDOARA

Str. Aurel Vlaicu nr. 25, Deva, Jud. Hunedoara, Cod 330007

E-mail: office@apmhd.anpm.ro; Tel: 0254/215445, Fax: 0254/212252

- The title holder is obliged to periodically revise throughout the planning and operating stages of the mine life, the mine closure plan, the technical environmental rehabilitation project and the environmental rehabilitation plan, drawn up during the design stage.
- Compliance with the mine closure plan, technical environmental rehabilitation project, environmental rehabilitation plan and post-closure monitoring, updated with:
 - New risk assessment for the tailings management facilities on medium and long term (taking into consideration the climatic changes, previous extreme events, anticipation of future extreme events, variations of geotechnical parameters, hydrogeological modifications, landslides, rock avalanches, volcanic activity, land collapses, water chemistry, safety against physical, chemical and biological hazards, both anthropogenic and natural)
 - Any modifications of the design along the operating stage
 - Previous and subsequent monitoring
 - Mine closure costs
- Compliance with the mitigation measures for the impact on the environmental factors - air, water, soil when performing the decommissioning and environmental rehabilitation works.
- The title holder must apply the selective collection of non-extractive wastes (metallic wastes, construction wastes, spent oils, etc), eliminating or recovering them through authorized economic agents during the closure and environmental rehabilitation works.
- the title holder is obliged to take into consideration the ecological, environmental, recreational and economical aspects for the subsequent use of the locations of the tailings management facilities; the involved parties (the operator, regulation authorities, non-governmental organizations, neighbouring communities) have to participate at discussions before submitting constructive solutions.
- The title holder will plan the closure works so as to prevent the penetration of physical or chemical pollutants and thus, the degradation of the downstream environment, including surface and underground waters.
- The title holder is responsible for ensuring the physical stability of all anthropogenic structures that remain after the mine closure. These structures should not represent a health and safety risk and must continue to have the function for which they have been designed.
- The closure works must be performed by taking into consideration the necessities and specifications of the location in point of climate (precipitations, storm frequency, seasonal extremes) and geography (vicinity of human habitats, topography, access to mine), reanalysed at the date of the mining activity closure.
- The closure works must optimize the opportunities for land restoration and the land exploitation update must be taken into consideration anytime it is appropriate and/or economically feasible.
- By land rehabilitation, it will be seen that the land use is optimized and compatible with the surrounding areas and with the needs of the local community.
- The biologic environment must be rehabilitated to the natural equilibrium of the ecosystem typical to the area, or brought to a such level that encourages and makes possible the natural rehabilitation and/or reintroduction of a stable biologic environment.
- The title holder is obliged to bear all costs for the implementation of the closure and rehabilitation plan.



- Before closure, the title holder will take adequate measures to ensure the socioeconomic involvement (development of a local policy taking into consideration the opportunities of the local communities, the existence of which may depend on the jobs and termination of the economic activities related to mining).
- As regards the mining objectives that belonged to the former Certej mine and which are located within the project site, but do not constitute the object of this project, the title holder has the obligation to ensure the closure and ecologization of them.

I) EMISSION LEVELS

ENVIRONMENTAL FACTOR “WATER”

Quality indicators of ARD treatment plant effluent:

In accordance with the provisions of the G.D. 188/2002 with subsequent modifications and addenda (NTPA 001), at the discharge into the Valea Grozii emissary (not registered in the cadastral register), the quality indicators of the treated water will not exceed the following limits:

Water category /emissary	Receiving water body	Quality indicator	Maximum admissible value (NTPA 001)
Acid water treated in the ARD treatment plant	Valea Grozii	pH	6.5-8.5
		MTS	60 mg/l
		NH ₄ ⁺	3 mg/l
		Nitrates (NO ₃ ⁻)	37 mg/l
		(*) Copper (Cu ²⁺)	0.1 mg/l
		(*) Nickel (Ni ²⁺)	0.5 mg/l
		Total ionic iron (Fe ²⁺ +Fe ³⁺)	5 mg/l
		(*) Zinc (Zn ²⁺)	0.5 mg/l
		Sulphates (SO ₄ ²⁻)	600 mg/l
		Fixed residue	2000 mg/l
		CCOCr	125 mg/l
		Magnesium (Mg ²⁺)	100 mg/l
		Calcium (Ca ²⁺)	300 mg/l
		(*) Cr total (Cr ³⁺ +Cr ⁶⁺)	1 mg/l
		Total manganese (Mn)	1 mg/l
		(*) Cadmium (Cd ²⁺)	0.2 mg/l
(*) Lead (Pb ²⁺)	0.2 mg/l		
(*) Mercury (Hg ²⁺)	0.05 mg/l		
(*) Arsenic	0.1 mg/l		

(*) - the amount of heavy metal ions must not exceed the concentration of 2 mg/l.

Quality indicators of the flotation tailings treatment plant effluent:

In accordance with the provisions of the G.D. no. 188/2002 with subsequent modifications and addenda (NTPA 001), at the discharge into the Valea Coranda emissary (not registered in the cadastral register), the quality indicators of the treated water will not exceed the following limits:

Water category /emissary	Receiving water body	Quality indicator	Maximum admissible value (NTPA 001)
Flotation TMF water treated in the flotation TMF water treatment	Valea Coranda	pH	6.5-8.5
		MTS	60 mg/l
		NH ₄ ⁺	3 mg/l



AGENCY FOR ENVIRONMENT PROTECTION HUNEDOARA

Str. Aurel Vlaicu nr. 25, Deva, Jud. Hunedoara, Cod 330007

E-mail: office@apmhd.anpm.ro; Tel: 0254/215445, Fax: 0254/212252

plant	Nitrates (NO ₃ ⁻)	37 mg/l
	^(*) Copper (Cu ²⁺)	0.1 mg/l
	^(*) Nickel (Ni ²⁺)	0.5 mg/l
	Total ionic iron (Fe ²⁺ +Fe ³⁺)	5 mg/l
	^(*) Zinc (Zn ²⁺)	0.5 mg/l
	Sulphates (SO ₄ ²⁻)	600 mg/l
	Fixed residue	2000 mg/l
	CCOcr	125 mg/l
	Magnesium (Mg ²⁺)	100 mg/l
	Calcium (Ca ²⁺)	300 mg/l
	^(*) Cr total (Cr ³⁺ +Cr ⁶⁺)	1 mg/l
	Total manganese (Mn)	1 mg/l
	^(*) Cadmium (Cd ²⁺)	0.2 mg/l
	^(*) Lead (Pb ²⁺)	0.2 mg/l
^(*) Mercury (Hg ²⁺)	0.05 mg/l	
^(*) Arsenic	0.1 mg/l	

(*)-the amount of heavy metal ions must not exceed the concentration of 2 mg/l.

Quality indicators of DETOX 2 effluent:

In accordance with the provisions of the G.D. 188/2002 with subsequent modifications and addenda (NTPA 001), at the discharge into the emissary, the quality indicators of the treated water will not exceed the following limits:

Water category/emissary	Receiving water body	Quality indicator	Maximum admissible value (NTPA 001)
CIL TMF water treated in DETOX 2 plant	Valea Coranda	pH	6.5-8.5
		MTS	60 mg/l
		Total cyanide (CN)	0.1 mg/l
		NH ₄ ⁺	3 mg/l
		Nitrates (NO ₃ ⁻)	37 mg/l
		Copper (Cu ²⁺)	0.1 mg/l
		Nickel (Ni ²⁺)	0.5 mg/l
		Total ionic iron(Fe ²⁺ +Fe ³⁺)	5 mg/l
		Zinc (Zn ²⁺)	0.5 mg/l
		Sulphates (SO ₄ ²⁻)	600 mg/l
		Fixed residue	2000 mg/l
		CCOcr	125 mg/l
		Lead (Pb ²⁺)	0.2 mg/l

In accordance with the provisions of the G.D. 188/2002 with subsequent modifications and addenda, at the discharge into the emissary, the water quality indicators will not exceed the following limits:

Category	Quality indicator	Admissible values
Sewage water treated at the discharge into the emissary: the channel diverting the Grozii, Ciongani and Borzei streams to round the South waste dump and the open pit	pH	6.5-8.5
	MTS	60 mg/l
	CBO ₅	25 mg/l
	CCOcr	125 mg/l
	NH ₄ ⁺	3 mg/l
	Fixed residue	2000 mg/l



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ENVIRONMENTAL FACTOR “AIR”

Source of pollution	Monitored pollutants	VLE
Works generating dust Ore extraction from open pit Transportation of ore, vegetal soil and other solid wastes and transportation of materials and personnel Waste storage facilities Crushing plant Grinding section Reagents preparation for flotation – transfer of solid reagents (PAX, copper sulphate) from bales to the dissolution tanks; Dust deposit Reagent warehouse (only solid reagents)	PM ₁₀ PM ₁₀ -metals: As, Pb, Cd, Ni	PM ₁₀ = 50µg/c.m Pb -V _L (calendar year) 0,5 µg/c.m As -V _{target} =6 ng/c.m Cd-V _{target} =5 ng/c.m Ni- V _{target} =20ng/c.m
Lime milk preparation plant – lime silo Limestone preparation plant	Total powders – directed sources	10 mg/c.m
Activated carbon regeneration (reactivation) plant Melting furnace and ingot pouring area	Powders – directed sources	5 mg/c.m
Cyanide preparation and storage Disposal of tailings in the CIL tailings management facility Leaching tanks and settling tank of the CIL tailings management facility Decyanidation tanks	HCN	In the Romanian and European legislation there are no limit values for HCN from nondirected sources - the admissible limit at the discharge into the atmosphere through the dispersion chimneys is max. 5 mg/mc according to Order 462/1993, for fixed sources - the maximum admissible limit for the hydrocyanic acid content at the workplaces is 1 mg/mc (exposures of max 15 min) according to GD 1/2012
Hydrochloric acid preparation/storage	HCl potential emissions	30 mg/c.m
Elution reagent preparation/storage (sodium metabisulphite, flocculant and caustic soda)	Total powders, SO ₂	50 mg/c.m 500 mg/c.m
Electrolysis cells	HN ₃	– < 5 mg/Nm ³
Elution column heater	Powders CO NO _x SO _x	50 mg/c.m 170 mg/c.m 450 mg/c.m 1700 mg/c.m VLE is referred to a non-oxygenic content of gaseous effluents of 3%
Electrical power generator	Powders CO NO _x SO _x	50 mg/c.m 170 mg/c.m 450 mg/c.m 1700 mg/c.m VLE is referred to a non-oxygenic content of gaseous effluents of 3%

ENVIRONMENTAL FACTOR “SOIL”



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To evaluate the pollution level of the environmental component soil, the interpretation of the laboratory assay results will be performed by reference to the limit values stipulated in the Order of the Ministry of Water, Forest and Environmental Protection no. 756/1997 “Regulations regarding the environmental pollution assessment” and for the quality indicators that are not limited, the comparison of the results will be done by reference to the results of the blank soil assays.

NOISE AND VIBRATIONS

The measured values will not exceed the limit values of the STAS 10009-88 for noise and STAS 12025-1 / 81 (Effects of vibrations produced by the road traffic on buildings or parts of buildings – Measuring methods), SR 12025-2 / 94 (Effects of vibrations on buildings or parts of buildings – Admissible limits) as well as the values stipulated in the Directive no. 2002/44/EC on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (vibrations).

Quality indicator of DETOX 1 effluent

The concentration of cyanide dissociable in weak acid environment at the discharge point in the cyanidation tailings management facilities (CIL TMF) will be maximum 5 ppm (mg/l), as per the technical documentation for substantiation.

m) PROVISIONS ON THE MINIMISATION OF LONG-DISTANCE OR TRANSBOUNDARY POLLUTION

In the case when a local accidental water pollution with potential significant transboundary impact is identified, the title holder is obliged to know and initiate the primary information flux:

- It is immediately informed the local *Water Administration System* (WAS Hunedoara);
- WAS Hunedoara immediately informs the downstream water utilities that could be affected by the accidental pollution.
- WAS Hunedoara informs the coordinating *Water Directorate (Mureş Water Basinal Administration)*.
- WAS Hunedoara informs the downstream WASs.
- The *Water Directorate* informs the National Administration “Apele Române” and depending on the extension of the pollution, it can initiate a transboundary warning message in compliance with the provisions of the Common Regulation in case of accidental pollution.
- The National Administration “Apele Române” informs the Romanian Principal International Alert Centre (**Romanian PIAC**).
- The **Romanian PIAC** decides whether it is necessary to initiate an alert plan at regional or national level.
- The **Romanian PIAC** decides whether the reported accidental pollution has or has not a transboundary impact and consequently, whether it is opportune to initiate an international alert. If so, the procedure of the international subsystem is applied.



n. MONITORING PROGRAM

I. CONSTRUCTION STAGE

Monitoring program of water quality of construction stage.

Source	Sampling location	Frequency	Quality indicators	Comments
<i>Acid drainage of Certej open pit . Nord and South waste dumps</i>	WHN, WHS, WQ	Quarterly	- pH, Fe, Cu, Pb, Zn, Mn, As, sulphates, fixed residues , suspensions, Ca	The initial database is completed
		Annualy	Thiobacillus Ferrooxidans -Thiobacillus Thiooxidans	
<i>Surface waters</i>	Surface water quality downstream the mining projects W1,W3,W5,W4 W6, W12	Monthly	- pH, CCO-Cr,filterable residues dried at 105 degree C , nitrites, chlorides, sulphates, sulphides , alkalinity, Fe, Cd, Ca, Cu, Pb, Zn, Mg,Mn, As	Water body characteristics shall not be changed; the water quality analysis will be performed by DAM on a half-yearly basis
<i>Water of wells and hydrogeological drill holes</i>	Water of the wells F1, F2, F5, F7, F11,F26 and hydrogeological hole of Valea Măcrișului CJSD 404 and PS1, PS7, PS2,	Quarterly	pH, conductivity, sulfates, ammonia, nitrates, nitrites, Cu, Pb, Zn, Fe total, Mn, As	Specific evidence will be kept for each drill hole apart to highlight the evolution in time of each specified indicator

Monitoring program of soil during the construction stage

Source	Sampling location	Frequency	Quality indicators	Comments
<i>Tailings facility surface</i>	S5,S6	Half-yearly	pH, humus, dried substance, Fe _{tot} sulfates, Cr tot, Zn, Ni, Cu, Pb, Mn, As, Cd	Results obtained at the soil analysis will be compared with the <i>reference values of the soil chemical elements mentioned in Table. 1.of the Annex to the Order 756/1997 –about the environmental pollution assessment .</i>
<i>Surface area adjoining the waste dumps</i>	S1,S2			
<i>Surface area adjoining the open pit</i>	S3,S4			
<i>Ramp site location</i>	S7			



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Air monitoring program –construction stage

Source	Sampling location	Frequency	Quality indicators	Comments
<i>Surface area adjoining the tailings facilities</i>	Meteo station	permanent	Wind direction, speed, temperature, atmospheric pressure , precipitation amount , sun rays	LAW 104/2011 STANDARD12574 -87
	A8,A9,A10,A11	Quarterly	Total particles in suspension, PM10, NO _x , CO, The As, Pb, Cd, Ni will be analysed of PM10	
<i>Surface area adjoining the waste dumps and open pit</i>	A1,A2,A3,A4,A7	Quarterly	Total particles in suspension, PM10. The As, Pb, Cd, Ni will be analysed of PM10	
<i>Ramp site location</i>	A5 (soil dump), A6 (site boundary Bocşa Mică) A12	Quarterly	Total particles in suspension, PM10. The As, Pb, Cd, Ni will be analysed of PM10	

Monitoring program of waste facilities

Objective	Monitoring locations	Control parameter	Frequency	Monitoring method
<i>Tailings Management Facilities</i>	Completion of the document “Construction Book” of the flotation TMF and CIL TMF which should include: <ul style="list-style-type: none"> - Initial projects, with amendments and adjustment of the construction period - Further projects for completions of works - An layout plan permanently updated which should represent all the works performed and decommissioned accurately indicating the project on which basis the work was done - Topographic plan including the accurate coordinates with the real position and elevation, determined after the execution, for all the invisible works (covered in time by the tailings depositions, galleries etc.) - Periodical studies of stability and evaluation of safety condition - Annual reports concerning the time behaviour - Studies and technical projects of the TMF’s closure etc. 			
	P7,P10,P11 – Flotation TMF P15,P17 CIL	Dam stability	Quarterly	- measurements will be performed with inclinometric columns installed in the dam body as it rises. Accuracy of measurements is 0.2-0.3 mm/sq.m for horizontal deformations and ±2-5 mm for vertical deformations (compating)



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	TMF			
	R7,R9, R10 – flotation TMF; R11, R12, R14, R15, R16 – CIL TMF		2det/quarter	-construction of a topografic landmarks network - to monitor from topographic point of view the subsidence (<i>measuring of subsidence in the foundation ground and in the dam body</i> with a precision of $\pm 2 - 5$ mm) and the horizontal and vertical displacement of the dam crest and berms - the landmarks will be installed in natural ground – witness landmark, located on the hillsides and landmarks located on tailings facilities along several alignments - the measurements will be made with GPS survey station
	The whole structure (evolution of dam construction stages)	Slope stability, crest elevations, seepage discharge etc	Permanently	Visual monitoring – performed by each shift (pre-established list: erosion, ravines, guard channel condition) - Exceptional inspections will be performed, eg. after strong vibrations and during torrential rains, earthquakes, hurricanes, high floods
	Paraseismic activity induced by the mining operations	Land acceleration		- checking the seismic criteria of the area
	Meteo station	Meteorologic al values	Permanently	- liquid or solid precipitations, evaporation, air temperature, wind direction and intensity
	Hydrochemical regime	Parameters and period according to the water monitoring program		
<i>Tailings Management Facilities</i>	Activity to monitor the time behaviour of the dams on 3 levels – according to the provisions of Emergency Ordinance 244 of 28.11.2000 About the safety	-level I , including the visual inspections (location usual inspections of the location), measurements with the measuring and control devices and primary interpretation of	Daily	The dam construction will include: - There will be drawn up construction layouts and current procedure files establishing any variation from the initial plan and if required, review of the design criteria - Construction will be supervised by an independent geotechnical engineer The files with the test results will be kept accordingly (example: consolidation works) performed for and during the construction stage

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of dams , checking the compliance with performance requirements referring to the dam safety and with the Reference Document on the Best Available techniques for Tailings and Residual Sediments Management Mining Operations 4.2.1.5 Control and monitoring	results – exceeding some warning and attention values – performed by the operating staff authorized by the Ministry of Waters and Environment Protection ;	
	The work will be supervised by a manager or an appointed person	Once a month
	level II , including the periodical synthesis of the comments, notes, measurements and annual technical inspections and their interpretation for the dam safety performed by the specialists who are drawing up the annual synthetic reports;	
	level III , including the analysis and approval of the annual synthesis reports completed by a commission in charge with the time monitoring of dam behaviour, organized by the holder , which membership is agreed by CONSIB and approved by the Ministry of Environment Protection and Forests ; in ase of holders who do not organize such commissions, the review and agreement of the annual reports is done either by the commissions of other holders or group of	



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		specialists approved by the Ministry of Environment Protection and Forests based on the technical agreement of CONSIB.		
	Synthesis of comments drawn up by the holder experts	Plans, layouts, records, test results, material quality control, etc	Once a semester	
	Periodical synthesis of the comments, measurements and annual visual inspections and their interpretation as regards the dam safety		Annually	Completed by experts employed by the dam holder who are drawing up annual synthetic reports
Waste dumps	R17,R18,R19,R20 ,R21,R22- North waste dump	Waste dump stability	2det/quarter	-construction of topographic landmark network – to monitor from topographic point of view the compacting and displacement of tailings facility and dams surface - the landmarks will be installed in natural ground – witness landmark, located on the hillsides and landmarks located on tailings facilities along several alignments - the measurements will be made with GPS survey station
	Whole structure		permanent	Carried out by each work shift (following a pre-set list: erosion, ravines, guard channel condition, seepage, retaining walls)
			annually	It will be carried out by expert teams

Deforestation monitoring program during the construction stage

Description of the monitoring measure	Monitoring	Monitoring period	Remediation measures / monitoring results
Delimitation of the lands impacted directly by the mining project constructions	Topographic measurements for determining the land surface areas occupied by the open pit, processing plant, industrial roads, North waste dump, flotation tailings management facility – starter dam, and waste dumps, CIL TMF- starter dam and other industrial facilities	Periodically until the completion of the construction and planning works	<ul style="list-style-type: none"> - Identification of the zone occupied by future objectives. - Identification of all land plots which use is to be modified.



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Delimitation of afforested land surfaces	Topographic measurements performed in the objective construction area.	Periodically until the completion of construction works	- Identification and marking of all forest plots to be deforested.
Record of deforested surface areas	Topographic measurements	Periodically until the construction work completion	- Periodical checking of little marking poles and implicitly the observance of the deforested surface boundaries.

Monitoring program of noise and vibrations

Source	Sampling location	Frequency	Location	Law regulations in force
<i>Surface area adjoining the tailings management facilities Surface area adjoining the waste dumps and open pits and pads</i>	PZ1, PZ2, PZ3 at the limit of the industrial area towards the residential area (noise and vibrations) Vibrations will be monitored in at least 3 points and in the TMFs area.	Monthly	Measurements at the limit of the residential areas	STANDARD 10009/88
		Monthly		STAS 12025-1 / 81 (Effects of vibrations produced by the road traffic on the buildings or parts of the buildings – measurement methods), SR 12025-2 / 94 (Effects of vibrations on buildings or parts of buildings – admissible limits)

Waste monitoring

Source	Description of the monitoring measure	Monitoring period	Comments
<i>Location site where the construction works are performed</i>	Record of non-mining waste management (garbage, spent oils, metal scraps etc.)	Monthly	Reporting the waste amounts to the environmental authority will comply with the legislation in force.
	Record of mining waste management: overburden soil	Daily	

Monitoring program – archeological heritage protection

Source	Monitoring measures	periods	Indicators



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<i>Site location</i>	All the industrially oriented interventions on soil (road plannig, drill holes, water conduit, excavations and constructions etc.) will be carried out only under archaeological surveillance	Permanently, Until obtaining the archaeological discharge certificate	Identification of some possible ancient mining workings or of any archaeological vestiges
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II. EXPLOITATION STAGE

Monitoring program of water quality in the exploitation stage

Source	Sampling location	Frequency	Quality indicators	Observații
Drinking water	Processing plant, explosive magazine	permanent	Flow rate	
Industrial water	Mures River	permanent	Flow –rate	
	Recycled water from flotation TMF, acid drainage and CIL TMF			
<i>Acid drainage open pit</i>	1) Collection basin – pumping to North waste dump	quarterly	- pH, total ionic Fe, Cu ²⁺ , Pb ²⁺ , Zn ²⁺ , Mn total, As, sulfates, fixed residues, suspensions, Ca ²⁺	
<i>Acid drainage North waste dump</i>	2) Collection basins– South waste dump pumping	quarterly	-pH, total ionic Fe, Cu ²⁺ , Pb ²⁺ , Zn ²⁺ , Mn total, As, sulfates, fixed residues, suspensions, Ca ²⁺	
<i>Acid drainage South waste dump</i>	In- flow acid drainage W 1 treatment plant	permanently	- Flow rate, pH	Treatment plant with continuous pH and input flow-rate monitoring system and flocculant dosage
		Weekly	- total ionic Fe, Cu ²⁺ , Pb ²⁺ , Zn ²⁺ , Mn total, As, sulfăți, reziduu fix, suspensii, Ca ²⁺ , Mg ²⁺	



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		quarterly	Cr total , Cd ²⁺ , Hg ²⁺ , Ni ²⁺	
Effluent of acid drainage neutralization plant				
	Discharge in the emissary (V. Ciongani)	Daily	Flow rate -pH, MTS, NH ₄ ⁺ , NO ₃ ⁻ , Cu ²⁺ , Ni ²⁺ , Total ion Fe, Zn ²⁺ , sulfates, fixed residues, CCOCr, Mg ²⁺ , Ca ²⁺ Total Cr, Total Mn, Cd ²⁺ , Pb ²⁺ , Hg ²⁺ , As,	Only when it is discharged in the emissary Admissible values according to NTPA 001
		anually	Thiobacillus Ferrooxidans -Thiobacillus Thiooxidans	
<i>Clarified water collected and discharged from the flotation TMF</i>	Influent flotation TMF (PULP)			
	Water pumped to the flotation TMF	Half-yearly	- pH, Total ion Fe, Cu ²⁺ , Zn ²⁺ , sulfates, fixed residues, suspensions, Ca ²⁺ total Mn, As, Pb ²⁺	Recycled without being treated
	Influent of flotation water treatment plant			
	Input to the flotation TMF treatment plant	Permanent	- Flow rate - pH	The treatment plant has a monitoring system of pH and flocculant input flow-rate and dosage
		Weekly	-pH, , Fe ionic total, Cu ²⁺ , Pb ²⁺ , Zn ²⁺ , Mn total, As, sulfates, fixed residues, suspensions, Ca ²⁺	
	Effluent of the flotation water treatment plant			
	Discharge in the emissary (V. Ciongani)	daily	-flow rate - pH, MTS, NH ₄ ⁺ , NO ₃ ⁻ , Cu ²⁺ , Ni ²⁺ , Fe ionic total, Zn ²⁺ , sulfates, fixed residues, CCOCr, Mg ²⁺ , Ca ²⁺ Cr total, Mn total, Cd ²⁺ , Pb ²⁺ , Hg ²⁺ , As	Treatment plant is equipped with a system of pH and flow rate permanent monitoring system Only in the periods when the discharge in the emissary is carried out Admissible values comply with NTPA 001
<i>Water of the CIL TMF</i>	Influent of the CYANIDATION TAILINGS MANAGEMENT FACILITY			
	Influent and effluent of the DETOX 1 treatment plant (slurry)	Daily during cyanidation	- pH, cyanide dissociable under weak acid environment	The treatment plant is provided with a permanent pH and input flow rate permanent

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			- flow rate	monitoring system as well as of the cyan ion and copper sulphate and oxygenated water CN _{WAD maximum} admissible limit 5ppm
	From the CIL TMF surface	monthly	- - pH, cyanide dissociable under weak acid environment total cyanides, total ion Fe, Cu ²⁺ , Pb ²⁺ , Zn ²⁺ , Mn total,sulfates, fixed residues	
DETOX II Influent				
	Treatment plant entrance	Daily when operating	- pH, MTS, total cyandies, CN _{wad} ,Total ion Fe, Cu ²⁺ , Zn ²⁺ , sulfates, NH ₄ ⁺ , fixed residues	Only in the periods when operating
DETOX II effluent				
	Discharge in pr. Grozii	Daily	-flow rate -pH, MTS,total cyanides, NH ₄ ⁺ , nitrates, Cu ²⁺ , Ni ²⁺ , Total ion Fe, Zn ²⁺ , sulfates, fixed residues , CCOCr, Pb ²⁺	Only during extreme seasons when the water discharge in the natural receiver is required Admissible values comply with the NTPA 001
<i>Surface water</i>	1.Hondol (Măcriș): Upstream diversion gallery and downstream South waste dump 2. V. Coranda Upstream and Downstream of diversion gallery 3. Diversion channels.pr. Grozii stream and its tributaries Ciongani 4. Certej stream: downstream the general proiect impact area	Monthly	- pH, CCOCr, filterable residue nitrates, nitrites, chlorides, sul;phates, total ion Fe, Cd ²⁺ , total Cr, Ca ²⁺ , Cu ²⁺ , Pb ²⁺ , Ni ²⁺ , Zn ²⁺ , Mg ²⁺ ,Mn total,total cyanides. -flow rates of P. Măcriș and V. Hondol	For each sector there will be kept a specific record to reveal the evolution with the time of each indicator specied to follow up the probability of modifying yhe characteristics of the CIL TMF , water pond, analysis on semester basis -notch weir with level gauge Monitoring downstream the project perimeter is carried out by S.C DEVA GOLD SA as follows : -V. Hondol creek and Certej stream as a result of the trans-boundary procedure developed for Certej ZUP; additionally V. Coranda and Coranzii creeks as a result of trans-boundary procedure developed for Certej project



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<i>Sewage</i>	Effluent of sewage treatment plant , explosive magazine (P. Ciongani stream)), effluent processing plant treatment and treatment plant of open pit yard (emissary diversion channel p. Ciongani, Grozii and Borzei)	monthly	- pH, CCOCr, CBO ₅ , nitrates, fixed residues, suspensions	The effluent quality must comply with the NTPA 001/2005
<i>Water from wells</i>	F1,F2,F5,F7,F11,F26	Quarterly	pH, sulphates, ammonia, nitrates, nitrites, Cu, Pb, Zn, Fe total, Mn, As	For each drill hole a specific record will be kept to reveal the evolution with the time of each indicator specified
<i>Hydrogeological drill hole water</i>	PS1, PS2, PS3, PS4, PS5(downstream the TMF's), PS6 (CIL TMF)	Quarterly	pH, sulfates, ammonia, nitrates, total cyanides (PS6), Pb, Cu, Fe total, Mn, Ni, Zn, As	
	Fh1 Fh2, Fh3, Fh4 la iazul CIL		pH, sulfates, ammonia, nitrates, total cyanides (PS6), Pb, Cu, Fe total, Mn, Ni, Zn, As	

Monitoring of tailings facilities

Objective	Monitoring locations	Control parameter	Frequency	Monitoring method
<i>TMF's dams</i>	Completion of the document "Construction Book" of the flotation TMF and CIL TMF which should include: <ul style="list-style-type: none"> - Initial projects, with amendments and adjustment of the construction period - Further projects for completions of works - An layout plan permanently updated which should represent all the works performed and decommissioned accurately indicating the project on which basis the work was done - Topographic plan including the accurate coordinates with the real position and elevation, determined after the execution, for all the invisible works (covered in time by the tailings depositions, galleries etc.) - Periodical studies of stability and evaluation of safety condition - Annual reports concerning the time behaviour - Studies and technical projects of the TMF's closure 			
	P1-P12 –flotation TMF P13-P18 CIL TMF	Stability of dams and embankments	Quarterly	- measurements performed with inclinometer columns mounted in the dambody as its rises. The accuracy of the measurements is ranging 0.2-0.3 mm/sq.m for horizontal deformations and $\pm 2-5$ mm for vertical deformations (subsidence)



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	R1-10 –TMF R27-28 lateral closure dam of the flotation TMF , R11-16 CIL TMF		2det/quarter	<p>- construction of a network of topographic landmarks – to monitor the subsidence (<i>measurement of subsidences of the foundation ground and in the dam body</i> with an accuracy of $\pm 2 - 5$ mm) and horizontal and vertical movements of the crest of wave and dam berms;</p> <p>-there will be mounted landmarks on the natural ground – witness landmarks situated on the tailings facilities along several alignments</p> <p>-determination performed with GPS station</p>
	C1-4 flotation TMF C5-8 CIL TMF		Quarterly	Telescopic Columns Subsidence Landmarks ensuring the measurement of subsidence within the dam body with an accuracy of $\pm 2-5$ mm. The columns consist of telescopic tubes made of OVC on which subsidence landmarks are mounted
		Technological characteristics		Crest of wave, guard, seepage, water turbidity, exfiltrated water, etc.
	Whole structure (evolution of the dam construction stages)	Stability of the slope , crest of wave level, discharge of leakages, seepage collection channels , guard channels, quality of rockfill material etc.	permanently	<p>Visual follow up – is performed by each shift (following a pre-set list: erosion , ravines, guard channels)</p> <p>-Excetpional inspections , for instance after strong vibrations and during the heavy rains , earthquakes , hurricanes , high floods</p>
	Paraseismic activity induced by the mining exploitation	Ground acceleration		-checking the seismic features of the zone
	Meteo station	Meteorologic values	Permanently	(liquid or solid precipitations, evaporation, air temperature, wind direction and intensity
	Hydro- chemical regime	Parameters according the water monitoring stage		



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<p>Activity to monitor the time behaviour of the dams on 3 levels – according to the provisions of Emergency Ordinance 244 of 28.11.2000 About the safety of dams , checking the compliance with performance requirments referring to the dam safety and with the Reference Document on the Best Available techniques for Tailings and Residual Sediments Management Mining Operations 4.2.1.5 Control and monitoring</p>	<p>-level I, including the visual inspections (location usual inspections of the location), measurements with the measuring and control devices and primary interpretation of results – exceeding some warning and attention values – performed by the operating staff authorized by the Ministry of Waters and Environment Protection;</p>	<p>daily</p>	<p>The dam construction will include:</p> <ul style="list-style-type: none"> • There will be drawn up construction layouts and current procedure files establishing any variation from the initial plan and if required, review of the design criteria • Construction will be supervised by an independent expert engineer/ independent geotechnical engineer <p>The files with the test results will be kept accordingly (example: consolidation works) performed for and during the construction stage.</p>
	<p>The work will be supervised by a manager or an appointed person</p>	<p>Once a month</p>	
	<p>level II, including the periodical synthesis of the ocomments, notes, measurements and annual technical inspections and their interpretation for the dam safety performed by the specialists who are drawing up the annual synthetic reports;</p>		
	<p>level III, including the analysis and approval of the annual synthesis reports completed by a commission in charge with the time monitoring of dam behaviour, organized by the holder , which membership is agreed by CONSIB and approved by the Minsitry of Environment Protection and Forests ; in ase of holders who do not organize such commissions, the review and agreement of the annual reports is done either by the commissions of other holders or groupd of specialists approved by the Ministry of</p>		



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		Environment Protection and Forests based on the technical agreement of CONSIB.		
	Synthesis of comments drawn up by the holder experts	Plans, layouts, records, test results, material quality control, etc	Once a semester	
	Periodical synthesis of the comments, measurements and annual visual inspections for the dam safety,		Annually	Completed by experts employed by the dam holder who are drawing up annual synthetic reports Urgency Ordinance 244 of 28.11.2000 about the dam safety , The compliance with the performance requirements regarding the dam safety is checked by experts and specialists certified by the Ministry of Public Works and Transport and Dwelling , the Ministry of Water and Environment protection.
<i>Tailings Management Facilities</i>	Inspection of TMF's	Formation of the beach, length	permanently	Visual inspection
		Debit turbureală		
		Water depth		
		Pressure of void water	Quarterly	
		Indicators of the lack of stability : Dirty sediments , increase of exfiltrated water , new infiltration areas, longitudinal and transverse crackings , condition of the pipelines, pumps etc.	Twice a day	Visual inspection
<i>Waste dumps</i>	R17-22 North waste dump R23-26 South waste dump	Stability of waste dump structure	Quarterly	There will be mounted topometry landmarks on the natural ground and slopes and ramps of the dumps - determinarea se va face cu Statie topografica cu GPS - periodical topographic measurements to monitor the time evolution of the variation of the ground level and the dump bench profile modification
	Control of waste rock			Physical – chemical analysis

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	consolidation			
	Visual inspection		Permanently	It is visualized if cracks, erosion, ravines, working face slide occur , he geometry of benches and berms , condition of the perimeter channels
	Entire structure		permanently	Visual inspection - Carried out by each shift (following a preset list : erosion, ravine, condition of guard channels , drains, water exfiltrated thorough the retaining wall)
			anual	Scheduled annual inspection – done by expert teams
Valea Măcriș and Hondol stream	Notch weir Water level gauge	Measuring the water flow rate and temperature	Daily	

Monitoring program of the air during the operation stage

<i>Surface adjoining the tailings management facilities</i>	Meteo station	permanently	Wind blow direction, wind speed , temperature, atmospheric pressure , precipitation amounts, sun rays	
	A8,A9,A10,A11	monthly	Total particle in suspension, PM10, NO _x , CO, Din PM10 se vor analiza As, Pb, Cd, Ni	Legea 104/2011 STANDARD 12574 -87
<i>Surface adjoining the waste dump and open pit area</i>	A1,A2,A3,A4,A7	monthly	Total particle in suspensions, PM10. The As, Pb, Cd, Ni will be analysed from the PM10	It is to be mentioned that the Romanian and European legislation do not provide any threshold values for the HCN -maximum admissible limit for the hydrocyanic acid at work places is 1 mg/mc (exposures of maximum max 15 min) according and 0.3 mg/c.m (exposure to 8 hours) as per the GD no.1218/2006 with further amendments and completions
<i>Periodical measurements of the emission at the nearest residential zone boundary (Hondol,Bocsa Mica si Bocsa Mare)</i>	A5 (soil dump), A6, A12	monthly	Total particles in suspension, PM10. The As, Pb, Cd, Ni will be analysed from the PM10	

Monitoring the emission at the plant

Source	Frequency	Indicators	Comments
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<i>Monitoring of the emissions at the electrolysis cells</i>	Charge duration	<p>Concentration of ammonia expressed in mg/Nm³</p> <p>Volumeter flow rate of the gases discharged expressed in Nm³/averaging time and in Nm³/h</p> <p>The temperature of gases at discharge expressed in °C</p> <p>Gas discharge rate expressed in m/s</p>	<p>No national or international standards for the ammonia emission measurement at the fixed source exist.</p> <p>To ensure an even better accuracy of the data it is recommended to use an automatic analyser for Nox with NH₃ converter and a gas dilution system.</p> <p>SR ISO 14164:2008</p> <p>Fixed source emissions. Determination of volumeter gaseous effluents through pipes. Automatic method</p>
<i>Monitoring of the emissions from the melting furnace</i>	Charge duration	<p>Particle concentration expressed in mg/Nm³</p> <p>Flow-rate of gases discharged expressed in Nm³/ sq.m averaging time and Nm³/h</p> <p>Temperature of discharge gases expressed in °C</p> <p>Gas discharge rate expressed in m/s</p>	<p>SR EN 13284-1:2002</p> <p>SR EN 13284-1:2002/C91:2010</p> <p>Fixed source emissions. Determination of the small mass concentrations in powders Part 1:Manual gravimetry method</p> <p>SR ISO 14164:2008</p> <p>Emissions from fixed sources. Determination of the gaseous volumetric flow-rate in the pipes. Automatic method</p>
<i>Monitoring the emissions at the active carbon regeneration plant</i>	Quarterly (Duration of each stage of the technological process (including the simultaneous ones) – collection of several samples throughout each stage (time interval established as averaging time), averaging the results per each stage and duration of the whole process)	<p>Particle concentrations expressed in mg/Nm³</p> <p>Volumetric flow-rate of discharged gases expressed in m³/averaging time and in Nm³/averaging time</p> <p>Temperature of gases at discharge expressed in °C</p> <p>Gas discharge rate expressed in m/s</p>	<p>SR EN 13284-1:2002</p> <p>SR EN 13284-1:2002/C91: 2010</p> <p>Fixed sources emissions. Determination of small mass concentration of powders. Part 1: Manual gravimetry method</p> <p>SR ISO 14164:2008</p> <p>Fixed source emissions. Determination of volumetric flow-rate of gaseous effluents of pipes. Automatic method</p>
<i>Monitoring the emission resulted at the cyanide preparation and storage</i>	Quarterly	HCN concentrations expressed in mg/m ³ – sodium cyanide preparation (stage 1 = Operation of cyanide discharge, dissolution , transfer to the storage tank processes)	There are no EN ISO standards or national ones for the measurement of the HCN emissions from sources. A method to measure it is US EPA OTM-29 (Draft method OTM-29 revised march, 2011, Other test method 29 - sampling and analysis for hydrogen cyanide emissions from stationary sources) consisting of the sampling of an



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		<p>Concentrations of e HCN expresased in mg/m³ – sodium cyanide storage (stage 2 = \at 15 - 30 minutes after the cyandie transfer to the cyanide tank)</p> <p>Volumetric flow-rate of the agses discharged expressed in m³/avweraging time (stage 1 and 2)</p> <p>Temperature of gases at their discharge expressed in °C stage 1 and 2</p> <p>Gas discharge rate expressed in m/s</p>	<p>adsorbtion solution and their analysis using the chromatographic method.</p> <p>Measurement of HCN concentrations can be done using portable instruments of micro-processors based on electrical chemical systems. ⁽¹⁾</p> <p>SR ISO 14164:2008</p> <p>Fixed sources emissions. Determination of the volumetric flow-rate of gaseous efffluent in the pipes. Automatic method</p>
<i>Permanent monitoring of the mining road and waste dump surface condition</i>	Permanently	Visually	<p>Sufficient humidity of surfaces is provided to minimize the dust amount released by the traffic and engaged by the wind during the hot and dried seasons</p> <p>By water spraying the roads and surfaces of the open pits and waste dumps</p>

(1) The portable device for measuring the HCN concentrations can be used to perform measurement tests at the active carbon regeneration and electrolysis cells in order to identify the occurrence of some eventual HCN emissions.

Monitoring program of the soil during the operation stage

Source	Sampling location	Frequency	Quality indicators	Comments
<i>Tailings management facility surface</i>	S5,S6	Half-yearly	pH, humus, dried substance, Fe _{tot} sulfates, Cr tot, Zn, Ni, Cu, Pb, Mn, As, Cd	The results obtained at the soil analysis will be compared with the <i>reference values for the chemical elements of the soil of the Table. 1.of the Annex of the Order 756/1997 – about the environment pollution assessment.</i>
<i>Surface area adjoining the waste dumps</i>	S1,S2			
<i>Surface area adjoining the open pit</i>	S3,S4			
<i>Processing plant platforms location</i>	S7			



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Noise and vibrations monitoring program

Source	Sampling location	Frequency	Location	Law regulations in force
<i>Surface area adjoining the tailings management facilities Surface area adjoining the waste dumps and open pits and pads</i>	PZ1, PZ2, PZ3 at the limit of the industrial area towards the residential area (noise and vibrations) Vibrations will be monitored in at least 3 points and in the TMFs area.	Monthly	Measurements at the limit of the residential areas	STANDARD 10009/88 STAS 12025-1 / 81 (Effects of vibrations produced by the road traffic on the buildings or parts of the buildings – measurement methods), SR 12025-2 / 94 (Effects of vibrations on buildings or parts of buildings – admissible limits)
		Monthly		

Deforestation Monitoring - Operating Stage

Monitoring measure description	Monitoring	Monitoring period	Remedying measures/monitoring results
Demarcation of lands directly impacted by the mining project Keep record of the deforested surface area	Surveying for determining the land surfaces occupied by open pit, waste dumps, tailings management facilities, etc.	Periodically until the mining operations closure	<ul style="list-style-type: none"> - Strict identification of the area occupied by the future extension of the objectives. - Strict identification of all plots of land (forest, pasture, agricultural, etc), the use of which is to be changed, comprised within the objectives extension areas. - Strict identification and marking out with stakes of all plots of land that are to be deforested. - Periodical checking of stakes and observing the boundaries of the deforested surface area.
Demarcation of land surfaces that are to be ecologized / forested during this period Checking the ecologization works performed	Surveying for determining the land surfaces within Certej open pit and North and South waste dumps that can be ecologized. - Field observations of the evolution of plantations made.	Periodically until the mine closure	<ul style="list-style-type: none"> - Strict identification and marking out with stakes all areas that can be ecologized/forested. - Checking the stakes and observing the boundaries of the ecologized/forested surface area. - Identifying and replacing all dried plants and trees.

Waste Monitoring – Operating Stage



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Source	Monitoring measure description	Monitoring period	Indicators	Observations
<i>Location of further construction and operating works</i>	Keep record of non-mining waste management (garbage, used oils, metallic waste, etc)	Monthly	Collected, eliminated and/or reused quantities	Reporting according to the legislation in force
	Keep record of mining waste management: soil resulting from stripping, waste rocks, flotation tailings, CIL tailings	Daily	Quantities Flow rate of slurry discharged into the TMFs	
	Chemical assays for the composition/acid water generation potential of the waste rocks to be deposited in the waste dumps	Half-yearly	pH, sulphur, carbonates, sulphates, SiO ₂ , Fe oxides, CaO, MgO, Al ₂ O ₃ , heavy metals	ABA test (or AP/NP test or Sulphur content test) performed annually
	Chemical assays and levigation tests for the flotation and CIL tailings	Half-yearly	Chlorides, sulphates, heavy metals (Cu, Pb, Zn Cd, Ni, Cr and As)	ABA test (or AP/NP test or Sulphur content test) performed annually

Technological Process Monitoring

Process stage	Monitoring measure description/indicators	Monitoring period	Observations	
Grinding-Classing	Ore feed rate	Permanently	377 t/h	Automatic measuring
	Dilution water addition at cyclones	Permanently	349 m ³ /h	Automatic measuring
	Dedusting system	Permanently		Visually, automatic control
Flotation and regrinding	Air flow rate for cell feeding	Permanently	248 Nm ³ /min	Automatic measuring
	Water level in sumps	Permanently	Preset level	Automatic measuring
	Water flow rate at tailings regrinding cyclones	Permanently	1 m ³ /h	Automatic measuring
Concentrate thickening	Density of thickened pulp	Permanently	1,72 t/m ³	Automatic measuring



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	Flocculant feeding flow rate	Permanently	0,1 m ³ /h	Automatic measuring
	Thickness of bed in the thickener	Permanently	Preset level	Automatic measuring
	Level of the thickener overflow basin	Permanently	Preset level	Automatic measuring
Flotation tailings thickening	Density of thickened pulp	Permanently	1,6 t/m ³	Automatic measuring
	Flocculant feeding flow rate	Permanently	2 m ³ /h	Automatic measuring
	Thickness of bed in the thickener	Permanently	Preset level	Automatic measuring
	Level of the recycled water basin	Permanently	Preset level	Automatic measuring
IsaMill ultrafine grinding	Pulp input flow rate in IsaMill	Permanently	60,8 m ³ /h	Automatic measuring
	IsaMill feed pulp density	Permanently	1,4 t/m ³	Automatic measuring
	Dilution water flow rate at IsaMill feed	Permanently	21,3 m ³ /h	Automatic measuring
	Isa Mill lubrication systems, 3MW engine, reductor and bearing systems	Permanently	Maintain optimum operating parameters	Automatic measuring
	Water flow rate and pressure from IsaMill seal glands	Permanently	3 m ³ /h	Automatic measuring
Albion oxidation	Feed rate of Albion leaching tanks	Permanently	61,3 m ³ /h	Automatic measuring
	pH of each Albion leaching tank, Eh	Permanently	5-5,5	Automatic measuring and adjustment of limestone dosage
	Temperature of each Albion tank	Permanently	90-95oC	Automatic measuring
	Oxygen flow rate blown in the Albion leaching tanks	Permanently	23,1 t/h	Automatic measuring
	Dilution water flow rate at each Albion leaching tank feed	Permanently	187,4 m ³ /h	Automatic measuring



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Albion leaching product thickening	Density of the thickened product	Permanently	1,6 t/m ³	Automatic measuring
	Thickness of the bed in the thickener	Permanently	Preset level	Automatic measuring
	Flocculant flow-rate	Permanently	13,7 m ³ /h	Automatic measuring
Albion product neutralisation and cooling	pH of the slurry from the neutralisation tank	Permanently	10,5	Automatic measuring and adjustment of lime dosage
	Level in the neutralisation tank	Permanently	Preset level	Automatic measuring
	Cooling tower inlet temperature	Permanently	98 oC	Automatic measuring
	Cooling tower outlet temperature	Permanently	45 oC	Automatic measuring
	Flow-rate of the slurry discharged from the cooling tower	Permanently	82,5 m ³ /h	Automatic measuring
	Density of slurry from CIL feed	Permanently	1,36 t/m ³	Automatic measuring
CIL leaching	CIL feed samples	Permanently	pH	Automatic measuring
	pH of the slurry and cyanide content in tanks 2 and 6	Permanently	pH=10,5 CN- = 0,3%	Automatic measuring and adjustment of lime and cyanide dosage
	Cyanide flow rate in the tanks	Permanently	1 m ³ /h	Automatic measuring
	Slurry level in the CIL tanks	Permanently	Preset level	Automatic measuring
	Flow rate of air blown in each CIL tank	Permanently	1250 Nm ³ /h	Automatic measuring



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	Carbon level in the loaded carbon tank	Permanently	Preset level	Automatic measuring
CIL tailings thickening and pumping	Density of the thickened product	Permanently	1, 63 t/m ³	Automatic measuring
	Thickness of the bed in the thickener	Permanently	Preset level	Automatic measuring
	Flocculant flow rate	Permanently	6,3 m ³ /h	Automatic measuring
	Level in the tank for the thickener overflow	Permanently	Preset level	The level in the tank for the thickener overflow is controlled for a maximum level by opening the control sluice of the pipe to Inco Detox and over a minimum level by controlling a valve of the recycled water addition pipe to CIL TMF.
Acid washing	Level of the HCl solution in the recycling tank	Permanently	Preset level	Maintain a minimum and maximum level
	pH in the acid neutralisation tank	Permanently	10,5	Automatic measuring and adjustment of lime dosage
	Level of the solution in the washing column	Permanently	Preset level	Automatic measuring
	Acid input rate in the acid washing column	Permanently	46 m ³ /h	Automatic measuring
	Raw water flow rate at the acid washing	Permanently	46 m ³ /h	Automatic measuring
Elution circuit	Temperature in the elution column	Permanently	130 oC	Automatic measuring
	Pressure in the elution column	Permanently	2,5 bari	Automatic measuring



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	Solution level in tanks	Permanently	Preset level	Automatic measuring
	Temperature in the heating assembly	Permanently	140 oC	Automatic measuring
Carbon regeneration	Temperature in the regeneration furnace	Permanently	750 oC	Automatic measuring
Electrowinning and melting	Power supply for electrolysis	Permanently	Optimized depending on the surface of the electrodes	Automatic measuring
	Pressure at the mud filter	Permanently	6-16 bars	Automatic measuring
DETOX I	pH, tank feed and discharge, CN _{WAD}	Permanently	Automatic measuring of pH, CN _{WAD} , Tank inlet/outlet sampling device	
	Copper sulphate flow rate	Permanently	Automatic measuring	
	Sodium metabisulphite flow rate	Permanently	Automatic measuring	
	Air flow rate at the inlet	Permanently	Automatic measuring	
Acid water treatment plant	Input flow rate	Permanently	Automatic measuring	
	Flocculant dosage			
	Lime dosage, pH, level in the tank			
	Water discharged from the plant	Sampling device	Analyses performed in own laboratory	
DETOX II	Input flow rate	Permanently	Automatic measuring	
	Ph		Cyanide is continuously measured for the water discharged	
	Oxygen peroxide flow rate			



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	Flocculant flow rate		
	CN water discharged		

Risk Monitoring

<i>Monitoring location</i>	<i>Monitoring measure description</i>	<i>Frequency</i>	<i>Indicators</i>	<i>Observations</i>
Flotation tailings management facility	Dam safety permanent control by safety parameters measurements	Daily	Crest safety elevation compared to the water surface level and length of beaches	These parameters must have lower values than the ones established by the dam operating rules
			Water level in piezometers and analysis of evolution in time	
			TMF water balance based on the level measurements of the TMF water surface, flow rate of water discharged into the TMF and flow rate of clarified water discharged from the TMF	It is aimed to permanently maintain an equilibrium between the water quantities discharged into and from the TMF.
			Permanent meteorological measurements (precipitations, snow layer, etc)	In case of exceeding the level of precipitations and/or snow melting established by the dam operating rules , the necessary intervention measures are applied.
Flotation tailings management facility	Dam safety permanent control by safety parameters measurements	Daily	Crest safety elevation compared to the water surface level and length of beaches	These parameters must have lower values than the ones established by the dam operating rules
			Water level in piezometers and analysis of evolution in time	
			TMF water balance based on the level measurements of the TMF water surface, flow rate of water discharged into the TMF and flow rate of clarified water discharged from the TMF	It is aimed to permanently maintain an equilibrium between the water quantities discharged into and from the TMF.
			Permanent meteorological measurements (precipitations, snow layer, etc)	In case of exceeding the level of precipitations and/or snow melting established by the dam operating rules , the necessary intervention measures are applied.



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Processing plant	Permanent control of accidental emissions into the atmosphere	Permanently and continuously	Automatic sensors for detecting the presence of the hydrocyanic acid in the atmospheric air	When the HCN concentrations exceed the imposed limits for hydrocyanic acid, the acoustic alarm starts. The admissible limit is 1 mg/c.m (exposures of min. 15min) according to the norms issued by the work protection department, year 2002.
North and South waste dumps	Waste dump stability control	Daily	Visual control	It is observed the occurrence of cracks, erosions, ravines, active face slides, geometry of benches and berms, perimeter channels condition
		Quarterly	Topographic measurements (there will be installed topometric marks in the natural ground and on the waste dump slopes and platform)	Monitoring the evolution in time of the base ground level variation and of the waste dump bench profile modification
		Weekly	Measurements of water level in piezometers	Analysis of the evolution in time
Hydrotransport pipeline	Integrity control of each pipe	Daily	Visual control	It is monitored the occurrence of fissures, deformations, etc.
		Permanently and continuously	Automatic control of pressure and flow rates at the two ends of each pipe	Any abnormal variation of the difference of pressure or flow rate indicates the formation of a plug or of a crack on the route
The whole site	Identification, reporting and documentation of incidents	Anytime it is needed	Causes and consequences of incidents	It is monitored whether a certain type of incident occurs repeatedly as well as the efficiency of the corrective measures applied

III. CLOSURE STAGE

Water quality monitoring program during the closure stage

Source	Sampling location	Frequency	Quality indicators	Observations
<i>Open pit acid waters North waste dump acid</i>	ARD treatment plant influent	Permanently	- Flow rate, pH	The treatment plant is provided with permanent monitoring system of the



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<i>waters</i> <i>South waste dump acid</i> <i>waters</i>		Monthly	Flow rate - pH, CBO ₅ , CCOCr Fe, Cu, Pb, Zn, Mn, sulphates, fixed residue	pH, input flow rate and flocculant dosage
	ARD neutralisation plant effluent	Permanently	- Flow rate, pH	The effluent quality must not deteriorate
		Monthly	- Flow rate - pH, CCOCr, CBO ₅ , Ca, Fe, Cu, Pb, Zn, Mn, sulphates, fixed residue, suspended matters, alkalinity	
		Annually	Thiobacillus Ferrooxidans - Thiobacillus Thiooxidans	
<i>Surface water and</i> <i>sediments</i>	W7 (Hondol Valley), W8(Hondol Valley), W9 (Grozii stream), W10 (Baiaga stream) W11 (Coranda stream), W12 (Măcriș stream), W13 (upstream CIL TMF) W14 (Borzei stream)	Quarterly/Half-yearly	- pH, CCOCr, filterable residue dried at 105 ⁰ C, nitrates, nitrites, chlorides, sulphates, Fe, Cd, Cr, Ca, Cu, Pb, Ni, Zn, Mg, Mn.	Order of the Ministry of Environment and Water Management 161/2006 – Monitoring of Hondol Valley water quality – it has to be improved.
<i>Sewage</i>	Sewage treatment plant effluent	Daily	- Flow rate - pH, CCOCr, CBO ₅ , extractable substances, detergents, sulphates, nitrates, chlorides, suspended matters	The plant remains in operation until the ecologization works are completed.
<i>Clarified water</i> <i>discharged from the</i> <i>flotation tailings</i> <i>management facility</i>	Treatment plant influent	Permanently	- Flow rate, pH	The treatment plant is provided with permanent pH, flow-rate and flocculant monitoring system
		Monthly	Flow rate - pH, CCOCr , Fe, Cu, Pb, Zn, Mn, sulphates, fixed residue	
	Treatment plant effluent	Permanently	- Flow rate - pH	The treatment plant is provided with



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		Monthly	Flow rate - pH CCOCr, Ca, Fe, Cu, Pb, Zn, Mn, sulphates, fixed residue, suspended matters, alkalinity	permanent pH and flow-rate monitoring system
<i>Clarified water from CIL TMF collected and treated in DETOX II</i>	Treatment plant influent	On a daily basis during the operating stage	- Flow rate - pH, cyanide	The treatment plant is provided with permanent monitoring system of the pH and input flow rate as well as of the cyan ion, copper sulphate and oxygenated water.
	Treatment plant effluent		- Flow rate - pH, CCOCr, Ca, Fe, Cu, Pb, Zn, Mn, sulphates, fixed residue, suspended matters, cyanide	The plant is provided with automatic sampling device for cyanide analysis
<i>Water from hydrogeological drill holes</i>	PS1, PS2, PS3, PS4, PS5 (downstream TMFs), PS6 (CIL TMF)	Quarterly	pH, conductivity, sulphates, ammonium, nitrates, total cyanide (PS6), Pb, Cu, Fe total, Mn, Ni, Zn, As	
	Fh1 Fh2, Fh3, Fh4 at CIL TMF		pH, conductivity, sulphates, ammonium, nitrates, total cyanide (PS6), Pb, Cu, Fe total, Mn, Ni, Zn, As	
<i>Permanent monitoring of Hondol stream water quality</i>	Automatic plant located downstream right after the confluence with Baiaga Valley	Permanently	pH, conductivity and cyanide content are automatically determined	

Air quality monitoring program during the closure stage

<i>Surface area adjacent to the tailings management facilities</i>	Meteorological station	Permanently	Wind direction, wind speed, temperature, atmospheric pressure, quantity of precipitations, solar radiation	
	A8,A9,A10,A11	Monthly	Total suspended particulates, PM10, NO _x , CO, Of PM10, there will be analysed As, Pb, Cd,	Law 104/2011 STAS 12574 -87 It has to be noted that there are no limit

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			Ni	values for HCN in the Romanian and European legislation
Surface area adjacent to the waste dumps and open pit	A1,A2,A3,A4,A7	Monthly	Total suspended particulates, PM10. Of PM10, there will be analysed As, Pb, Cd, Ni	
There will be performed periodical measurements of emissions at the limit of the closest residential areas (Hondol, Bocsa Mica and Bocsa Mare)	A5 (soil waste dump), A6, A12	Monthly	Total suspended particulates, PM10. Of PM10, there will be analysed As, Pb, Cd, Ni	

Soil Monitoring Program – Closure Stage

Source	Monitoring points	Frequency	Indicators	Observations
TMFs surface	S5,S6	Half-yearly	pH, humus, dried substance, Fe _{tot} sulphates, Cr _{tot} , Zn, Ni, Cu, Pb, Mn, As, Cd	The soil assay results will be compared with the reference values for the chemical elements in soil, specified in Table no.1 of Appendix of Order 756/1997 – regarding the environmental pollution assessment.
Surface adjacent to waste dumps	S1,S2			
Surface adjacent to open pit	S3,S4			
Platform site	S7			

Noise and Vibrations Monitoring Program

Source	Sampling location	Frequency	Location	Legal norms in force
Surface adjacent to TMFs Surface adjacent to waste dumps, open pit and platforms	PZ1, PZ2, PZ3 at the limit of the industrial area towards the residential area (noise and vibrations) Vibrations will be monitored in at least 3 points and in the TMFs area	Monthly	Measurements at the residential areas limits, at the site limit respectively	STAS 10009/88
		Monthly		

Monitoring of Waste Facilities Stability



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Source	Monitoring	Parameter	Frequency	Observations
<i>TMFs dams and TMFs surface</i>	P1-P12 – flotation TMF P13-P18 CIL TMF	Physical stability	Half-yearly	- Inclinomeric columns - they are mounted in the dam body as the dam rises. The measurement precision is 0.2-0.3 mm/sq.m for horizontal deformations and $\pm 2-5$ mm for vertical deformations (subsidence)
	R1-10 – flotation TMF, R27-28 lateral closure, R11-16 CIL TMF		Half-yearly	- Topographic marks - a topographic mark network will be set up to monitor the dams and TMFs platform surface subsidence and movement; - there will be installed marks in the natural ground – landmarks, located on slopes and marks located on TMFs, on more lines - determination will be performed with the help of a topographic station with GPS
	Visual monitoring		Permanently	Monitoring of erosion, ravines, guard channels condition, exfiltrated water, suffusion, revegetation Exceptional inspections after extreme events: earthquake, high floods, hurricane, floods, landslides, avalanches
	Planned annual inspection		Annually	It will be done by a specialist team
<i>Meteorological station</i>		Meteorological parameters	Permanently	
<i>Waste dumps</i>	Topographic marks R17-22 – North waste dump; R23-26 South waste dump		Half-yearly	- a topographic mark network will be set up to monitor the waste dump surface subsidence and movement
	Visual monitoring		Permanently	Monitoring of erosion, ravines, guard channels condition, drain channels, exfiltrated water, abutment wall, revegetation
	Planned annual inspection		Annually	It will be done by a specialist team



<i>Tailings facilities</i>	Underground water drill holes, exfiltration water quality, treatment plant water quality	Chemical stability	Permanently	
	Starea florei și faunei după revegetarea instalațiilor de deșeuri	Biological stability	Half-yearly	

Revegetation Work Monitoring Program – Closure Stage

Monitoring measure description	Monitoring	Monitoring period	Remedying measures/monitoring results
Spatial delimitation of land surfaces to be ecologized for their reuse for agricultural and other purposes, after the closure of the mining objectives (TMFs, waste dumps, processing plant)	Topographic measurements to determine the land surfaces left to be rehabilitated and ecologized	Periodically until the end of the closure and revegetation works	- strict identification and marking out of all areas that have to be ecologized by afforestation works, according to the technical closure study. - checking of the revegetated locations
Monitoring the evolution of vegetation on the surfaces seeded or planted with forest vegetation	Observations regarding the evolution of vegetation, visual modifications of the surface condition, etc	Half-yearly, after the completion of the revegetation works until the plantations grow up	- identification of all dried plants and trees and their replacement with other saplings.

Waste Monitoring – Closure Stage

Source	Monitoring measure description	Monitoring period	Indicators	Observations
<i>The site where the dismantling, rehabilitation and ecologization works are performed</i>	Keep record of the non-mining waste management (garbage, spent oils, metallic waste, waste resulting from demolition works, etc)	Monthly	Collected, eliminated and/or recovered quantities	Reporting according to the legislation in force
	Keep record of mining waste management: soil from vegetal soil dumps	Daily	Quantities used for ecologization	

Note: the monitoring points indicated in the tables are marked on the monitoring drawings associated to the documentation on which basis the environmental permit was issued.
Revised .Modification of the monitoring points will be notified to APM Hunedoara.



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BIODIVERSITY MONITORING

Protocol 1 Monitoring Of The Habitats

Indicator: Surface of the habitats. Conservation status of habitats.

Justification: Habitats will change on the surface and in the conservation status due to impacts of the project. The impact will occur both on the project footprint area and in the immediate vicinity. This protocol will also monitor the habitats of the species for which the natura 2000 metaliferi mountains site was designated.

Attributes: Surface of the habitats. Conservation status of habitats.

Sampling protocols

Number of the monitoring zones : A buffer area around the project footprint. Distribution and selection of monitoring areas. A buffer area around the project footprint.

Size of the monitoring zones: The buffer area will be of 3 km width.

Locating / marking of the monitoring zone: Selected area will be mapped, will be marked on ortho-photoplans, the Stereo 70 coordinates will be presented in table. The area will not be marked in site in order not to interfere with markings of the forest authorities.

Data collection

Detailed information on the data collected and method of collection

Aerial photographs of the area to be monitored will be acquired and analyzed. All habitats that will change will be analyzed on site. There will be made dynamic habitat maps; maps from different years will be compared. Any difference between old and new maps will be inspected on site, affected areas will be measured and the differences in conservation value will be described along with causes of these changes.

Data collection format

Frequency and programming of monitoring activities: First analysis will be performed in year 1. Analysis will be repeated every 3 years.

Management and data analysis protocols

Data storage and information management

Aerial photographs and maps based on their analysis will be stored in electronic format and printed. Analysis will be stored in electronic format and printed.

Data analysis procedures : Simple comparison of the maps. Comparison of descriptions of the habitats' conservation status.

Reporting format and the results communication process

Reports will be short, with conclusions marked by "bullet points", graphics. Reports will be delivered to the environmental department of the company and then they will be submitted to Environment Agency.

Biodiversity monitoring plan for the area of the mining perImeter certej Protocol 2

Indicator: Plant populations within the impact area and neighborhood. Plant associations within the impact area and neighborhood.

Justification: Orchid species are species that occur in some red lists published in Romania..

Attributes:

Attributes: Relative abundance



Sampling protocols

Number of the monitoring zones: 15 transects with test markets.

Distribution and selection of transects/ monitoring markets : Transects shall be distributed around the project footprint and within the project so that shall cover the habitats of the target plants.

Size of the transects: Transects shall be 30m long.

Locating l marking of transects: Transects shall be marked on maps.

Stereo 70 coordinates for start and finish will be shown as table. The start and finish points will be marked on site by pegs. The center of the test markets will be marked on maps and in site. Will be prepared a detailed description of transects.

Frequency and programming of monitoring activities : Site analysis will be performed annually between May - June. Each year will be assigned 7 days for site activity and at least 7 days for data analysis.

Water management and analysis protocols

Data storage and information management : Data will be collected in two photocopied sets at the head offices of Deva Gold and Consultant. Information will be imported into Excel files by consultants. There will be conducted two sets of data stored on company and consultant computers.

Data analysis procedures and details on the statistical methods used :

Coverage will be estimated for each transect. Each transect will be considered as a separate specimen. Annual differences of the same set of transects can be identified by calculating the differences on coverage. When changes are apparent abundance of species can be compared annually using various statistical tests (e.g. T-test) and the trend will be monitored over time using progressive regression.

Reporting format: Reporting will be done annually by brief, explicit notes, with graphs and recommendations.

Biodiversity monitoring plan for the area of the mining perimeter certej Protocol 3 – Monitoring of the Macro-zoo-benthos

Indicator: macro-zoo-benthos

Justification: Quality of the streams from the project impact area is significantly impaired by the historical impact of the old underground and surface mining.

Starting at the confluence of the Macris creek with Coranda creek and up to the confluence of the Certej river with Mures river, there is noticed the biological destruction phenomenon produced by the impact of the mining operations and water pollution with domestic waters produced by communities from localities that are not provided with sewage system.

Macro-zoo-benthos is the best and the easiest to study indicator regarding the water quality of a lotic system.

Attributes: species composition, density, abundance, biological indices.

Number of collecting stations : There will be used a minimum of 10 macro-zoo-benthos collection stations.

Distribution of collecting stations : Stations will be located at equal distances of about 1.5 km. The first will be placed downstream from the second tailing pond from Macris Valley, the last station being placed in the area were Certej river flows into Mures river.

Size of plots/sites for monitoring: At least 0.09 m²/station, representing the area of the surber.



Locating and marking of the collecting stations: GPS coordinates of each point will be stored in a database. Stations will be marked on maps and on the ground by visible markings. Descriptions of each station will be gathered in a dedicated database.

Frequency and monitoring programming : Data will be collected at least 4 times a year (after melting of the ice, during summertime, autumn and before the first frost). If there will occur external factors (severe pollution, commissioning of water treatment plants and water detoxification, etc.) there will perform further collection and analysis sessions.

Data management and analysis

Data storage and information management

All the primary data are the common property of Deva Gold SA and Consultant. Electronic data will be copied on computer or external hard drives for back up and will be printed and stored in this format.

Data analysis procedures

There will be calculated densities, abundances and frequencies using classical statistical methods. Indices of water quality will be calculated by classical methods.

Reporting and results communication

Reports sent to the environmental department of the company shall be simple and concise. It will be made a general report at the end of year, which will be submitted to the environmental agency designated to verify these reports. Any significant change in water quality (severe pollution, cleaning of water) shall be immediately reported.

Biodiversity monitoring plan for the area of the mining perimeter certej Protocol 4 – Monitoring of amphibians

Measure/ Indicator: Amphibians species, relative abundance of each species.

Justification: Amphibians are sensitive to changes in aquatic and terrestrial habitats. This group is protected at European level. Changes in population size may indicate damage or restoration of habitat.

Attributes: Composition of species, relative abundance:

Sampling protocols

Number of the monitoring lands / points: In the first year of monitoring first of all will be marked on the map the area of the ponds. This will mean mapping all permanent ponds and areas where can form semi-permanent ponds favorable for amphibians breeding. These areas will be checked in the breeding season to identify which areas are commonly used by species of amphibians. After identifying distribution of potential areas with amphibians, will be selected a number of up to 15 representative ponds as a basis for long-term monitoring.

Distribution of monitoring units: Based on the study of basic situation, the most representative permanent and semi-permanent ponds. There will be included ponds from different areas of the zone.

Size of monitoring units: Will be sought all the representative and semi-permanent ponds. A number of maximum 15 will be used in the long-term monitoring.

Locating / marking of the specific points: There will be GPS and map entries registered for each permanent and semi-permanent pond to help relocate in the coming years. It will include instructions to reach each of these places.



Frequency and programming of repeated monitoring activities : Usually amphibian populations are best evaluated after mating and mating season. The census will be repeated annually.

Data management and analysis protocols

Data storage and information management

Data on the position of ponds with amphibians shall be kept confidential (in case the risk of interest to collectors). GIS shall be updated to track past and present records of the amphibians distribution. Locations and number of specimens shall be input in computer. Computer records will be backed up and the original entries shall be stored.

Reporting format and the results communication process

Reports shall be short with subheadings and graphics to ensure development of the appropriate actions by the company's environmental department management.

Biodiversity monitoring plan for the area of the mining perimeter Certej Protocol 5 – Monitoring of the birds that depend on the creeks

Indicator: The Grey Wagtail (*Motacilla cinerea*), White-throated Dipper (*Cinclus cinclus*), Common Sandpiper (*Actitis hypoleuca*)

Justification: Food supply on the species dependent on streams and rivers depends on water quality and density variations of these species can be linked to this parameter. The project may significantly affect water quality in case of accident. Investor assumed ARD collection and treatment from site, appearance of some species and increased density of species already present, can be used as a criterion for certification of increasing the water quality in rivers.

Attributes: The attributes measured are concerning the relative abundance and densities of the species indicator, per km.

Sampling protocols

Number of lands/ monitoring points: Five transects

Distribution and selection of lands/ monitoring points: Transects shall be distributed evenly from the flowing area of the Certej river to the second tailing pond from Macrisului Valley.

Size of lands/ monitoring points: Five transects, of 1.5 km each.

Location /marking of specific points: Transects shall be marked on a map. Every year the same fixed routes shall be covered. Route description and location of the main points of monitoring will be done in writing. Both ends shall be marked on the ground and on the maps.

Frequency and programming of repeated monitoring activities

Ideally, the census will be made twice a year, once in April - mid May and the first part of June. Transects shall be monitored five days by consultant biologists and delegates of Deva Gold.

Reporting format and the process of results communication to Company's management

The study of the rivers shall be briefly centralized in the annual report on the monitoring progress submitted to company's environmental manager. If no significant changes are found, this will be stated as such. Any questions about the accuracy of the census shall also be recorded. Where significant changes are recorded, the data will be presented on the sub-paragraphs, or in graphical form, as appropriate. If from results are found statistical significance, statistical data shall be reproduced and interpreted. The implications of these results shall be highlighted as subheadings as well as management actions and / or recommended further research.



Biodiversity monitoring plan for the area of the mining perimeter certeji Protocol 6 – Monitoring of the woodpeckers and, in particular, of those of community interest

Indicator: Woodpecker populations

Justification: All species of woodpeckers recorded in the area are classified as protected. Woodpeckers are affected largely in Romania by loss of habitat from deforestation. Some species are indicative of changes in forest or grove habitats.

By implementing this protocol there will also be monitored the woodpeckers species, criterion for designation of natura 2000 metaliferi mountains site (Dendrocopos Leucotos, Dryocopus Martius, Dendrocopos Medius And Picus Canus) on the area affected from site and from other areas affected by project.

Attributes: Species of nesting woodpeckers. Attributes measured are on densities and relative abundance.

Sampling protocols

Number of the monitoring units - There will be defined ten transects.

Distribution and selection of lands/ monitoring points

Independent routes (not linked to each other) (transects) will be distributed on areas and key habitats in forests from the area around the mining areas and other forests remaining within the mining site. The census will also include some areas such as orchards, gardens and wooded pastures.

Size of the monitoring units: Transects will be linear. Transects will be of about 3km (abundance will be estimated for each km traveled). Fixed counting points will be established every 100 m. Birds will be observed on distances of 25-50m from the forest observation plots and on 50-100 m in open field.

Location /marking of specific points: Routes will be marked on a map. Every year the same fixed routes will be covered. description of the Route and tracking points location will be in writing.

Frequency and programming of repeated monitoring activities: Studies will be made between March 10 and June 10. Census will be repeated each month (March-June) and every year.

Reporting format and the results communication process : Woodpeckers census shall be briefly centralized in the annual report on the monitoring progress submitted to company's environmental manager. If no significant changes are found, this will be stated as such. Any questions about the accuracy of the census shall also be recorded. Where significant changes are recorded, the data will be presented on the sub-paragraphs, or in graphical form, as appropriate. If from results are found statistical significance, statistical data shall be reproduced and interpreted. The implications of these results shall be highlighted as subheadings as well as management actions and / or recommended further research.

Biodiversity monitoring plan for the area of the mining perimeter certeji Protocol 7 – Monitoring of the nesting birds

Indicator: Nesting bird populations are easily monitored and represent very good indicators for estimation of habitat quality. Some nesting birds species are criteria species for the designation of Natura 2000 Metaliferi Mountains site.



Justification: Nesting bird species recorded in the area are listed in different Annexes of nature protection legislation in Europe and Romania. Birds are an excellent indicator of changes in habitat and of other forms of impact.

By implementing this protocol there will also be monitored the birds species, criterion for designation of natura 2000 metaliferi mountains site (*Lullula arborea*, *Ficedula albicollis*, *Lanius collurio*) on the area affected from site and from other areas affected by project.

Attributes: Focus on nesting species. Attributes measured concern relative abundance, the densities and presence / absence of some species.

Sampling protocols

Number of the monitoring units - At least seven transects.

Distribution and selection of lands/ monitoring points: It will use a stratified random selection to include all major habitat types.

Size of lands/ monitoring points: Routes will be linear, of about 3 km length.

Location /marking of specific points: Routes will be marked on a map. Every year the same fixed routes will be covered. Description of the route and of the tracking points location will be made in writing. Start and end points will be marked on the ground by metal rods or by colored marks on trees.

Frequency and programming of repeated monitoring activities

It is necessary to visit at the beginning (April-mid May) and at the end (mid May-June) to maximize the chances of recording local nesting specimens and migratory species that nest later on.

Reporting format and the process of results communication to Company's management

The census of the brooding birds shall be briefly centralized in the annual report on the monitoring progress submitted to company's environmental manager. If no significant changes are found, this will be stated as such. Any questions about the accuracy of the census shall also be recorded. Where significant changes are recorded, the data will be presented on the sub-paragraphs, or in graphical form, as appropriate. If from results are found statistical significance, statistical data shall be reproduced and interpreted. The implications of these results shall be highlighted as subheadings as well as management actions and / or recommended further research. The decline of raptors will also be reported to the forest departments and to the hunting associations.

Biodiversity monitoring plan for the area of the mining perimeter certej Protocol 8 – Monitoring of the diurnal raptors

Indicator: Raptors population.

Justification: Several of raptors species recorded in the area are classified as rare. Some of diurnal raptors species are species criterion for designation of Natura 2000 Metaliferi Mountains site.

Being pray species, the raptors provides an indication of the abundance of animals that hunt in the area, caused by changes in ecosystem. By implementing this protocol there will also be monitored the diurnal raptors species criterion for designation of natura 2000 metaliferi mountains site (*aquila chrysaetos* and possibly other species in case that will be observed) on the area affected from site and from other areas affected by project.

Attributes: Focus on brooding birds species. Attributes measured concern the relative abundance and nests number of the raptors species.

Sampling protocols



Number of the monitoring units: There will be placed 5 observation points at the limit of the project footprint.

Distribution and selection of monitoring units: In areas with the highest visibility over the buffer zone and the footprint of the project.

Size of the monitoring units: Observation points.

Location /marking of specific points: Points shall be marked on the map. Each year shall be used the same fixed observation points. Description of the observation points shall be made in writing.

Frequency and programming of repeated monitoring activities: Studies will be done between March 10 and June 10. Census will be repeated each month (March-June) and every year.

Data management and analysis protocols

Data storage and information management

An Excel database will be made containing raptors observations that will include "the total number of specimens per km²" on each target species. Consultant biologist will handle the data management. Data will remain the common property of consultants - Company. Moreover, the data shall be made available to national databases. Backup data will be kept in another system, at the head offices of the data owners. It shall keep the original data sheets.

Methods of data analysis and details of statistical methods to be used

Variables "specimens per unit of search effort or per km²" for each species will be filled in for all the monitoring years. There will be taken into account „total raptors per observation point”.

Data will be entered in a regression analysis statistical program for at least four years of collected data. In addition, the average number of specimens per point / year (on all transects) will be used for graphical representation of data in an easily accessible form. A level of $p < 0.05$ will be considered a significant relation in time.

Reporting format and the process of results communication to Company's management

Census of the raptors shall be briefly centralized in the annual report on the monitoring progress submitted to company's environmental manager. If no significant changes are found, this will be stated as such. Any questions about the accuracy of the census shall also be recorded. Where significant changes are recorded, the data will be presented on the sub-paragraphs, or in graphical form, as appropriate. If from results are found statistical significance, statistical data shall be reproduced and interpreted. The implications of these results shall be highlighted as subheadings as well as management actions.

Biodiversity monitoring plan for the area of the mining perimeter certej Protocol 9 – Monitoring of the mammals through the method of the traces reading during winter

Measure/ Indicator: Mustelids, red fox, ungulates

Justification: Some species are listed on special lists in Romania or international, being of national or community importance.

Attributes: Relative abundance, territory and use of the habitats

Sampling protocols

Number of lands/ monitoring points: 5 transects will be selected within the mining site and its immediate vicinity.

Distribution and selection of lands/ monitoring points: Routes (transects) will be defined in the main habitats. It may be necessary to use flexible transects, but it is preferable to be able to walk



on the same visible paths and major roads every year. Transects will be connected by a route that can be traveled in one working day.

Size of the monitoring transects: Completion of the routes will be made in about a day (about 5 km per day). Start and end observation points will be defined according the areas known as habitat for carnivores. Each transect will be followed for three times in winter, at intervals of at least a week and after the snowfall.

Location /marking of specific points: Transects shall be marked on a map. Every year the same fixed routes shall be covered. Route description and location of the main tracking points will be done in writing.

Frequency and programming of repeated monitoring activities

The study will be done in the winter. It will have to consider the seasonal activity rhythms of different species. If snow cover is deep, ungulates concentrate on the feeding areas, usually in valleys. So, there are so-called "concentration points" that can be taken into account in the census. Study will be made annually during the winter once / month.

All transects must be covered in one day to avoid the statistical complications. The interval for continuation of censuses should be as short as possible.

Whenever possible, the census will be repeated on the same date each year, if weather permits. Weather conditions and snow depth are the main factors influencing the scheduled date and time.

Data management and analysis protocols

Data storage and information management

Data storage and analysis is the responsibility of the consultant biologist. Data will remain the common property of consultants and of the company. Large or low density mammals areas will be integrated into a GIS system. Backup data will be kept in another system. The original data sheets will be preserved.

Methods of data analysis and details of statistical methods to be used: Will be designed an Excel database on large mammal species. Data from similar habitats can be grouped on each transect section to compare the use of the habitat type. Note that the low number of detected traces records causes an abnormal distribution of data. It is recommended that for the analysis of trends to use non-parametric statistical procedures (e.g. Kursk-Wallis test of analysis of variance or the multiple comparison Dunn test). To avoid the temporal pseudo repeating-of the tracking data collected at different snow in the analysis will be used the average number of traces observed on each transect during a month census.

Reporting format and the process of results communication to Company's management

The census of the mammals shall be briefly centralized in the annual report on the monitoring progress submitted to Deva Gold environmental manager. If no significant changes are found, this will be stated as such. Any questions about the accuracy of the census shall also be recorded. Where significant changes are recorded, the data will be presented on the sub-paragraphs, or in graphical form, as appropriate. If from results are found statistical significance, statistical data shall be reproduced and interpreted. The implications of these results shall be highlighted as subheadings as well as management actions and / or recommended further research.

Biodiversity monitoring plan for the area of the mining perimeter certej Protocol 10 – Monitoring of the bats in the feeding territories



Measure/ Indicator: Bats species

Justification: Bats are sensitive to changes in habitat and resting places, and some species of conservation interest were observed in the project area.

Attributes: Number of bat species, the general activity.

Sampling protocols

Number of the monitoring transects: Within the area will be designated at least 7 transects. Transects will be monitored for at least four times a year.

Distribution and selection of lands/ monitoring points: There will be drawn transects of at least four kilometers long on the paths close to the center of the mining project and its vicinity. Transects shall cover all the major habitats.

Size of the monitoring transects: Transects shall be of at least four kilometers long. They shall be of equal length. This length must be recorded.

Location /marking of transects: Transects routes shall be marked on a map and exact start and end points of the transect will be marked on the ground by metal rods and GPS for complete description.

Frequency and programming of repeated monitoring activities: It will cover the seven transects every spring (April-May), twice in summer (June and August) and once in early autumn (October). It will be allocated a night for each transect in each stage field work, seven nights / stage totaling 28 nights / year for each specialist involved.

Data management and analysis protocols

Data storage and information management

Total number of passes on the transect length and the list of species identified will be input in computer on a table. This will be kept separately as backup copy and will be also kept the original data sheets.

Methods of data analysis and details of statistical methods to be used

The activity spent on each interval of 20 minutes will be averaged over every portion of each transect and these numbers can be compared with the dominant habitat type in that portion of the transect. Total activity of bats on each transect will be averaged annually, which will allow comparison of activity changes from one year to another (plotted graphically depending on time). Number of species detected during censuses will be recorded for each year. If a species is not recorded four years in a row, there will be additional census to verify the decrease in abundance of bats species in the area.

Reporting format and the process of results communication to Company's management

If there are any significant changes in bat activity over a period of years, this will be reported to the environmental director of Deva Gold with an explanation of possible implications of this finding.

Biodiversity monitoring plan for the area of the mining perimeter Certej Protocol 11 – Monitoring of boars and Cervidae populations from the area potentially impacted

Indicator: Population of boars (*Sus scrofa*) and cervidae (roe deer *Capreolus capreolus* and red deer *Cervus elaphus*)

Justification: Boars (*Sus scrofa*), roe deer *Capreolus capreolus* and red deer *Cervus elaphus* species are important on hunting interest for the area.



Attributes: Attributes measured concern relative abundance of adult specimens and young specimens proportion in this population.

Sampling protocols

Number of the monitoring transects: 7 long transects to cover in every (of four) areas where are known reasonable populations of boars.

Distribution and selection of lands/ monitoring points

The routes (transects) will be established over the areas with wild boars and Cervidae and will be recorded the effort for each transect (distance covered and time). It may be necessary to use flexible transects (side paths can be used to explore the habitats of boars and Cervidae) but it is preferable to be possible to walk on the same paths and main roads each year.

Size of the monitoring transects: Routes will have a length of about 7 km and can be covered in one day. Start and end observation points will be defined according to the areas known as being the habitats for boars and Cervidae.

Location /marking of specific points: Transects will be marked on a map. Every year will be covered the same fixed routes . Route description and description of location of the main tracking points will be done in writing.

Frequency and programming of repeated monitoring activities: Census will be done in the summer months (June-August) and winter (December-January). Whenever possible, censuses will be distributed over a period of 14 days. Census will be done annually (twice, once in winter, once in summer, every year).

Data management and analysis protocols

Data storage and information management

An Excel database on boars and Cervidae will be made containing „the total number of specimens per unit of search effort (time or distance)” on each transect covered on each day of the census. In addition, there will be annually assessed the proportion of young specimens of the total population. Consultant will be responsible for data management, but the areas with high density of boars and Cervidae will be integrated in the GIS system. Data will remain the common property of consultant and the company, but shall be made available to national monitoring programs and scientific community at decision of the consultant biologists. Backup data will be kept in another system. It shall keep the original data sheets.

Methods of data analysis and details of statistical methods to be used

Variables "specimens per unit of search effort” will be filled in for all the monitoring years (each route annually covered is considered a separate variable, therefore should be taken into account the locations of the covered transects). In addition, there will be analyzed the „ proportion of young specimens of the population” within all the areas studied on each year and variation curves in time shall be plotted. Accuracy can be improved through the outline of distance that boars are observed (e.g. at 250 m). This will help to estimate densities in those areas. Average number of specimens per effort unit per year (on all transects) will be use to represent the data in an easily accessible graphical form. In addition, data will be entered in a regression analysis statistical program for at least four years of collected data (whether the data will show that it is necessary). A level of $p < 0.05$ will be considered a significant relation in time.

Reporting format and the process of results communication to Company’s management



Census of wild boar and Cervidae shall be briefly centralized in the annual report on the monitoring progress submitted to company's environmental department. If no significant changes are found, this will be stated as such. Any questions about the accuracy of the census shall also be recorded. Where significant changes are recorded, the data will be presented on the sub-paragraphs, or in graphical form, as appropriate. If from results are found statistical significance, statistical data shall be reproduced and interpreted. The implications of these results shall be highlighted as subheadings as well as management actions and / or recommended further research. If no decrease in populations is observed in the zone, associations of hunters and forest departments shall be informed.

AUDIT

The title holder has the obligation to have the independent audit performed for the two flotation and cyanidation tailings management facilities in order to regularly evaluate their performance and safety.

The audit has to be performed by a qualified and experienced expert with no connection with the designer or title holder of the tailings facilities.

The audit has to cover all aspects that could affect the safety of the tailings facilities, (during the designing , execution/ construction, exploitation / operating and closure stages) such as:

- Their design, consistent should comply with with the applicable standards, construction/ execution documentation and the changes/modifications of the design of the respective installations should comply with the following criteria
- Issues concerning the historical pollution from the waste facility site
- Verification of the compliance with the legal terms according to standards in force for the calibration or metrological verification of equipments and measuring devices of some physical and chemical parameters and control of technological parameters
- Evaluation and record of waste facility data
- Existence of an action plan for dealing with the irregularities found (corrective action reports, initiation of preventive measures, etc.
- Organization of safety measures of exploitation – appointment of persons in charge with the safety management, training programs and existence of a reporting procedure of incidents
- Verification of the operating handbook existence – Dam Book and of the compliance of the ata recorded with the exploitation phase of the waste storage facilities
- Evaluation of risks, incidents, uncontrolled discharges
- Assessment of hazards, including human life losses, environmental and economical issues (or corporate issues)



- Existence of a plan of staff training for emergency events and knowledge of the procedure for the evacuation of the entire personnel serving the waste storage facility
- Existence of intervention and protection measures for the limitation of an incident/ accident ;

The audit results will be used in the revision process of the risk control and major accident prevention strategy and policy.

The title holder together with the environmental authorities will mutually agree upon the approval of a checking and monitoring diagram of the performance of works stipulated by the environmental permit.

The title holder is obliged to prepare the Annual Environmental Report (comprising material balance sheet, water balance sheet, cyanide balance sheet, environmental monitoring results, incidents/accidents, treatment of unconformities, results of authority inspections) and submit it to the environmental authority starting with the first year after the start up of the works stipulated in the project.

The title holder is obliged to provide data about the progress of the work stages anytime to the Agency for Environment protection Hunedoara , depending on the investment execution schedule and at its request..

V. INFORMATION ABOUT THE PUBLIC PARTICIPATION TO THE PROCEDURE DEVELOPED

Documentation for the environmental eprmit issuing contains :

- Technical memorandum drawn up by S.C CEPROMIN SA DEVA (2009);
- Report to the environmental impact assessment study drawn up by « Babeş Bolyai » University of Cluj Napoca- Center for Disaster Management Research;
- Completions to the Report to the Environmental impact assessment (asked by Ministry of Environment and Forests within the trans – boundary procedure and ARPM Timisoara within the national procedure)
- Potential trans- boundary impact drawn up by « Babeş Bolyai » University of Cluj Napoca- Center of Disaster Management Research
- Assessment of the Cumulated Impact of Rosia Montana and Certej Projects and the consequences of a simultaneous accident with possible trans-boundary impacts , authors :
AMEC – S.C. AMEC Earth& Envionmetal S.R.L, România
UTCB – Technical University of Constructions Bucharest
UBB –Babes – Bolyai University of , Cluj Napoca,
OCON ECORISC – S.C. OCON ECORISC S.R.L, Turda
MARILENA PATRASCU – expert for Environmental Impact Assessment
PAUL WHITEHEAD – Profesor at Oxford University,
WESTAGEM – S.C. WESTAGEM S.R.L., Bucuresti
- Safety Report developed by S.C. OCON ECORISC S.R.L. Turda 9 original and revised)
- Notification according to the4 GD no.804/2007 about the dangerous substances existing or possibly existing on the Project site ;



AGENCY FOR ENVIRONMENT PROTECTION HUNEDOARA

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- Presentation memorandum including the modifications of the original design, elaborated by S.C DEVA GOLD SA;
- Technical Design for the environment rehabilitation developed by S.C CEPROMIN SA DEVA
- Environmental monitoring programme during the operating and post closure stage developed by S.C CEPROMIN SA DEVA
- Plan of Environmental Rehabilitation developed by S.C CEPROMIN S.A
- Initial Plan of Mine Closure developed by S.C CEPROMIN S.A.
- Internal Emergency Plan developed by S.C. OCON ECORISC S.R.L. Turda original and revised)
- Plan for the prevention and fight against Accidental Pollution developed by S.C. OCON ECORISC S.R.L. Turda
- Waste Management Plan developed by S.C CEPROMIN SA DEVA
- Biodiversity Monitoring Plan developed by de Wildlife Management Consulting S.R.L. Hunedoara, Romania *Author* biol. Călin Hodor
- Risk Study for the dams of the tailings management facilities of the gold –silver ore mining of Certej perimeter developed by the Technical University of Constructions Bucharest
- Report of the auditing/ approval of the technical documentation concerning the " Dams of the gold-silver ore mining of Certej perimeter, Hunedoar county". Alexandru CONSTANTINESCU Expert for dam safety
- Certificate of Urbanism no.30/19,11,2010; 15/24.10 2013
- Proof of payment of the fees for the environmental permit;
- Layout plan; plan of zone boundaries
- Technological flow-sheet plans
- Environmental element monitoring plans

**Throughout the environmental permitting stages the public was informed as follows:
National procedure**

Procedure stage	Date of information	Method of public information
Application for the environmental permit	4.08.2009	Submission of the application for the environmental permit issuing registered at ARPM Timișoara
	11.08.2009	Public announcement concerning the submission of the application, in Ziuă newspaper
	11.08.2009	Public announcement on the internet site of ARPM Timisoara
Stage of project categorization	20.04.2010	Decision about the project categorization 16/20.04.2010 issued by ARPM Timisoara
	20.04.2010	Public announcement on the internet site of ARPM Timisoara
	26.04.2010	Public announcement in Mesagerul Hunedorean newspaper



	21.04.2010	Display of the public announcement on Deva Gold SA site, at the Mayoralty of Certejul de Sus, at SC Deva Gold SA head-office
Definition stage	20.04.2010	Publishing on the ARPM Timisoara site of the guidelines
Submission of the Report to the Environmental Impact Assessment Study	15.07.2010	Publishing on the ARPM Timisoara website of the Report to the Environmental Impact Assessment Study , Safety Report and enclosed documents
Public debates about the Report to the Environmental Impact Assessment Study	24.02.2011	Publishing on ARPM Timisoara site
	28.02.2011	Public announcement at Mayoralty of Certejul de Sus and Mayoralty of Harau
	01.03.2011	Public announcement in Servus Hunedoara newspaper
Decision concerning the issuing of the environmental permit	14.06.2012	Displaying the announcement and decision for the environmental permit issuing on the ARPM Timisoara internet site
	15.06.2012	Displaying the issuing of the environmental permit at the head-office of SC Deva Gold SA and Mayoralty of Certejul de Sus
	18.06.2012	Announcement concerning the issuing of the environmental permit in Servus Hunedoara newspaper
Environmental permit revision	09.10.2013	Posting of the public announcement about the submission of the notification and memorandum on the site of the Agency for Environment Protection Hunedoara (submitted to the Agency for Environment Protection on 07.10.2013)



	09.10.2013	Posting of the public announcement regarding the Decision issued by the Agency for Environment Protection Hunedoara, no.819/08.10.2013 for partial resuming of the environmental impact assessment and of revision of the environmental permit on the site of the Agency for Environment Protection Hunedoara
	09.10.2013	Posting on the site of the Agency for Environment Protection Hunedoara of the Adequate Assessment Study
	11.10.2013	Posting of the Adequate Assessment Study – amended / corrected version on the site of the Agency for Environment protection Hunedoara
	17.10.2013	Posting of the decision for the environmental permit revision on the site of the Agency for Environment Protection Hunedoara,
	23.10.2013	Posting of the revised Safety report and its annexes o(registered at n the site of the Agency for Environmental Protection under the number 8614/23.10.2013)
	23.10.2013	Posting of the Memo of Presentation on the site of the Agency for Environmental Protection Hunedoara
	12.11.2013	Posting on the site of the Agency for Environment Protection of the Public Announcement about the decision issued by the Agency for Environment Protection Hunedoara of the revised environmental permit
	13.11.2013	Posting of the Public Announcement about the decision made by the Agency for Environment Protection Hunedoara to issue the revised environmental permit on the site of S.C DEVA GOLD S.A
	14.11.2013	Publishing of the annlouncement of S.C. DEVA GOLD S.A. about the decision to issue the revised environmental permit
	27.11.2013	Posting on the site of the Agency for Environment protection of the revised environmental permit



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- On the 13.04.2011 and 14.04.2011, at 15⁰⁰ h there was held the Public Debate for the consultation and review of the report to the environmental impact assessment study in Certej and Barsau localities.

- No comments concerning the project from the public were submitted;

- Throughout the procedure development, a written notification from the public was submitted to ARPM Timișoara registered under the number 4308/12.08.2009, and it was delivered to the beneficiary, too.. ARPM Timișoara sent the answer to this notification, to the holder by the note no.4429/18.08.2009. No other objections were made.

-The Commission for the technical review met on the 11.06.2012 for the reiew of the report to the environmental impact assessment study , accepted it and decided to issue the environmental permit.

- In the procedure for the environmental permit revision, there were made the following comments/ notices by the stakeholders:

- After displaying the documentations required for the revision procedure on the site of the Agency for Environment Protection Hunedoara, the public made the the following comments/ notices registered at the Agency for Environmental Protection Hunedoara under the numbers 8341, 8353, 8354, 8363 of 14.10.2013 and no. 8385 of 15.10.2013, they were submitted to the members of the Technical Analysis Committee. The Agency for Environment Protection Hunedoara submitted to the Commission for Technical Analysis the contestations submitted and there resulted that the detailing of the impact assessment and the request for additional data were no longer necessary. The answers given by the Agency for Environment Protection Hunedoara were sent to the stakeholders.
- After making the decision to issue the revised environmental permit and to dispaly it on the Agency for Environment Protection site there were received comments/ observations (no.9333/18.11.2013, 9378 of 19.11.2013, 9402, 9403, 9435, 9, 9522 of 25.11.2013) These were analysed during the TAC meeting of 26.11.2013 but, after their review it was noticed that there were no indications requiring the decision amendment. Each signatory received the answer in writing..

Trans – boundary procedure

The Project went through the procedure of environmental impact assessment under trans- bloundary context in accordance with the provision of Law no.22 /2001 about the reatifying of the convention about the environmental impact assessment under trans- boundary context adopted at Espoo on 25 February 1991 and of the Order no. 864/2002 for the approval of the Procedure for the environmental im;pact assessment procedure under gtrans- boundary context and of public participation at the decision making process .

The procedure was developed by the Ministry of Environment and Forests. Within the procedure there were held 3 public debates , one in Serbia (Novi Knezevac -15.09.2011) and two in Hungary (Budapes 27 .09.2011 and Szseged -28.09.2011). Also, there was a consultative meeting between the Romanian and Hungarian environmental authorities at Timisoara on 8.12.2012 . According to the note issued by the Ministry of Environment and Forests no.144.104/ DM/21.03.2012 , the trans-



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boundary consultations about Certej Project were completed and the national procedure of the environment impact assessment continued, The Serbian and Hugarian Republics sent their final opinions about the project in November 2011, respectively March 2012. The final result of the consultations between Romania, Serbia and Hungary about the „Gold- silver ore exploitation of Certej perimeter”Project was taken into account in the national procedure previously developed and further to it there was issued the environmental permit no. 8/ 05.07.2012.

Within the procedure for the revision of the environmental permit issued and further to the analysis of the additional documents, the Ministry of Environment and Climate Changes decided the modifications proposed by the project holder respectively the modification of the processing plant site within the approved ZUP boundaries, do not represent modifications that can cause a trans-boundary impact on the environment of other state and consequently, the application of the provisions of *Espoo Convention* about the request of environmental permit revision.

In compliance with the provisions of art.6 of the Convention about the environmental impact asessment unde rtrans- boundary context adopted at Espoo om 25 February 1991, ratified through the Law no.22 /2001 , the final requirements agreed with the two participating states within the developed procedure are :

1. The adequate and efficient measures for the mitigation of the potential trans-boundary impact resulting at the project implementation included now in the revised environmental permit and related to the issues approached by Hungary finally comments are given below:

- 1.1 Environmental impact caused by the deforestation works required for project implementation

Chapter I. Description of the project, works designed including the installations and equipments used , tables with titles, Deforestation Strategy that will be applied within the Project entitled „Gold-silver ore exploitation of Certej perimeter, Hunedoara county”and the „Stages of the forest deforestation of the poroject „ (pages 9-11)

Chapter III. Measures for the prevention, mitigation and where applicable, the compensation of the significant negatiuve environmental impacts.

- point f – Mitigation measures of the impact on environmental factors soil and subsoil (pages 156-157)
- point g –Measures for biodiversity protection (pages 157-158)

Chapter IV Revised environmental permit is issued under the following conditions:

- point e) –Biodiversity protection requirments throughout the execution of deforestation works (pages 167);
- point h) Requirments for the terrestrial and aquatic ecosystem and landscape protection (page 170-171)
- point n) – Environment monitoring plan (pages 179-216) The monitoring program of deforestation works within the construction and exploitation stages; Monitoring program of revegetation works – closure stage .Biodiversity monitoring program ;



1.2 Dealing prioritarily with the issues associated to the monitoring system by means of the following measures :

Chapter IV. The Revised environmental permit is issued under the following conditions: - point n) – Environmental Monitoring Plan (pages 179-207) Biodiversity monitoring (pages 207-216) and Audit (pages 217-218)

1.3. Detailing the solution for the flotation TMF and CIL TMF sealing

Chapter I. Description of project, works provided by the design, including the installations and equipments used: point D) Construction of rockfill dams (page 14-20); Materials for dam construction, subpoints a), b) and c) (pages 131-132);

Chapter II. reasons and considerations associated to the regulating act issue among others dealing also with the quality and conclusions/ recommendations of the report of the environmental impact assessment and public participation – compliance with the community requirements transposed in the national legislation as per the following provisions (pages 136-144)

- Directive 2006/21/EC of the European Parliament and Council of 15 March 2006 about the management of waste of extractive industry transposed through the Government Decision no.856/2008 about the management of waste from extractive industry;
- Frame Directive about Water (2000/60/EC) of 23 October 2000 establishing the community framework of action within water policy transposed in the national legislation through the Law of water no.107/1996 with further amendments and completions;
- Directive 2006/118/EC of the European Parliament and Council of 12 December 2006 about the protection of underground water against pollution and deterioration transposed through the National Plan of underground water protection against pollution and degradation approved through the Government Decision no.53/2009 and Order of Ministry of Environment no.137 of 26/2009 about the approval of threshold values for underground water bodies of Romania.

1.4 Geotechnical tests of the sites of the Flotation and CIL TMF's

confirming the fulfilment of the representativity requirements imposed by the specific national and international legislation : specific requirements at *Chapter II: Reasons and consideration for the issue of the regulating act , among other related to the quality and conclusions/ recommendations of the report referring to the environmental impact and public participation (pages 140) .*

1.5 Intensity, duration and frequency of rainfalls considered for the of the waste storage facilities and corresponding water constructions

Chapter II. Reasons and consideration for the issue of the regulating act , among other related to the quality and conclusions/ recommendations of the report referring to the environmental impact and public participation: information taken over from the Risk study for the dams of Certej mine tailings management facilities (pages 140-142)

1.6 Measures for the development of mining operations under safety conditions, mining waste management and storage method during all the reviewed stages (construction, operation, closure and post closure)

Chapter I Description of the works provided by the project including the installations and equipments used



Surveillance measures presented in:

- sub chapter 2 : Technological Flow-sheet (pages 104-124);
- subchapter 3. Oxygen production technology (page 124)
- subchapter 4: Technology for the tailings storage in the tailings management facilities (pages 125)

Chapter II Reasons and consideration for the issue of the regulating act , among other related to the quality and conclusions/ recommendations of the report referring to the environmental impact and public participation

The compliance with the specific provisions required by the Directive 2006/21 /EC of the European Parliament and Council of 15 March 2006 about the management of wastes from extractive industry (pages 136-137)

Chapter III Measures for the prevention , mitigation and where applicable, the compensation of significant negative environmental impacts

- There are designed measures for the prevention of the environmental factors , for the waste and dangerous substance management, measures for the mitigation of the impact on site; biodiversity protection measures; measures for the prevention of pollution during the closure/ dismantling/ decommissioning and land rehabilitation for further reuse; measures for the removal of environmental prejudices (pages 147-163).

1.7 Monitoring Program of surface and underground water of the exploitation project perimeter and the protection perimeter established (monitoring points, monitored indicators and sampling frequency, site layout plan corresponding to the monitoring program

Chapter IV Revised environmental permit is issued under the following conditions – point n)- Environment Monitoring Plan

- a) monitoring plan of water quality during the construction stage (page 179) during the exploitation period (pages 185-187) and during the closure stage (pages 201-203);
- b) data about the A.B.A Mures monitoring program in sectors Gelmar and Branisca (upstream and downstream the confluence with Certej stream) (page 145)
- c) data referring to the water management in accordance with the requirements of the water management approval issued for the project (pages 164-166);
- d) additional monitoring program of surface water carried out by the project holder as a result of the trans- boundary procedures developed for ZUP Certej and Certej Project (page 187).

1.8 Framing of the project in the warning , monitoring and intervention systems in case of accidental pollution for Mures river

Chapter II Reasons and consideration for the issue of the regulating act , among other related to the quality and conclusions/ recommendations of the report referring to the environmental impact and public participation

- a) information referring to the implementation of the provisions of the Directive 2004/35/EC of 21 April 2004 about the environment responsibility related to the prevention and repair of environment damages transposed through the GUO no.68/2007 about the environment responsibility referring to the prevention and repair of environmental prejudices with further amendments and completions (page 142)



- b) data of the section „*Trans-boundary*” about the operation of the Warning system for accidental pollution events (SAPA –ROM) and of the Main International Centre of Warning for Accidental Pollution of the Danube in Romania (CIPA –ROM) (pages 144-145)

Chapter III. Measures for the prevention , mitigation and where possible, the compensation of the significant negative environmental impacts – Requirments for the risk prevention (pages 171-173);

Chapter IV: Revised environmental perm it is issued under the following conditions: information about the provisions for the limitation of the pollution impacts at log distance or trans-boundary , as required (page 177-178).

2.The final report about the environmental impact was completed with the specific data mentioned within the final opinions of the two states within the procedure for the issue of the Environmental Permit no.8 /05/07/2012 as follows :

- at chapter „Project description”(completions requested by the Serbian party)
- at chapters „Products of sodium cyanide decomposition ,, „Microbiological decomposition”and „Supply of insufficient data about the accidents”(completions requested by Hungarian party)

Should the project is modified , the holder is obliged to notify in writing the public authority issuing the environment protection about such modifications.

The present environmental permit is valied throughout the project implementation period.

The present environmental permit does not exonerate the holder, designer and/or builder of responsibility in case of accidents during the work performance.

The provisions of the present document may be revised if there is noticed new elements , unknown by the time of the present permit issuing, occur , in accordance with the law in force.

The holder will notify the finalization of works to ARPM Timisoara, GNM – CJ Hunedoara, so that the compliance with the requirments of this permit is checked and to sign the report of findings which will accompany the reception minute of the works associated to the investment carried out.

The putting into operation of the plant will be carried out only after obtaining the integrated environmental permit.

The failure to comply with the provisions of the environmental permit attract either its waiving or its cancellation , as may be the case, in accordance with the art.17, paragraph (3), (4), (5) of the GUO no.195/2005 about the environment protection approved through the Law no.265/2006, with its further amendments and completions.



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The present permit can be opposed in accordance with the provisions of the GD no.445 /2009 about the environment impacts of certain public and private projects and of the Law of administrative solicitor's office no.544/2004 with further amendments and completions.

Mentions referring to the administrative appeal and administrative solicitor's office

Any of the stakeholders and who considers that one of its rights or legitimate interest has been damaged, it may address the solicitor's office to contest from procedure or substantial point of view, the acts, decisions or omissions of the entitled public authority of the environment protection which make the object of public participation at the environmental impact assessment procedure provided by the GD 1213/2006, with strict compliance with the provisions of the Solicitor's office Law 554/2004, with further amendments.

The non-government organizations which are involved with the promotion of the environment protection and fulfill the requirements of the laws in force can address the solicitor's office if they consider that one of their rights or legitimate interest has been damaged.

Before addressing the administrative solicitor's office the stakeholders and considers that one of their right or legitimate interest has been damaged must ask for the competent issuing public authority the revoking of the respective decision within 30 days since the public notification about the decision regarding the issuing of the environmental permit, revoking the respective decision.

The issuing public authority is obliged to answer the prior complaint within 30 days since its registration at that authority office.

Prior administrative procedure is free of charge.

The present environmental permit contains 226 pages (Romanian version).

Executive Director
Viorica Georgeta BARABAŞ

Head of Regulation Div.,
Lucia Doina COSTINAŞ





**Ministry of Environment and Climate Changes
National Agency for Environment Protection**



Agency for Environment Protection Hunedoara

Annex to the ENVIRONMENTAL PERMIT no.8 of 05.07.2012

Revised on 28.11.2013

**For „GOLD-SILVER ORE EXPLOITATION OF CERTEJ PERIMETER”
Hunedoara county**

Holder S.C.DEVA GOLD S.A. Certeju de Sus

Based on the GUO 195/2005 about the environment protection with further amendments and completions taking into account the principles governing the whole activity of environment protection and which indicate the directions of economic activity adjustment in order to achieve the objectives of the sustainable development the following steps are necessary :

In accordance with the provisions of the Directive 2006/21/CE about the management of waste of the extractive industry and the amendment of the Directive 2004/35/EC, referring to the responsibility for the environment protection in terms of prevention and repairs of environmental damages, the holder is obliged to constitute the financial guarantees required prior to the start up of the tailings management facilities.

In accordance with the provisions of the Directive 2004/35/EC about the responsibility for the environment protection referring to the prevention and repair of environmental damages , trasposed in the National legislation through the GUO no.68/2007, the holder is obliged to constitute the financial guarantees required, prior to the start up of the processing plant construction.

In accordance with the Mining Law, the holder is obliged to constitute the financial guarantees required for the environment rehabilitation works prior to the opening of Certej – Coranda open pit.

The present Annex is integral part of the Environmental Permit no.8 of 05.07.2012 revised on 28.11.2013 for the „Gold-silver ore exploitation of Certej perimeter” Hunedoara county, Holder S.C. DEVA GOLD SA Certeju de Sus.

EXECUTIVE DIRECTOR,
Viorica Georgeta BARABAS

HEAD OF DIVISION,
Avize, Acorduri,Autorizatii,
Lucia Doina COSTINAS

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The undersigned PESCARU ALEXANDRA, certified interpreter and translator for the French and English languages, based on the authorization no.15 of May 1998 issued by the Ministry of Justice of Romania, certify the accuracy of the translation from Romanian to English that the text submitted was entirely translated , without any omissions and that neither the contents and nor the understanding of the document have been altered

