TSD # 7

WATER BALANCE FOR RBB/RTB FACILITIES

IN BOR AREA

NOTICE TO READER

The following presents a general summary of the water balance for the RRB and RTB facilities located in the Bor Area.

It serves to summarize the following:

- Current state of consumption of fresh water in technical facilities of RBB associated with:
    - Flotation concentration processes in plants Bor and Veliki Krivelj;
    - industrial fresh water (from Bor Lake); and
    - technical water use for flotation tailings of Bor and Veliki Krivelj.
- Water needs of RBB plants for fresh and technical water in future production for the -
    - “Bor" Complex;
    - Flotation "V. Krivelj "; and
    - Cerovo Mine
- Description of water distribution system for RTB plants that includes:
    - Bor Lake RTB and connecting pipeline;
    - Industrial water for cooling;
    - Treated industrial water – processed through softening and demineralization for use in power and heating plant
- Investments in water supply systems in the RBB to meet the 20 year production and business plan.

WATER BALANCES

1. THE CURRENT STATE OF CONSUMPTION OF FRESH WATER IN TECHNICAL FACILITIES OF RBB

Flotation concentration processes in plants Bor and Veliki Krivelj industrial fresh water (from Bor lake) and technical water (from flotation tailings of Bor and Veliki Krivelj is used.

"Bor"

"Bor" flotation for the purposes of aggregate work as well as for the technological process is supplying with the industrial fresh water from Lake Bor. Most of the fresh water is used for cooling and sealing of aggregates, the preparation of reagents and lime milk while for the technological process only lost of technical (technological) water is being compensated. Technical water is provided from the accumulation lake of flotation tailings and the water is constantly circulating, thus no need to discharge. Water losses are manifested through the moisture in the copper concentrate, water that is trapped in the tailings and evaporation (especially in summer months). Technological scheme of movement of water in the Bor flotation plant is represented in Figure 1 and Table 1. The scheme also applies to the open pit ore and slag.

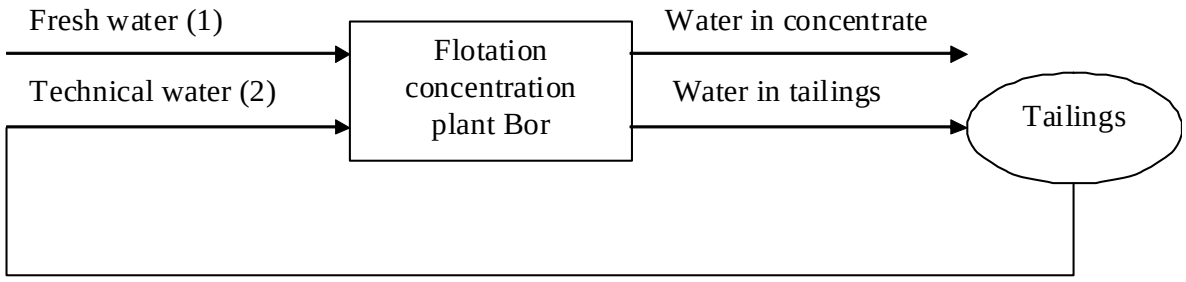


Figure 1: Scheme of Movement of Water in the Bor Flotation Plant

Flotation "V. Krivelj "

Flotation Veliki Krivelj for the needs of industrial plants is using fresh water from its own water intake located on the Krivelj river. Most of the fresh water is used for cooling and sealing aggregates, the preparation of reagents and lime milk while for the technological process only lost of technical (technological) water is compensated. Technical water is provided from the accumulation lake of flotation tailings and the water is constantly in recirculation. Water losses occur through moisture in the concentrate, in year 2009 amounted to 10 281m ^{3,} then water is trapped in the tailings and evaporation (especially in summer) and water that flows through the tailings dam in Krivelj river, so called drainage waters of dam 1A, which were in year 2009

amounted to about 100 000 m ^{3}. It should be mentioned that the drainage waters do not occur continuously, therefore, there is drainage system pumping of drainage waters, but only the inadequate functioning of the system leads to the appearance of these water. Technological scheme of movement of water in the flotation plant Veliki Krivelj is represented in Figure 1 and Table 1.

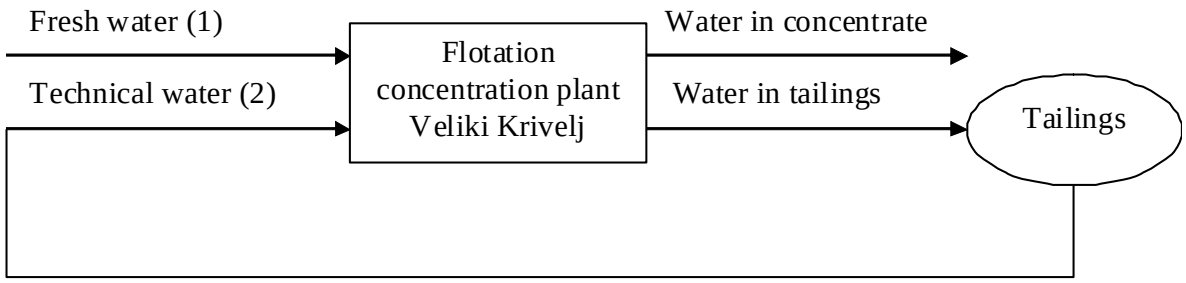


Figure 2: Schematic of Movement of Water in the Flotation Plant Veliki Krivelj

Cerovo Mine

The Cerovo mine is currently in the temporary suspension of work. Because there isn't any processing of ore there is no water consumption, either fresh that would be used for refrigeration units as sealing water pumping systems, or any technological waters that could be used for the technological process of processing the ore.

Table 1: Water Balance in Plants RBB

	Type of water	V. Krivelj	Pit mining	Slag	Cerovo	In total m^3	m^3/t of Cu in conc
1.	**Fresh**	1.95 million	300 000	2.2 million	0	4,450,000	342.38
2.	**Technical**	15,000,000	550 000	4 million	0	19,550,000	1504.17
	Total:	16,950,000	850 000	6.2 million	0	24,000,000	1846.55
Water losses							
3	**With concentrate**	7,500	1,500	3,300	0	12,300	0.95
4	**Technological losses**	931,000	15,000	45,000	0	991,000	76.25
	Total:	938,500	16,500	48,300	0	1,003,300	77.19

Table 1 presents the losses of water through moisture in the concentrate and through technological losses of water. Technological losses are related to the water that evaporates on tailings, the water that remains trapped in the tailings and water that is lost due to technical defect of aggregates and the water supply system. A total loss in the current volume of production is 1.0033 million m^3 per year or 77.19 m^3 per tone of copper in concentrate.

Flotation tailings area in the Veliki Krivelj is quite large, 359 ha, of which 277 ha is under water. On the basis of available data on the evaporation of water from flotation tailings, the amount of water lost by evaporation is about 830 000 m^3 per year. The average value of atmospheric precipitation during the year about 500 mm/m^2 it in the tailings reaches 1.8 million m^3 of water. Quantity of water that evaporates and atmospheric precipitation are dependent on the orientation and weather conditions.

Similar situation is in the flotation tailings RTH Bor flotation, with a total area of 86 ha of which was under water about 20 ha. The water lost by evaporation is about 60,000 m^3 per year and atmospheric water inflow in the barren soil around 370,000 m^3 per year. Quantity of water that evaporates and atmospheric precipitation are dependent on the orientation and weather conditions.

2. THE WATER NEEDS OF RBB PLANTS FOR FRESH AND TECHNICAL WATER IN FUTURE PRODUCTION

"Bor"

Flotation "Bor" will for the production in future period for the same purposes and in the same way supply fresh water both industrial and technological water for normal functioning of the technological process of flotation concentration.

Losses of water from the processing will be the same as before, through the moisture in the copper concentrate, water that is trapped in the tailings and evaporation (especially in summer months).

Consumption of fresh technical water will be solely depend on the production of copper concentrate per year. Future production in the Bor flotation will be around 1.0 million tons of ore per year and 0.9 million tons of slag per year. Technological scheme of movement of water in the Bor flotation plant is represented in Figure 3 and Table 2. The scheme also applies to the open pit ore and slag.

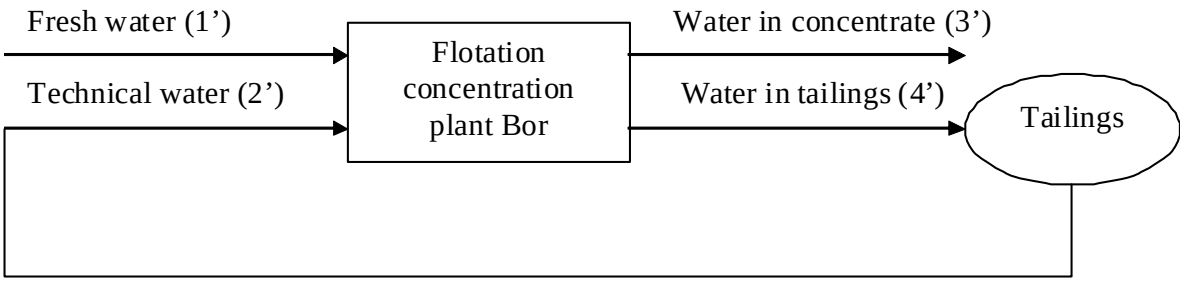


Figure 3: Schematic of Movement of Water in the Bor Flotation Plant
Note: Numbers refer to future production

Flotation "V. Kri velj "

Flotation Veliki Krivelj will for its work use fresh industrial water from their own water intake located on the Krivelj river. Fresh water will be used for the same purposes as before, with exception that consumption will increase due to the ore processing Cerovo ore that will be partially treated in the flotation concentration plant Veliki Krivelj. Technical water will be provided from the accumulation lake of flotation tailings, which is constantly in circulation. Loss of water will be the same as before, through moisture.

Consumption of fresh technical water will only depend on the production of copper concentrate per year. Future production in flotation Veliki Krivelj will be around 10.6 million tons of ore per year of Krivelj ore and 5.0 million tons of Cerovo ore per year. Technological scheme of movement of water in the flotation plant Veliki Krivelj is represented in Figure 4 and Table 2.

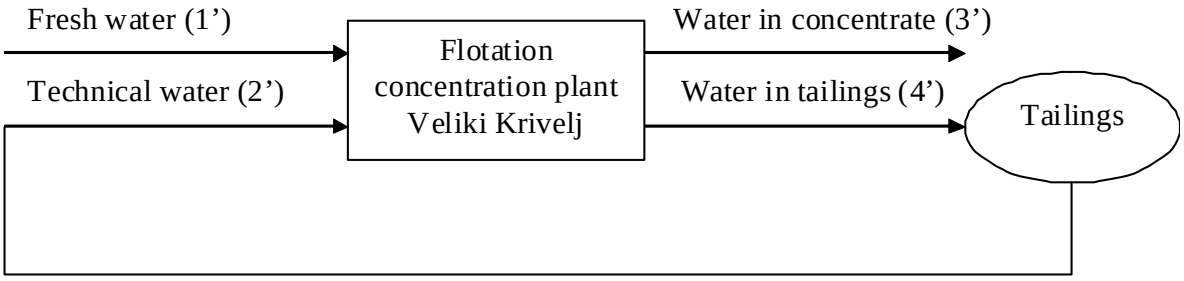


Figure 4: Schematic of Movement of Water in the Flotation Plant Veliki Krivelj
Note: Numbers refer to future production

Mine Cerovo

The plan is to prepare the ore from mine Cerovo in crushing and grinding plant located on Cerovo, while the flotation concentration of copper minerals will be performed in the flotation plant Veliki Krivelj. Fresh water plant located on Cerovo will be supplied from the accumulation of the pools located in Bor, while fresh water for the process of concentration in the flotation plant Veliki Krivelj will be supplied same as for ore mines in the Veliki Krivelj from water intake on the Krivelj River. Technical water will be provided from the accumulation lake of flotation tailings, where water is constantly in circulation. Loss of water will be the same as before, through moisture. Planned Cerovo ore processing is 5 mil. tons per year. Technological scheme of water movement in the plant for the preparation of ore Cerovo is represented in Figure 5 and Table 2.

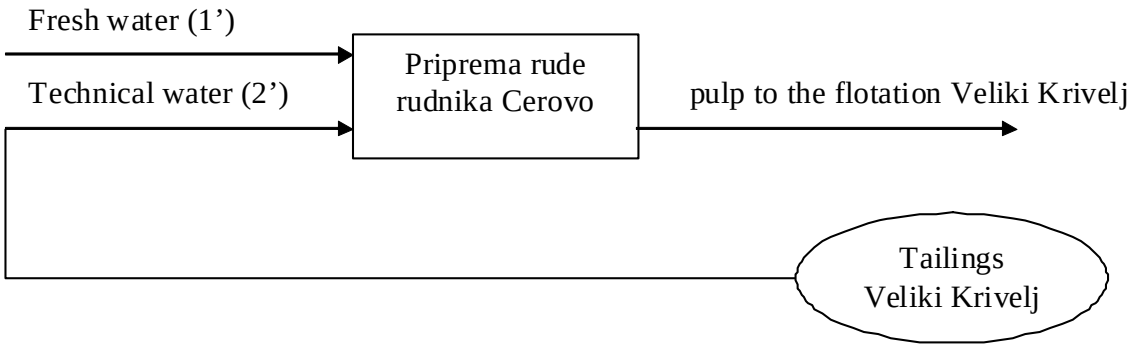


Figure 5: Scheme of Water Movement in the Plant Cerovo
Note: Numbers refer to future production

Table 2: Water Balance in RBB Plants

	Type of water	V. Krivelj	Pit mining	Slag	Cerovo	In total	m^3/t of Cu in conc
1.	**Fresh**	3.55 million	1 million	2 million	2 million	8,550,000	253.58
2.	**Technical**	23,000,000	2.5 million	3.5 million	4.5 million	33,500,000	993.56
	Total:	26,550,000	3.5 million	5.5 million	6.5 million	42,050,000	1247.15
	Water losses						
3	**With concentrate**	11,500	2,200	2,500	3,300	19,500	0.58
4	**Technological losses**	640,000	35,000	45,000	190,000	910,000	26.99
	Total:	651,500	37,200	47,500	193,300	929,500	27.57

Table 2 presents the losses of water through moisture in the concentrate and through technological losses of water. Technological losses related to the water that evaporates in the tailings and water that remains trapped in the tailings. Total losses in the planned volume of production in the future amounted to 929,500 m^3 per year or 27.57 m^3 per tonne of copper in concentrate. Losses of water in the evaporation and atmospheric water inflow within the tailings are approximately the same as before and will depend on the hydro-meteorological events.

Therefore, with the flotation reconstruction there will be a significant reduction in water losses from the current 77.19 (m^3 / t Cu in concentrate) to 27.57 (m^3 / t Cu in concentrate), which represents a saving of 64.25%.

3. DESCRIPTION OF WATER DISTRIBUTION SYSTEM FOR RTB PLANTS

From an artificial reservoir, Bor Lake RTB is the supplied with industrial water. Water supply to Bor is the channel type, after that in companies round the water distribution is by pipeline diameter 640 mm. Supplied water is used as cooling and in some sections in the production process as technological water. The block diagram in Figure 14 gives a general view of distribution with the average consumption of water by plants while the other schemes show water internal distribution within the the plants (Figures 6-8).

At RTB Power Plant a small amount of the industrial water is used as cooling and most of it is processed in the softened and demineralized water. Thus prepared water is used to supplement steam pipeline in Heating and Power Plant (softened water) and power boilers Heating Power Plant and Smelter (dem. water). The amount and flow are given in the block diagram, Figure 9.

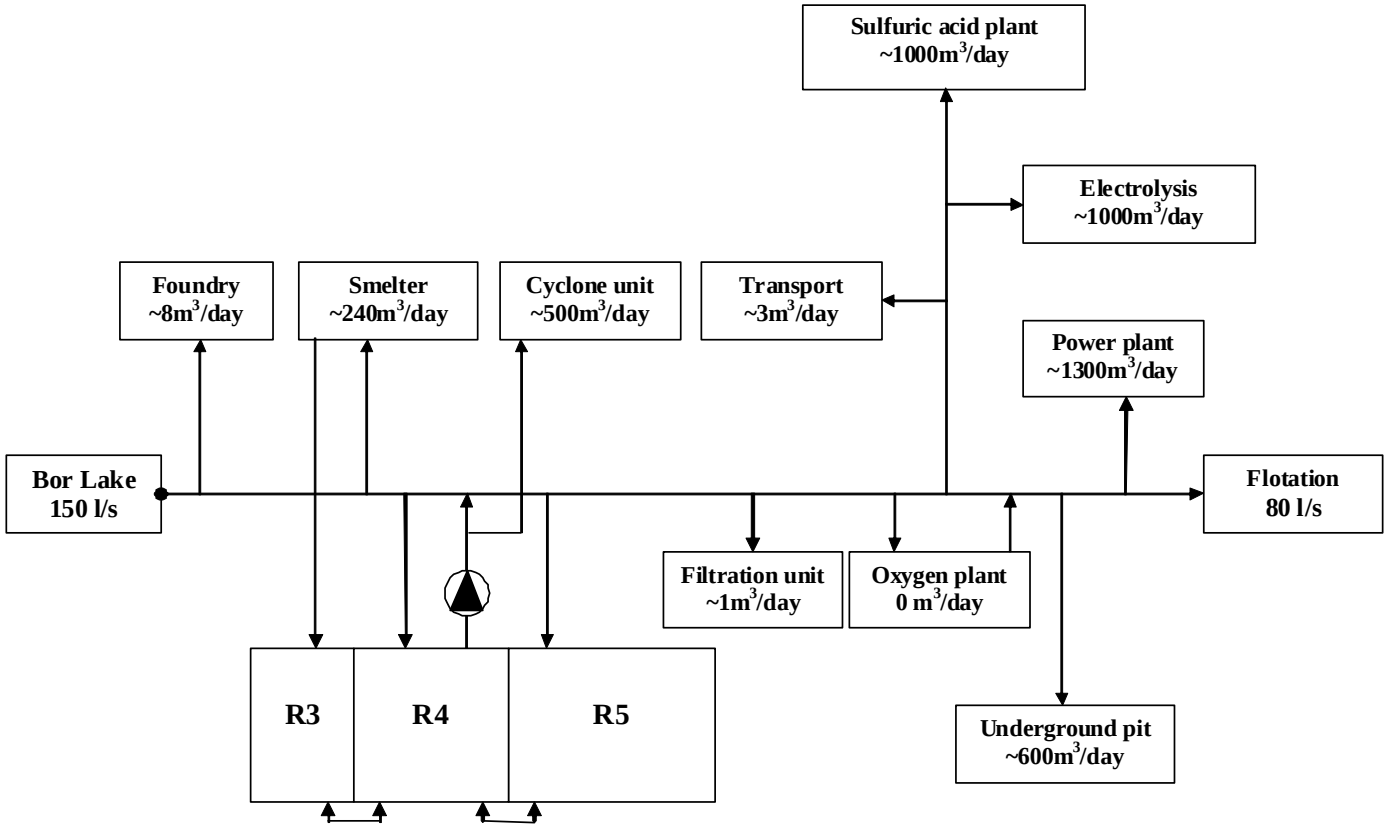
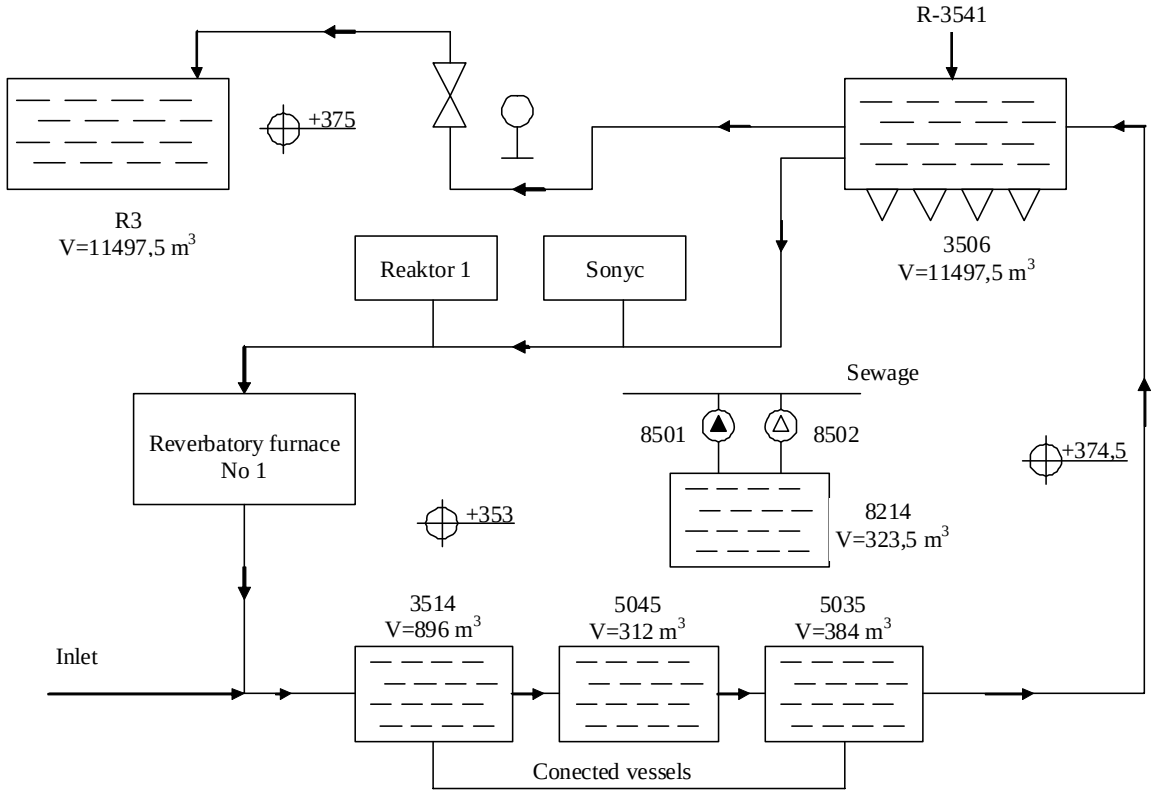


Figure 6 Block Diagram of Industrial Water Supply in RTB Bor



Note:

- In Smelter iclosed system for cooling is built
- Water losses only appeat due to the evaporation or possible damages at instalations
- Cooling water temperature is 30 – 33°C

Figure 7 Block Diagram of Cooling Water Distribution

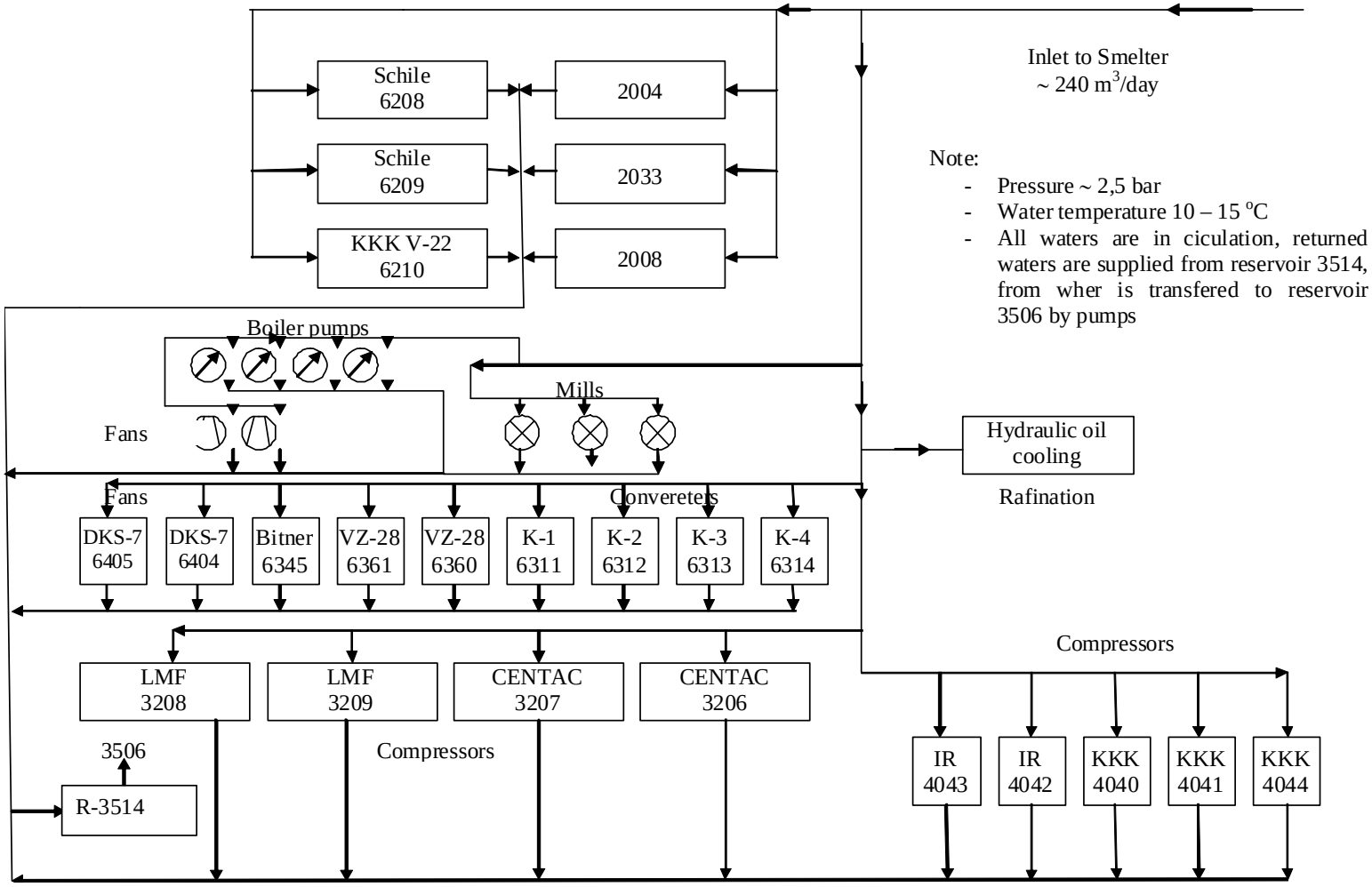


Figure 8 Block Diagram of Industrial Distribution in Smelter Plant

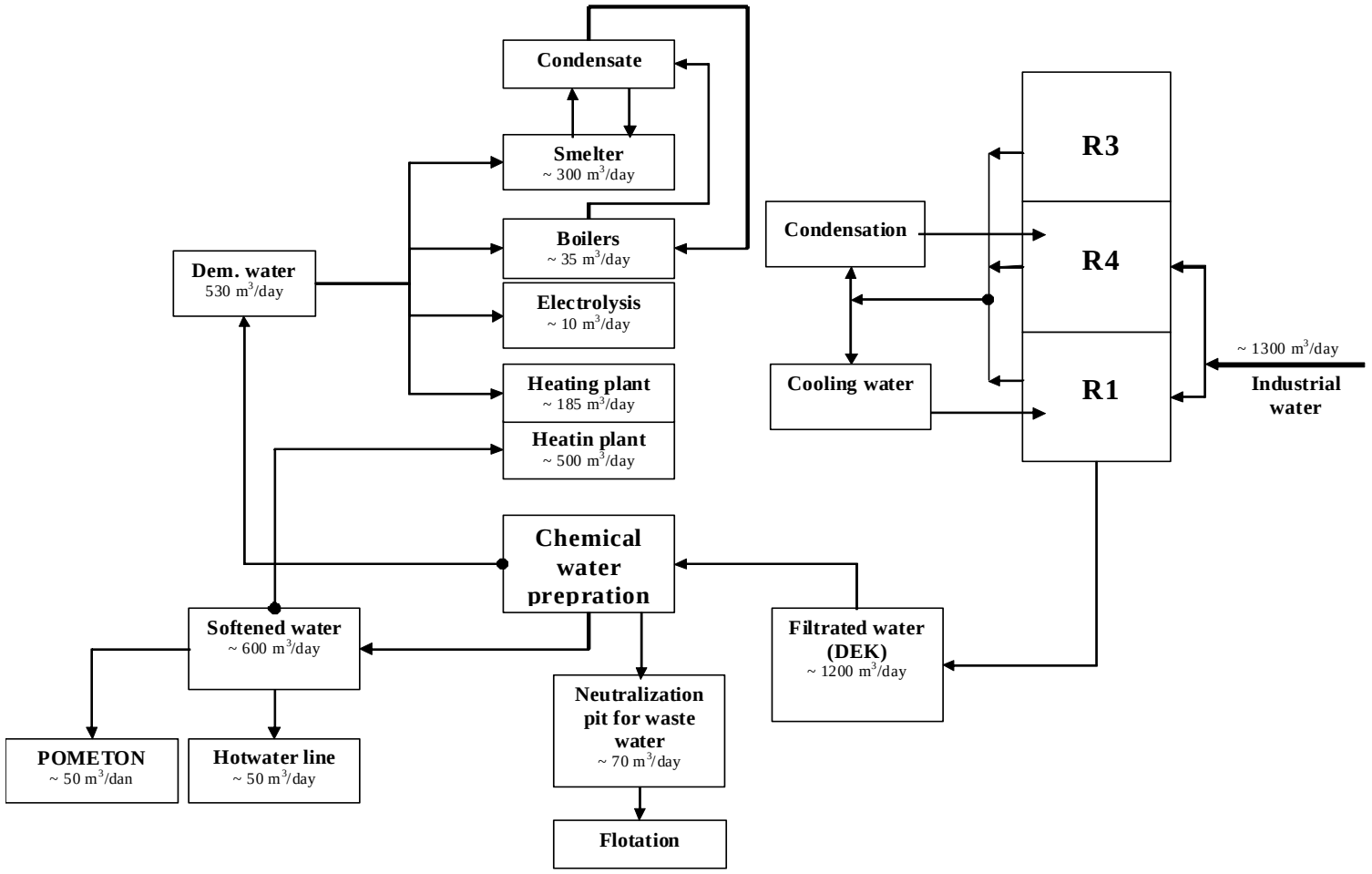


Figure 9 Block Diagram of Production and Distribution of Softened and Demineralized Water in Power Plant

4. INVESTMENTS

In the period from 2010 until 2018 the planned growth of the processing of pit ore from 0.264 x10 ^{6} to 1x10 ^{6} t of ore per year is expected, so this increase in production expected to follow the development of the water supply system. Necessary investments in water supply system are planned within the investments for the Bor Open Pit Bor and Bor flotation plant. The total investment is $20 million U.S.

In Bor flotation will in the future be included also processing of furnace slag and with unchanged capacity of 0.9 x10 ^{6} t per year. In order to achieve production capacity in the period 2010-2014 year planned investments is $ 1.939 million U.S., of which a part of the funds will be focused on water supply system.

In the period from 2013 to 2033 is planned for mine Veliki Krivelj to work with increased capacity from the current 8.5 x10 ^{6} to 12.5 x10 ^{6} t of ore per year. To achieve the production capacity planned are investments in open pit and flotation in the amount of $72 million U.S. One part of the resource requirements is focused in the water supply system.

Mine Cerovo will re-start operations in 2011 with an initial capacity of 2.5 million t / year. In 2015, it is planned to ramp-up processing capacity up to 5 million. t / year. Mine with this volume of production should work continously for 23 years to 2033. In order to achieve increased production and capacity an investment of $ 64.4 million U.S. is required for --- the pit, modifications to the flotation Veliki Krivelj (part of ore processing Cerovo) and modifications to the water supply system.

All projects on the water supply systems in the RBB will be financed by means of a strategic partner or RTB (Government of Serbia).