

## Mine Water Desalination Plant

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The aim of this study is to present Mine Water Desalination Plant in Oświęcim, Poland The Plant was designed to utilise the brine from coal-mine's saline water - a liquid waste.

### 1. INTRODUCTION

The Nadwiślańska Coal Mining Company of Tychy operates seven hard coal mines, two of them i.e. "Piast" and, "Ziemowit" dispose the largest salt charge into the Vistula river. A Mine Water Desalination Plant (MWDP) in Oświęcim is planned to utilise brine from these two coal mines.

The Construction of the Plant will be divided into two stages:

1<sup>st</sup> stage - utilisation of the saline water with total charge of chlorides and sulphates 850 T/day.

2<sup>nd</sup> stage - utilisation of the saline water with total charge of chlorides and sulphates 1650 T/day

### 2. LOCATION

Mine Water Desalination Plant construction site is located within area of Chemical Plant in Oświęcim. The chosen location was considered for the following reasons:

- The neighbourhood of the operating power-plant, owned by Chemical Plant in Oświęcim, which will cover 100% of power requirements of MWDP,
- The possibility to make use of already existing developed area: roads and rail, water and sewerage, electrical network, telecommunications, fire - protection, chemical - protection and civil - protection system
- The possibility of the direct sale of the output products to the chemical plant in Oświęcim (mainly NaCl and water),
- Input products (i.e. gaseous chlorine, hydrochloric and sulphuric acids, soda lye, natural gas and air ) used in the process of desalination will be delivered by the chemical plant in Oświęcim

- The availability of chemical plant in Oświęcim, technical know-how as well as possibility of usage of their technical workshop and repair potentials.

### 3. TECHNOLOGICAL CHARACTERISTICS

The idea of mine water desalination process is to use the highest concentrated saline water (brine) to produce inorganic salt (NaCl) as a commercial product. This method was already proven on the industrial scale in Poland in the Desalination Plant at Debiensko.

The Basic Design of MWDP was performed by consortium Bakke - Dürr - Energoprojekt Katowice. [1]

As a result of ecological mine water desalination process, clean water, chemical products and intermediates will be obtained

- The production technology of vacuum salt using brine utilisation consists of the following processes:

1. Pre-concentration.
2. Evaporation
3. Precipitation of gypsum

Moreover clean water and sludge are obtained. The sludge also can be utilised and  $I_2$ ,  $Br_2$ ,  $KCl$ ,  $Mg(OH)_2$ ,  $CaCl \cdot 2H_2O$  can be extracted. In the 1<sup>st</sup> stage MWDP will produce 400 000 tonnes per year of NaCl and 2,5 mln m<sup>3</sup> per year of desalinated water. The 2<sup>nd</sup> stage will be achieved by constructing a twin installation.

### 4. ECOLOGY

Presently, Vistula river contains about 55% of Polish water reserves, meeting 35% (including its drainage basin about 60 %) of national water demands.

Construction of sewage-treatment system and implementation of other projects reducing water

pollution, without constructing of MWDP at the same time - can not result in restoring Vistula's certain usable values nor liquidate ecologically dangerous waste.

According to experts from Polish Academy of Science, total losses caused by disposals of mine waters to Vistula river are estimated as high as 90 mln Eur per year.

Over normative salinity of Vistula results in: disadvantageous changes of quality of water and biotic reserves as well as in indirect consequences such as social and economical losses described as ecological-ones.

The coalmines "Piast" and "Ziemowit", which dispose the highest charge of salt to Vistula river, were classified as the one of the most dangerous poisoners of the environment on the Polish ranking list. By the rectifying decisions of Katowice voivode, the coalmines mentioned above were obliged to eliminate this harmful influence on the environment.

The construction of Mine Water Desalination Plant in Oświęcim will allow to achieve highest ecological effect since the Plant will utilise most of the salty water from mentioned above coal mines. Hence, rejection of MWDP investment will result in closing down the biggest Polish collieries, which generate profit.

Construction of the 1<sup>st</sup> stage of MWDP enable reduction of salt charge being disposed to Vistula river together with the mine water by 30%.

##### 5. COST and ECONOMY

The aims of the 1<sup>st</sup> stage of MWDP are to solve ecological problems and to produce vacuum salt. The cost of 1st construction stage is estimated to be about 105 mln USD. Taking into account income from salt production and fees and penalty for Environment Protection Found paid by coal mines, the IRR index volume exceeds 12%.

In the Polish conditions, where the concentration of chloride and sulphate ions in the brine is more than 7.5 kg/m<sup>3</sup> the repayment period for MDWP is assessed to be 7 to 8 years.

##### 6. CONCLUSIONS

1. Brine from coalmines can be used as raw materials for a high quality evaporated salt production.
2. The investments for brine utilisation (liquid waste) from coalmines and evaporated salt production can be cost-effective.

##### REFERENCES

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