Engineering Cup Challenge

UTILIZATION OF EXCESS BRINES GENERATED DURING SYLVINITE ORE PROCESSING

Focus Area

Solutions in chemical process engineering, environmental technologies, and industrial waste processing.

Objective

To develop a technologically and economically justified solution for the utilization of excess brines, reducing environmental risks and decreasing the need for constructing new brine storage facilities.

Company Overview

EuroChem is an international mineral and chemical company producing a wide range of nitrogen, phosphate, and NPK fertilizers, as well as industrial chemical products. Total number of employees exceeds 13,500.

Context and Relevance

During the beneficiation of sylvinite ore, excess brines are generated—aqueous solutions of potassium chloride and sodium chloride. Their accumulation leads to the need for constructing additional storage facilities, increases environmental pressure, and creates risks associated with expanding waste storage areas.

EuroChem's environmental policy focuses on minimizing environmental impact and reducing the formation of waste storage sites. Therefore, identifying effective brine utilization methods is a high-priority engineering challenge.

Problem Statement

Excess brines require processing or disposal.
It is necessary to identify economically efficient methods for utilizing aqueous solutions of potassium and sodium chlorides to reduce environmental risks and minimize the construction of additional storage capacity.

Task for Participants

- review potential methods for the utilization of aqueous brines containing potassium and sodium chlorides
- propose an economically viable method for processing or utilization
- consider the technical characteristics of the brines
- justify the applicability of the proposed method under actual plant conditions

Input Data

Plant Capacity

- 2,200 thousand m^3/year
- 282 m^3/h

Average Characteristics of Circulating Brine

Component	Average Value
KCl	8.79%
NaCl	19.16%
$CaSO_4$	0.40%
$Mg(Cl_2 + SO_4)$	0.79%
Density	1.22 g/cm^3

Economic Parameters

- unit production cost
- electricity tariff
- cost of raw materials
- labor costs for the production site

Constraints

When developing the solution, participants must consider:

- Implementation budget
- Project timeline
- Safety requirements
- Personnel limitations
- Potential need for plant shutdown during integration

Expected Deliverables

Participants must present:

1. Analysis of potential brine utilization methods (KCl, NaCl).
2. Justification of the selected method, considering technical and technological parameters.
3. Economic evaluation of the proposed solution.
4. A preliminary process flow scheme or sequence of implementation steps.
5. Assessment of the environmental impact.

Additional Materials

Appendix 1. EuroChem Company Information

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1. Name

Mineral and Chemical Company **EuroChem**

2. Industry Sector

Chemical industry; production of mineral fertilizers and industrial chemical products.

3. Core Activities

EuroChem specializes in the production of nitrogen, phosphate, and complex fertilizers, as well as a range of industrial chemical products.
The company includes enterprises covering the full production cycle: mining, beneficiation, fertilizer production, logistics, and service divisions.

4. Company Structure

The group includes:

- EuroChem-BMU LLC
- Phosphorit Industrial Group LLC
- EuroChem Northwest LLC
- Nevinnomyssky Azot
- JSC NAK Azot with Novomoskovsky Khlor branch
- Kingisepp-Remstroyservice LLC
- Nevinnomyssky Remstroyservice LLC
- Novomoskovsk-Remstroyservice LLC
- ProTech Engineering LLC
- ProTech Lab LLC

5. Number of Employees

More than **13,500**, including:

- EuroChem-BMU — 878
- Phosphorit — 1,154
- EuroChem Northwest — 239
- Nevinnomyssky Azot — 3,150
- NAK Azot + Novomoskovsky Khlor — 3,696
- Nevinnomyssky Remstroyservice — 1,340
- Kingisepp-Remstroyservice — 839
- Novomoskovsk-Remstroyservice — 1,099
- ProTech Engineering — 1,058
- ProTech Lab — 100+

6. Core Values and Approach

The company is committed to innovation, technological efficiency, environmental responsibility, production safety, and employee development.