Engineering Cup Challenge

PRODUCTION OF NEW PRODUCTS FROM BRINES GENERATED AFTER ORE BENEFICIATION

Focus Area

Solutions in chemical process engineering, mineral feedstock processing, and development of new products.

Objective

To create a technologically sound solution for the processing of brines, enabling the production of new products and improving production efficiency through diversification of the company's product portfolio.

Company Overview

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

Context and Relevance

The company's production facilities generate significant volumes of surplus brines containing dissolved potassium chloride, sodium chloride, and various impurities. These brines are byproducts of ore beneficiation.

The task is highly relevant, as the company aims to produce new products from these brines as a means of diversifying production and increasing operational efficiency.

Problem Statement

Surplus brines contain valuable dissolved salts but are currently not used to produce commercially significant products.

Task for Participants

1. Propose a technological solution for producing new products from aqueous solutions of potassium chloride and sodium chloride.
2. Take into account the chemical composition of the incoming stream, temperature range, and brine volume.
3. Evaluate the applicability of the chosen method under real production conditions.

Note:

Your solution should also consider operational constraints and integration into existing processing infrastructure.

Input Data

Brine Volume

- Up to 3.5 million m^3/year
- 449 m^3/h

Incoming Stream (brine from the tailings storage of the beneficiation plant)

Component — Annual Average:

- KCl — 8.51%
- NaCl — 19.62%
- $MgCl_2$ — 0.51%
- $CaCl_2$ — 1.12%
- $CaSO_4$ — 0.12%
- Insoluble solids — up to 100 mg/L
- Temperature — –10 to +20 °C

Economic Parameters

- Unit production cost
- Electricity tariff
- Raw material cost
- Labor costs at the processing unit

Constraints

When developing the solution, participants must consider:

- Budget limitations
- Project timeline
- Safety requirements
- Personnel/skills constraints
- Potential need for process shutdowns

Expected Deliverables

Participants must present:

1. Analysis of brine composition and its potential for new product formation.
2. Proposed technological solution for extracting and producing target products.
3. Justification of applicability of the proposed solution under real industrial conditions.
4. Economic assessment based on the provided parameters.
5. A process scheme or a step-by-step technology implementation flow.

Additional Materials

Appendix 1. EuroChem Company Information

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1. Name

Mineral and Chemical Company “EuroChem”

2. Industry

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

3. Main Activities

The company specializes in producing nitrogen, phosphorus, and complex fertilizers, as well as a range of industrial chemicals. EuroChem integrates companies across the full production cycle, including raw material extraction, processing, fertilizer production, logistics, and service divisions.

4. Company Structure

The group includes:

- EuroChem-BMU LLC
- Phosphorit Industrial Group LLC
- EuroChem North-West LLC
- Nevinnomysskiy Azot
- NAC “Azot” JSC with the “Novomoskovsky Chlor” branch
- Kingisepp-Remstroyservice LLC
- Nevinnomyssk-Remstroyservice LLC
- Novomoskovsk-Remstroyservice LLC
- ProTech Engineering LLC
- Pro Tech Lab LLC

5. Number of Employees

Total: 13,500+, including:

- EuroChem-BMU — 878
- Phosphorit Industrial Group — 1,154
- EuroChem North-West — 239
- Nevinnomysskiy Azot — 3,150
- NAC “Azot” & Novomoskovsky Chlor — 3,696
- Nevinnomyssk Remstroyservice — 1,340
- Kingisepp-Remstroyservice — 839
- Novomoskovsk Remstroyservice — 1,099
- ProTech Engineering — 1,058
- Pro Tech Lab — 100+

6. Core Values and Approach

EuroChem prioritizes:

- Innovation and technological development
- Process efficiency
- Environmental responsibility
- Workplace safety
- Employee development