

**RICARDO HENRIQUE KOZAK - CHEMICAL ENGINEER  
SULPHUR MANAGEMENT EXPERIENCE**

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**A. PETRÓLEO BRASILEIRO S.A. - PETROBRAS (January 1962/June 1966)**

Chief Process Engineer for the Process Design and Engineering of the Gas Treating and Sulfur Recovery Units for the Shale Oil Prototype Plant located in São Mateus do Sul-PR-Brazil.

**B. FOSTER WHEELER CORPORATION (June 1966/December 1973)**

**1. Foster Wheeler Corporation, Livingston - NJ - USA**

- a. **SHAHPUR CHEMICAL Co.:** 1500 (2 x 750) metric tons/day Sulfur Plant (Proposal).
- b. **DORR OLIVER INC.:** Sulfur Recovery Plant (Study).
- c. **KNPC:** Sulfur Plant (Operating Manual).

**2. Foster Wheeler Ltda, Rio de Janeiro**

**a. PETROBRAS - SIX (São Mateus do Sul - PR)**

**Shale Oil Prototype Plant:** Conclusive Study of Air Pollution by the Tail Gases from Plant, sizing of all Chimneys and the Flare to minimize the effects of the pollution by SO<sub>x</sub> in the environment.

**b. PETROBRAS - REPLAN (Paulinea - SP)**

**Sulfur Recovery Unit:** Complete Process Design, including thermal ratings of Waste Heat Boilers and Sulfur Condensers, and preparation of the operating manuals for the Units.

**c. PETROBRAS - FAFER (Cubatão - SP)**

**Sulfur Recovery Unit:** Complete Process Design, including thermal ratings of Waste Heat Boilers and Sulfur Condensers, and preparation of the operating manuals for the Units.

**d. PETROBRAS-REFAP(Canoas - RS)**

**Fuel Gas Treating and Sulfur Recovery Unit:** Complete Process Design, including thermal ratings of all Heat Exchangers of the Fuel Gas Treating Unit and thermal ratings of Waste Heat Boilers and Sulfur Condensers of the Sulfur Recovery Unit.

**e. PETROBRAS-REGAP (Betim - MG)**

**Fuel Gas Treating and Sulfur Recovery Unit:** Complete Process Design, including thermal ratings of all Heat Exchangers of the Fuel Gas Treating Unit and thermal ratings of Waste Heat Boilers and Sulfur Condensers of the Sulfur Recovery Unit.

**C. PROJEPRO – Projetos de Processamento Ltda. (since June 1974)**

**1. PETROBRAS - SIX (Oil-Shale Industrialization Superintendence) (1975)**

- a. **Project Title:** Pyrolysis Gas Treatment Unit for Shale Oil Industrial Plant.
- b. **Unit Capacity:** 13,000,000 Nm<sup>3</sup>/day of raw gas.

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**c. Description:** Preliminary process design packages for cost estimation including process flowsheets, heat and material balances, P&I diagrams, summary process descriptions, and equipment design and specifications for the Light-oil, Hydrocarbon and Sulfur Recovery Units, and Gas Treating Unit.

**2. PETROBRAS - SIX (Oil-Shale Industrialization Superintendency) (1977)**

**a. Project Title:** Sulfur Recovery Unit of the Irati Shale Oil Prototype Plant.

**b. Unit Capacity:** 40 metric tons/day of sulfur

**c. Description:** Operational analysis and equipment re-design in order to achieve a better sulfur recovery flexibility at lower operational capacities. Based on operational data, the theoretical/practical correlations were set, and a computer re-design of the waste-heat boiler and sulfur condensers along with the calculation of the new heat balances were performed.

**3. PETROBRAS - REPAR (President Getúlio Vargas Refinery) (1979)**

**a. Project Title:** REPAR - Global Re-evaluation of the Sulfur Recovery Unit.

**b. Unit Capacity:** 60 metric tons/day of sulfur.

**c. Description:** Computer analysis of the unit operational data and equipment re-design for a better performance of the sulfur recovery unit was performed. After the modifications were introduced and new operational data analyzed, computer simulations of the unit with material and heat balances were made in order to define the best operational conditions for the unit.

**4. PETROBRAS - REVAP (Henrique Lage Refinery) (1982/1984)**

**a. Project Title:** REVAP - Global Re-evaluation of the Sulfur Recovery Unit.

**b. Unit Capacity:** 200 metric tons/day of sulfur.

**c. Description:** Computer analysis of the unit operational data and equipment re-design for a better performance of the sulfur recovery unit was performed. After the modifications were introduced and new operational data analyzed, computer simulations of the unit with material and heat balances were made in order to define the best operational conditions for the unit.

**5. PETROBRAS - DEPIN (Industrial Department) (1984/1986)**

**a. Project Title:** Sulfur Recovery Units Optimization.

**b. Description:** Overall re-evaluation of the REFAP and REPLAN Sulfur Recovery Units designs, with operational data analysis and the issue of an abnormalities/corrective measures report, so as to achieve better operational efficiencies.

**6. PETROBRAS - REPAR (President Getúlio Vargas Refinery) (1986)**

**a. Project Title:** Sulfur Recovery Unit Residual Gas Incineration.

**b. Description:** Process Design of the new Incineration Chamber.

**7. ULTRAFÉRTIL S.A. - Indústria e Comércio de Fertilizantes (1991/1992)**

- a. Project Title:** UFAR - Global Re-evaluation of the Sulfur Recovery Unit.
- b. Unit Capacity:** 58 metric tons/day of sulfur.
- c. Description:** Analysis of the complete process design, including the Safety and Emergency Shutdown System, of the Sulfur Recovery Unit located at Araucária-PR, and analysis of the operational data, with the purpose to revamp the unit to improve the operational safety and to increase its performance.

**8. PETROBRAS - REPAR (President Getúlio Vargas Refinery) (2001/2002)**

- a. Project Title:** REPAR - Global Re-evaluation of the Sulfur Recovery Unit.
- b. Unit Capacity:** 60 metric tons/day of sulfur.
- c. Description:** Computer simulations of the SRU considering the new acid feed conditions that will result from the Refinery expansion to verify which changes should be made in the unit to permit with the new conditions. Material and heat balances were made in order to define the best operational conditions for situations of H<sub>2</sub>S concentration and ranges of feed rates.

**9. PETROBRAS - SIX (Oil-Shale Industrialization Superintendence) (2006/2007)**

- a. Project Title:** 100 MW Power Generation Plant.
- b. Description:** Preliminary Technical and Economical Feasibility Study for a 100 MW Power Cogeneration Plant burning fines of oil shale in a circulating fluidized bed combustor. The flue gas leaving the Electrostatic Precipitator has about 500 mtpd of sulphur dioxide, which will be removed from the gas and transformed in ammonium sulphate or sulphuric acid and/or liquefied SO<sub>2</sub> and/or Sulphur.