# Waldemar S. Nelson and Company
Incorporated
*Engineers*

## Sulphur Expertise











1200 St. Charles Ave.
New Orleans, Louisiana 70130
(504) 523-5281

4 CityNorth
16945 Northchase Drive
Suite 200
Houston, Texas 77060
(281) 999-1989

*www.wsnelson.com*

## FREEPORT SULPHUR COMPANY:

After World War 2, Freeport Sulphur Company expanded the capacity of its Grande Ecaille mine. Freeport's and NELSON's engineers collaborated on design and procurement for the project, which involved the addition of new, higher pressure steam boilers and a steam turbine-generator, installation of additional mine water heaters with increased water treating and chemical handling facilities, and modifications to the piping and electrical systems.

In 1952 Freeport Sulphur Company acquired the mineral rights to several sulphur deposits along the Louisiana coast, leading to the idea of installing a mining plant on a barge. This sulphur production facility, in essence a mobile mining plant, could be constructed onshore and then towed to the mine location where it would be connected directly to the sulphur wells. The Bay Sainte Elaine mining barge was thus conceived, and NELSON was retained to design this unique facility, with Freeport personnel and our staff working closely together.

This concept was so successful that the original mining barge was used to mine the Bay Sainte Elaine deposit from 1952 until its depletion in 1959, then moved to Lake Pelto where it was in operation from 1960 until 1975. Finally, it was moved to the Caillou Island sulphur dome where it was used from 1980 until 1984, in all, a period of 32 years.

Since it was not feasible to store sulphur at Bay Sainte Elaine, the molten sulphur was pumped into 1,000 ton capacity barges, which were towed to Port Sulphur. NELSON and Freeport engineers designed the long, narrow barges, drawing only 5½ feet of water, with molten sulphur in cargo tanks enclosed by structural weatherproofing. Barging of liquid sulphur was so successful that Freeport began to serve its major customers by barges and specially-designed ships. NELSON designed 4 terminals in Maine, Florida, Ohio, and Illinois.

In 1953, NELSON was retained to design the Garden Island Bay plant, and the Company's technical staff and Freeport's engineers worked on the design and procurement for the project. The Garden Island Bay project included a power plant, a shop building, a warehouse, and housing and dining for the operators. The Garden Island Bay mine continued in operation until 1990, producing more than twenty-seven million tons of sulphur.

NELSON worked with Freeport's technical staff in developing two smaller sulphur deposits: Nash Dome in Texas and Chacahoula in Louisiana.

## OFFSHORE SULPHUR MINES:

Freeport Sulphur Company acquired two sulphur leases in the Gulf of Mexico. The larger deposit was located approximately seven miles south of Grand Isle. The average water depth is 50 feet and the location is totally exposed to the winds, tides, long-shore currents, and hurricanes which sweep the Gulf of Mexico. This would be the first sulphur mine in an offshore environment. Freeport retained NELSON to assist their technical staff in developing this mine, which was placed in operation in 1960 and operated until 1994, producing more than 26 million tons during its life span. The facility withstood major hurricanes: Betsy in 1965, Camille in 1969, and Andrew in 1994.

Freeport's second, smaller sulphur mine in the Gulf was located seven miles south of Caminada Pass, also at a water depth of 50 feet. This mining plant was developed on a smaller, more compact basis - a scaled down version of the Grand Isle Mine. This mine operated until 1994 when the deposit was depleted.

### MAIN PASS MINE:

Freeport-McMoRan and its partners leased a major sulphur deposit in Main Pass Block 299 in the Gulf of Mexico, approximately seventeen miles east of the mouth of the Mississippi River in a water depth of 210 feet. The sulphur deposit contained more than 67 million long tons of proven reserves worth more than $8 billion. As sulphur is removed from the dome subsidence occurs, and the initial water depth of 210 feet will increase to more than 270 feet.

The 2,000-ton, 40,000sf Quarters Module was designed for 180 persons, and the auxiliary quarters located above the Shop-Warehouse was designed for 40 workers. These were used during construction as well as during operations.

The three-level, 5,500-ton, 110 foot by 210 foot by 70 foot tall Power Plant Module included all of the equipment required for production of steam, electricity, mine water and high pressure air. The complex of six large pile-supported platforms extending 1¼ mile, was the largest offshore mining facility in the world, contained more than 100,000 tons of steel, more than 15 miles of field piping and thousands of feet of complex power plant piping, and it had a highly sophisticated control and communications system, allowing remote access to mine operations data nonpareil in the industry. Although designed to produce 5,500 long tons of sulphur per day, it consistently produced more than 7,000. The total cost of the project was $850 million.




Refining/manufacturing facilities...




Marine facilities...




Buildings...




Transfer, Transportation, Storage...




Miscellaneous...




Environmental Services...

## Waldemar S. Nelson and Company Sulphur Experience

NELSON's experience with design and construction of sulphur facilities began in 1947, soon after our founding. After World War 2, with the demand for sulphur increasing rapidly, Freeport Sulphur Company expanded the capacity of its Grande Ecaille mine. An engineering contract was negotiated with NELSON, and their engineering staff and our engineers worked side-by-side on the design and procurement for the project.

The experience gained at the Grande Ecaille mine served the company well in the subsequent design of additional mining facilities for sulphur and other minerals, such as:

| | | |
|---|---|---|
| Bay Sainte Elaine Mine | Garden Island Bay Mine | Grand Isle Mine |
| Lake Pelto Mine | Nash Dome Mine | Caminada Mine |
| Caillou Island Mine | Chacahoula Mine | Main Pass Mine |

NELSON also worked on the design of barges for transporting molten sulphur and the design of multiple molten sulphur terminals, including at Bucksport, Maine, Tampa, Florida, Wellsville, Ohio, and Joliet, Illinois.

Much of NELSON's work has been involved with chemical plants and processes, including the Uncle Sam Phosphoric Acid Plant for Freeport Chemical Company located on the east bank of the Mississippi River at Convent, Louisiana. The plant process includes molten sulphur which is mined offshore south of Louisiana where it is transported to Convent in insulated barges. The sulphur is used to make sulphuric acid which, in turn, is used to react with the phosphate ore to make phosphoric acid, one of the main ingredients in agricultural fertilizer. The four-train sulphuric acid plant at Uncle Sam is said to be the largest in the world.

The process of making phosphoric acid from phosphate ore leaves a residue of gypsum containing traces of phosphoric acid and sulphuric acid, two soil nutrients which are used in commercial fertilizers. In the spring of 1991, NELSON was retained by Freeport Research and Engineering to devise a cost-effective plan to reduce the discharge of these soil nutrients by 75 percent. The terraced gypsum stacks were graded to a gentler slope to enhance their stability and covered with a six inch blanket of clay planted with Bermuda and winter rye grasses. More than 1,000,000 cubic yards of semi-impermeable clay were placed on the stacks.

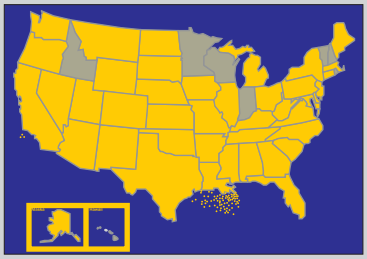
In 2012, NELSON was retained by Chevron to provide multi-discipline engineering services for design of the TenguChevroil Sulfur Expansion Project (SEP) in Kazakhstan. The objective was to select, define, and implement systems and facilities that would increase saleable sulphur export capacity In order to contribute to management of the inventory of solid sulfur, in alignment with the facility owners' expectations and sound economic principles. The main elements were the following:

- New remelting facilities.
- Additional degassing facilities.
- Additional granulation facilities.
- Incremental pumping and piping.
- Dry conveying/bulk transfer of sulphur
- Control system integration.
- Expansion of utilities and infrastructure.

NELSON has also designed various other sulphur facilities including molten sulphur unloading and handling for a prilling plant, prilled sulphur conveyor belt loading and transfer, repair of concrete facilities damaged by molten sulphur, facility evaluation and design of repairs at sulphur terminals, and surveys of stored sulphur in prilled, bulk and molten forms at terminals in Texas, Louisiana, Florida and Illinois.

**Serving our Clients Since 1945.**

**Nationally**



**Worldwide**

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