April 20, 1995

MEMORANDUM TO: Hugh Hanes

FROM: Mark Emly

SUBJECT: Potential Sulfuric Acid Emissions at the Lorain Facility

At the Lorain facility, two production operations released significant quantities of sulfuric acid (H_2SO_4), sulfur dioxide (SO_2) and sulfur trioxide (SO_3) into the working atmosphere. These operations were the sulfation of heat-treated beryl ore frit and the calcination of beryllium sulfate to beryllium oxide.

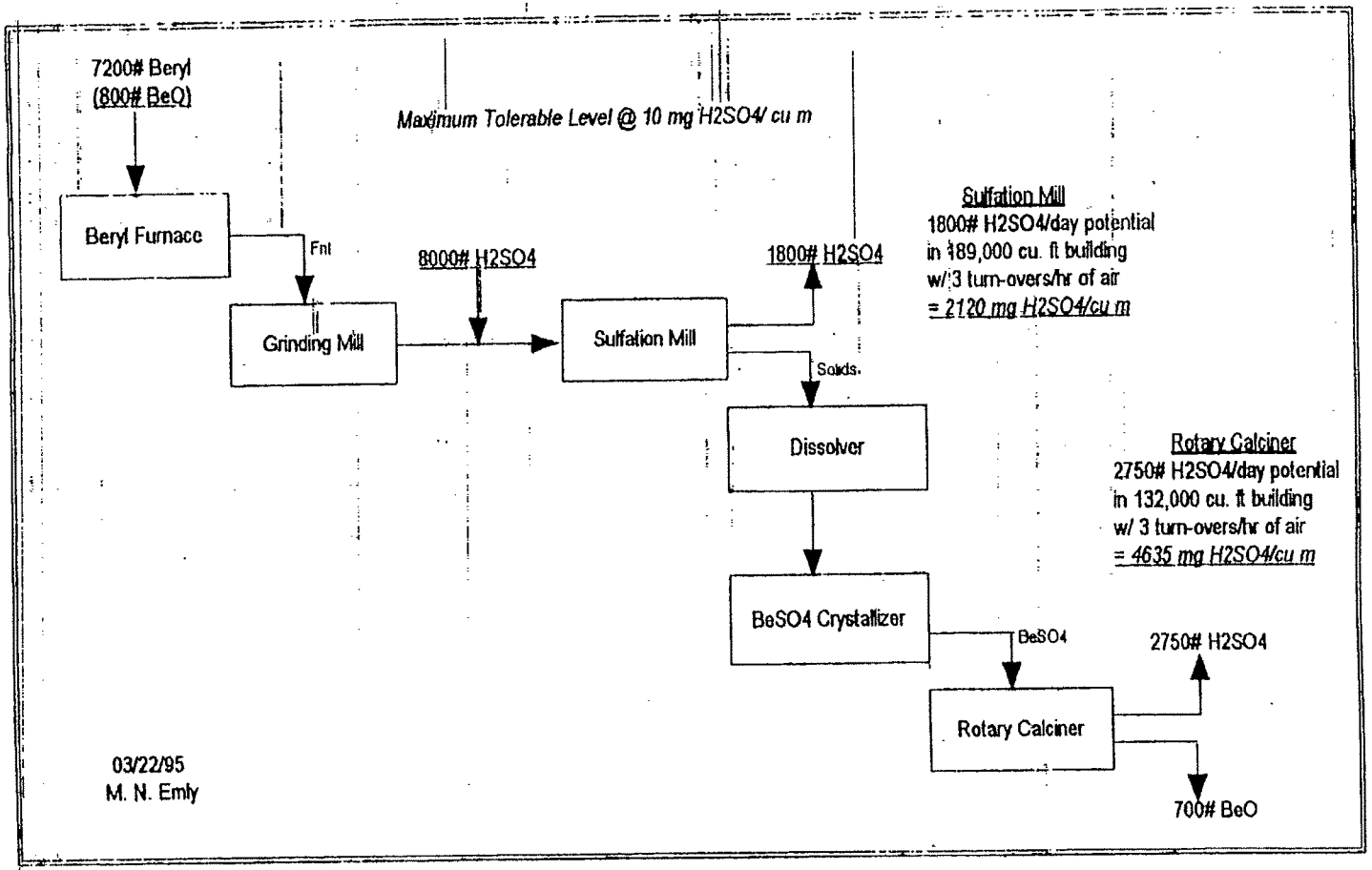
Sulfation of beryl frit was conducted batchwise. A fluid mixture of finely ground beryl frit in concentrated, 93% (66° Be) sulfuric acid was air blown through a nozzle with two 1/4" openings into one of two gas-fired sulfation mills preheated to 325°C (600°F). After an additional hour of heating to ensure reaction, the sulfated material was expelled from the mill through a small grated door into a water filled dissolver tank for eventual recovery of beryllium sulfate. The entire sulfation run required a minimum of three hours--one hour to spray the acid-frit mixture into the mill, one hour to react the mixture, and one hour to discharge the sulfated material into the dissolver pit.

Typically, at least 20% of the input sulfuric acid is lost (presumably as H_2SO_4, SO_2, and/or SO_3) during the sulfation process. By assuming a uniform natural gas burner requirement of 30,000 Btu's per minute, the sulfation mill would emit nearly 600 ft^3 per minute of burner gases along with an average of 2000 g H_2SO_4 per minute. Expressed as sulfuric acid equivalent, the sulfation mill would have emitted an average sulfuric acid concentration of 60 mg/m^3. In order for the immediate area to be at least tolerable for breathing, the ambient room air undoubtedly mixed with and diluted the H_2SO_4 mist to at least the "objectionable" range of 5 to 10 mg/m^3 for H_2SO_4. In all likelihood, this operation was not vented until after 1948.

A direct-fired, rotary gas kiln was used to calcine beryllium sulfate to beryllium oxide at temperatures approaching 1200°C. A production rate of 700 lb BeO/day, would require the calcination of 210 lb beryllium sulfate per hour with a minimum energy requirement of 975,000 Btu/hr. Burner off-gases at 200 ft^3/min would carry off nearly 500 g SO_2/min. for an average concentration of 70 mg SO_2/m^3. The process gases were apparently vented through an electrostatic precipitator (to capture fine BeO particles) followed by a 125 foot stack. Actual ambient levels of SO_2 are difficult to estimate, but presumably were less than 5 or 10 mg/m^3.

cc: J. Stonehouse, P. Wilson

ME002651


7200# Beryl
(800# BeO)
Maximum Tolerable Level @ 10 mg H2SO4/ cu m
Beryl Furnace
Fnl
Grinding Mill
8000# H2SO4
Sulfation Mill
1800# H2SO4
Sulfation Mill
1800# H2SO4/day potential
in 189,000 cu. ft building
w/ 3 turn-overs/hr of air
= 2120 mg H2SO4/cu m
Solids
Dissolver
Rotary Calciner
2750# H2SO4/day potential
in 132,000 cu. ft building
w/ 3 turn-overs/hr of air
= 4635 mg H2SO4/cu m
BeSO4 Crystallizer
BeSO4
2750# H2SO4
Rotary Calciner
700# BeO
03/22/95
M. N. Emly