Operation	Particles per cu. ft.
Screening sand prior to mixing with cement..	2,493,160
Mixing batch.....	1,699,200
Shoveling mix into hopper.....	6,485,280

About 40% of the dust particles in samples taken while mixing the batch and filling the hopper were crystalline, quartz-like in appearance, and about five microns in size. The remainder were dark grey in color and below one micron in size. The dust particles in air coming out of the bottom manhole of a soaking drum being gunited averaged 528,640 particles per cubic foot, and were slightly angular, crystalline in appearance and four microns or less in size.

A gunite crew consists of six men. The average service credit of the men in the Crews studied was eight years. Two "nozzle-men" who "spell" each other every two or three hours apply the gunite. There is one man at the gunite machine, and three men screen the sand and mix it with cement. Only about 25% of their working time, or nine hours per week per man, is devoted to guniting.

Removal of Gunite Lining: Pneumatic chisels are used to remove gunite lining. Samples taken from inside a cracking coil tar separator during this operation had as high as 16,595,520 particles of dust, ten microns or less in size, per cubic foot, and an average of 10,804,080 particles per cubic foot. About 75% of these particles were rounded, angular, more or less opaque, in appearance, one micron or less in size, and 25% were angular, quartz-like, about ten microns or less in size. A chemical analysis of the gunite lining showed that it contained 68.2% free silica. Four men from the Plant Labor Department, with an average service of seven years, spend about twenty hours per week removing gunite linings from process equipment. An air syphon provides ventilation, and the men are required to use the goggles and respirators which are furnished them.

V - WELDING AND CUTTING OPERATIONS

Welding has never been considered a dust-producing operation. However, our studies and those of others indicate that the use of the modern coated electrodes or rods produces a large amount of dust in addition to the fumes which are evolved. An electric arc is used for most of the welding around refineries. There are a number of welding jobs, however, for which oxy-acetylene is used. Oxy-acetylene is also used for practically all burning or cutting.

A - WELDING OPERATIONS:

1. ELECTRIC ARC WELDING: Electric arc welding is used on all types of construction and repair work. The average service of the electric welders is about two years and most of them came from the Labor Department, having been developed into welders at the individual plants. They are exposed to particulate matter generated by the welding operation on an average of six hours per shift, nine shifts out of fourteen. This particulate matter is ordinarily referred to as "fumes or smokes". The particles when found have a much smaller size range than that of dust, such as silica. With some operations there may also be some dust present, but the product formed from volatilizing the metal and rod coatings is commonly termed a "fume". All welders are provided with approved hand shield or helmets equipped with #10 Noviweld lens. Welding in shops is done in canvas or wooden booths. A steam or air syphon is installed when any arc welding is done inside of closed vessels such as drums or towers.

What are Coated Electrodes? Coated electrodes are metal welding rods covered