

this fatal occupational disorder consists in the introduction of measures that will prevent occupational contact with the causative agent.

*The Lung Cancer of the Joachimsthal Miners*

*Technological Notes.* Joachimsthal, which is located on the southern slope of the Erzgebirge in the Sudetenland, has been the site of mining activities for several centuries. Silver mines were opened there in the year 1516. After the exhaustion of the silver ores, and toward the end of the sixteenth century, mining was continued on a reduced scale to recover nickel, cobalt, bismuth and arsenic ores. During the latter part of the last century, the mining activities in Joachimsthal were revived following the mining of uranium ores (pitchblende) used as the basic material for the manufacture of uranium pigments. These operations were greatly enhanced after the discovery of radium in pitchblende. Large quantities of uranium ores have to be mined for the recovery of radium as the uranium ores contain very small amounts of radium ( $3.4 \times 10^{-7}$  gram of radium is in equilibrium with 1 gm. of uranium). A total of two grams of radium have been recovered in recent years from the uranium ores at Joachimsthal.

There were approximately 400 miners employed in the mines during 1929 (Löwy), while an additional 60 workers were engaged in the manufacture of radium and uranium dyes in factories and laboratories located in Joachimsthal. Invalids were estimated to number about 100. Somewhat lower figures were recorded by Šickl in 1931 (320 active and 80 retired miners). Hueck placed the number of miners at 250 to 300 in 1939.

*Exposure.* The production methods, used in the Joachimsthal mines, are similar to those employed at Schneeberg. The dust found in the mines contains crystalline slate, feldspar, quartz, sometimes calcium, lead, and occasionally arsenic, bismuth, nickel, cobalt and uranium. Běhounek has demonstrated that the dust is radioactive. The same property is exhibited by the air and the water of the mines. The radium emanation escapes through cracks in the rock (Běhounek). The statements made concerning the degree of radioactivity of the air vary to some extent. Pirchan and Šickl reported that one liter of air contains 4 to 15 Mache units, but that some parts of the mines might contain as many as 52 Mache units. An average of 10 Mache units and a range of 3 to 30 Mache units was recorded by Tschelnitz, while Neitzel noted a radioactivity of the air of 30 to 40 Mache units.

*Causative Mechanism.* There are evidently two agents which may possess etiological relations to the development of the pulmonary malignancies observed among men working in the Joachimsthal mines. The first factor is the dust, especially its siliceous component, and the second factor is the radioactive substance inhaled in the form of dust or gas. The dust hazard in the Joachimsthal mines is less pronounced than in the Schneeberg mines. The reason for this difference is not quite clear. It may be due to differences in the character