

Problem 11

A planning engineer for a new alum plant must present some estimates to his company regarding the capacity of a silo designed to contain bauxite ore until it is processed into alum. The ore resembles pink talcum powder and is poured from a conveyor at the top of the silo. The silo is a cylinder 100 ft high with a radius of 200 ft. The conveyor carries ore at a rate of $60,000\pi$ ft³/h and the ore maintains a conical shape whose radius is 1.5 times its height.

- (a) If, at a certain time t , the pile is 60 ft high, how long will it take for the pile to reach the top of the silo?
- (b) Management wants to know how much room will be left in the floor area of the silo when the pile is 60 ft high. How fast is the floor area of the pile growing at that height?
- (c) Suppose a loader starts removing the ore at the rate of $20,000\pi$ ft³/h when the height of the pile reaches 90 ft. Suppose, also, that the pile continues to maintain its shape. How long will it take for the pile to reach the top of the silo under these conditions?