

Public Abstract

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Title:AIR PERMIT FOR THE CONSTRUCTION AND OPERATION OF A CALCIUM CARBIDE MANUFACTURING PLANT

The purpose of this thesis is to determine the regulatory requirements necessary for constructing calcium carbide manufacturing plants. Material and thermal balances were made on the basis of biomass as a substitute for typical carbon raw materials, such as petroleum coke. The calcium carbide plant design was adapted from a novel concept that gasifies biomass in three stages to form the carbon raw material. Emission rates to air were calculated using comparable emission factors to determine the potential environmental impacts of the plant and its compliance to current State of Missouri air pollution regulations. The results show that the emissions associated with the calcium carbide plant allow for 1,657 tons per year of production for a true de minimis source, without the need for a construction or operating permit. For higher levels of production, a de minimis, minor or major permit is required. A synthetic de minimis source can achieve an annual calcium carbide production rate of up to 6,362 tons with the use of particulate filters. A true minor source can produce 30,273 tons per year without control devices. A synthetic minor source can produce 39,876 tons annually with the use of particulate filters. A major source can produce 44,389 tons annually with the installation of low NO<sub>x</sub> burners and particulate filters. The results of this thesis are significant for the design and operation of a pilot or permanent calcium carbide manufacturing plant because permitting of air emissions is necessary prior to the start of any construction activities.