Low Voltage Anode Effects and Unreported PFC Emissions

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Abstract

It has been established in a number of industrial plant measurements that low voltage anode effects (LVAE) occur in primary aluminum electrolysis cells with the emission of perfluorocarbons (PFCs), CF_4 and C_2F_6. These LVAE are more common in modern high amperage cells that have twice the number of anodes, e.g., 40 - 48 anodes compared with about 24 anodes in small 100 to 250 kA prebake cells. The emission of PFCs during LVAE is not currently reported by plant computer process control systems because they occur below the usual 6 to 8 V detection limit. The causes for the propagation of anode effects on individual anodes during high voltage anode effects versus the non-propagation of anode effects on individual anodes during LVAE is discussed. The trend to reduce the specific energy consumption by reducing the anode-cathode distance has been shown to have an impact on reducing the maximum voltage as well as the duration of LVAE in cells due to electrical shorting between anodes and aluminum metal waves.

Keywords: Low voltage anode effects; anode effects on individual anodes; PFC emissions; reporting of PFC emissions.