

**Radiation from Swedish bedrock - applied to building materials,
NORM and uranium mineralization's**

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Abstract

Sweden has some of the world's largest occurrences of energy metals, mainly uranium but also thorium. Most of the uranium occurs in black shales. Due to low grades in most of the resources, they are not economical to mine. Historically there have been some attempts to extract uranium, but the black shales have also been used for alum and energy production, leaving heaps of material behind. The Swedish nuclear power plants use about 1500-2000 tons of uranium each year, all of which is imported. There has been a wave of uranium exploration in Sweden in the 2000s, but today, very few exploration permits for uranium are valid. REE occurrences are often enriched in uranium, but this is not the case for Norra Kärr, the only REE project nearing potential mining.

Areas with enhanced uranium and thorium concentrations are clearly visible on airborne radiation maps, e.g. areas with alum shales. In addition to black shales Swedish granites and pegmatites often have elevated uranium content, e.g. the Bohus granite, and the uranium-rich granitoids in western Mälardalen. They are also enriched in thorium. Generally, the uranium and thorium concentrations in Swedish bedrock need to be considered when using crushed rock for concrete in buildings where people can be exposed. Out of > 27 000 gamma spectrometry measurements on outcrops, 30 % exceeds activity index 1, and 4 % exceeds activity index 2. This means that many quarries in Sweden cannot deliver crushed rock to concrete for buildings without selective quarrying, mixing with other material or pre-treatment. Uranium and thorium minerals in granites are to a large part included in biotite crystals, i.e., the biotite behavior during crushing and handling determines the uranium and thorium content of the different aggregate fractions.
