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Michigan International Copper Analogue (MICA) project – assessment of long-term behaviour of copper in repository relevant environments

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One of the key requirements for the deep geological disposal of high-level nuclear waste is the assessment of its long-term performance and safety. As any other barrier of the disposal system, waste containers must fulfil their respective safety functions for the required duration, which can vary from a few hundreds of years to several hundreds of thousands of years, depending on disposal system requirements. Sufficient corrosion resistance under repository conditions is one key requirement for container material to provide complete waste containment. Copper is an important part of many waste packaging and disposal concepts, e.g. KBS-3 developed in Sweden and Finland and Mark II developed in Canada. Much of the data available regarding its behaviour under repository conditions comes from short-term investigations, such as laboratory experiments at different scales and under controlled conditions. Observations made from copper analogue studies provide additional information on copper behaviour during the assessment time scale and under real geological environments. By this, they can support the argumentation in the safety case.

Keweenaw native copper occurrences (Lake Superior, US) reflects more than one billion years of deposit evolution covering various geological (from bedrock to sediments and even anthropogenic mine site remnants) and geochemical environments (e.g., brines to meteoric water, anoxic vs. oxic, sulphur-free vs. sulphur-bearing). These deposits have been mined for a long time and there is a great deal of knowledge related to them as well as samples collected. However, data to be used in process based safety assessments for geological disposal is lacking and no formal review has been made from the geological disposal point of view. The current MICA Project Phase I systematically collect and review the existing literature and data on the Michigan copper analogue sites and available sampling potential. Based on the outcome, MICA Project Phase II will then study and analyse prospective sites and samples to address relevant questions regarding long-term behaviour of copper under disposal conditions. The MICA Project thus will provide a unique

complementary data source to estimate processes governing behaviour of metallic copper and to support safety cases.