Applying Freeze Technology for Characterisation of Liquids, Sludge and Sediment

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Keywords: characterisation, sub surface, sediments, sludge, freeze technology

Contaminated solids below a water table or solids in a water saturated environment can be major cost drivers and have a massive impact on the overall schedule and scope for a decommissioning project if not managed properly. One well recognized key activity in the preparation for decommissioning is to perform a proper characterisation covering all objects and areas which have been affected or potentially affected by contamination. Characterization of potentially contaminated material located below water or in water saturated environments can be difficult to perform accurately. Furthermore, traditional sampling techniques typically result in the disturbance or spreading of the contamination during sample collection.

Sampling programs should be done in such a way that the radioactivity is contained (to avoid further spread of contamination), and in a way that the risk for cross contamination is minimised. Studsvik's Freeze Technology has been used to develop the necessary sampling techniques to meet these objectives. This technology is proven and frequently used for environmental characterization and remediation applications. The design of the sampling tools for radiological characterisation allows for samples to be taken at specific depths and at specific locations within the contaminated area without disturbing the contaminated material around the sample location.

In addition to the sampling technique described above, a modified freeze sampling design has proven to be very useful in collecting frozen core samples that provide an accurate profile of the contamination and chemical and physical characteristics of the sediment or sludge as a function of depth into the sludge or sediment. Ultimately, this technique is used to develop a 3-D map of the physical characteristics and the chemical and radiological composition of the contaminated area. For many projects, this type of information will allow for a large reduction in the dredging/remediation activities required, as well as a significant reduction in the overall amount of material that must be disposed. With an accurate 3-D model of the contaminated area, the contaminated material can be effectively removed while minimizing the amount of excess non-contaminated material that is also removed during a typical large scale remediation project. The reduction of transportation and disposal costs can be significant for projects that require the removal and disposal of large amounts of material.

The same technology can also be scaled up and used to accurately remove contaminated fractions with essentially no cross-contamination with surrounding material. After the necessary characterization activities have been completed, the freeze technology can also be used to remove the contaminated material. Freeze dredging plates have been designed, fabricated and successfully used to complete both small and large scale dredging projects. The advantages of using freeze technology for dredging activities are accuracy and the minimization of cross-contamination or spreading of the contaminated material. Typical dredging techniques will spread the contamination which increases the required dredging activity and the volume of material that must be disposed. Freeze dredging is capable of removing material to a specific depth without disturbing or spreading the contamination or the material surrounding the contamination. The freeze front expansion can be well controlled such that a precise amount of material is extracted each time the freeze dredging activity is performed. Furthermore, by freezing the sludge or sediment, the risk of spilling or spreading the material during collection activities is significantly reduced.

During transportation of the remediated material (to a treatment location or for disposal), it is possible to keep the material frozen to insure easy, safe and cost effective transport. In the solid state there is less risk of exposure in case of an accident compared to transportation in a liquid or semi liquid form.