



Canadian Environmental Technology Verification (ETV) Information Bulletin

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Subject: Errors associated with calculating removal efficiencies by particle size fraction

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Overview

The CETV *Procedure for Laboratory Testing of Oil Grit Separators* specifies that sediment removal results shall be reported by total mass and individual particle size fractions. The particle size distributions (PSD) of the samples taken from each of the injected and retained sediment for each run are the basis for reporting removal efficiencies by particle size fraction.

It was recognized during the preparation of the Procedure that there would be inherent errors and procedural difficulties associated with the generation of highly accurate and precise removal efficiencies from particle size distribution data. For this reason, claims for sediment capture by Oil Grit Separators were to be limited to the modified mass balance results. Removal efficiencies by particle size class were to be calculated in order to provide readers with a general understanding of the capacity of tested devices to remove different particle size fractions.

A comprehensive assessment of the source of errors associated with the collection and analysis of PSD samples has not been undertaken. However, it would appear that at least some of the error relating to removal efficiency calculations may be associated with the inconsistent capacity of the PSD analytical method (ASTM D422) to break down particles into their finest grain size components. While the dry injected sediment is already somewhat disaggregated, the wet retained sediment contains clumps of coagulated sediment that persist through the drying process. Failure to completely break down the coagulated sediment into their finest grain size components can introduce biases when comparing injected and retained sediment PSDs. The presence of removal efficiencies above 100% for some particle size fractions suggests that the retained sediment may still contain some aggregates not present in the dry injected sediment mass (although there are alternate explanations for such a result). Other sources of

error may relate to the collection of representative sub-samples of the injected and retained sediments, and/or inaccurate interpolation of reported size classes into the size classes specified for reporting in the Procedure. Accredited test laboratories exert considerable efforts to collect representative samples for submission to analytical laboratories, and interpolate particle size fractions correctly, but inadvertent errors may still persist.

The ASTM D422 - 63(2007)e1 method was specified for the analysis of the sediment particle size distribution. This method was withdrawn by ASTM in 2016 with no replacement because "...*Regulations Governing ASTM Technical Committees*..." requires that standards shall be updated by the end of the eighth year since the last approval date" (accessed October 20, 2016). Since the method was withdrawn for procedural reasons, rather than reasons associated with the accuracy of the test, CETV continues to support ASTM D422 - 63(2007)e1 as the best available method for the analysis of sediment particle size distribution.

Due to the withdrawal of the ASTM D422 method and the problems associated with calculating removal efficiencies by particle size fraction noted above, removal efficiency results based on PSD data should be interpreted with caution.