PD CEN/TR 16363:2012

BSI Standards Publication

Characterization of waste — Kinetic testing for assessing acid generation potential of sulfidic waste from extractive industries

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National foreword

This Published Document is the UK implementation of CEN/TR 16363:2012.

The UK participation in its preparation was entrusted by Technical Committee B/508, Waste Management, to Subcommittee B/508/3, Characterization of waste.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Published by BSI Standards Limited 2013

ISBN 978 0 580 72732 0

ICS 13.030.01

Compliance with a British Standard cannot confer immunity from legal obligations.

This Published Document was published under the authority of the Standards Policy and Strategy Committee on 31 January 2013.

Amendments issued since publication

Amd. No.	Date	Text affected

TECHNICAL REPORT

RAPPORT TECHNIQUE

TECHNISCHER BERICHT

CEN/TR 16363

December 2012

ICS 13.030.01

English Version

Characterization of waste - Kinetic testing for assessing acid generation potential of sulfidic waste from extractive industries

Caractérisation des déchets - Essais cinétiques pour la détermination du potentiel de génération d'acide des déchets sulfurés des industries extractives

Charakterisierung von Abfällen - Kinetische Prüfungen zur Bestimmung des Säurebildungspotentials von sulfidhaltigen Abfällen der mineralgewinnenden Industrie

This Technical Report was approved by CEN on 9 April 2012. It has been drawn up by the Technical Committee CEN/TC 292.

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Ref. No. CEN/TR 16363:2012: E

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Foreword

This document (CEN/TR 16363:2012) has been prepared by Technical Committee CEN/TC 292 “Characterization of waste”, the secretariat of which is held by NEN.

The preparation of this document by CEN is based on a mandate by the European Commission (Mandate M/395), which assigned the development of standards on the characterization of waste from extractive industries.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

Introduction

A specific feature of sulfide containing waste is the risk for acid/neutral drainage generation (A/NRD). Acid drainage occurs if the acid generation from sulfide oxidation exceeds the acid buffering from minerals in the waste while, in this context, neutral drainage occurs when neutralisation generation exceeds the acid generation.

Test methods for the determination of acid generation behaviour can be divided into static and kinetic tests. A static test is used for screening purposes. It is usually relatively fast to perform, but gives only indicative information based on total content of sulfur (or sulfides) and of readily available buffering minerals in the waste material. Kinetic tests give more detailed information on behaviour based on the determination of mineral reaction rates under specified conditions. A European Standard, EN 15875, has been established for the static testing, while this Technical Report gives guidance on how the kinetic testing may be performed and interpreted.

Kinetic testing has been required as part of permit processes for many new and operating mine sites. Many different test methods have been used over the last 20 to 30 years. These tests are commonly designed to avoid that the oxidation rate is limited due to the lack of oxygen or build-up of secondary minerals. Kinetic tests based on current standards and laboratory-scale standard practise (ASTM D5744 - 96:2001 and ASTM D5744 - 07:2007; Morin and Hutt, 1997; Lapakko, 2003) are not designed to evaluate short- and long-term drainage water quality. However, adjustments to the standard protocols can be done to produce indicative information about short-term drainage water quality. Together with modelling, this information can be used to predict/estimate long-term drainage water quality.

This Technical Report is a guidance document that discusses the main kinetic test methods that are used within the mining sector internationally, the applicability of the different tests and how to evaluate the results. Kinetic test results may provide valuable information, but it is important to understand their limitations. Sulfide oxidation in the field is controlled by many different factors that may be difficult to simulate within the laboratory. Some of these factors may in fact be unknown at the time of testing. The complexity of applying test results to field conditions may to some extent be balanced by long experience in evaluating such data.

The objective of this Technical Report is to support the management of waste from extractive industries by giving guidance on how to characterize the kinetically controlled process of acid drainage generation.

The target audience of the document includes all stakeholders concerned with the management of extractive waste including the extractive industry, authorities, regulators, consultants, and testing laboratories.

Document structure

This Technical Report is organized to provide the answers to the three main questions below.

What type of data will kinetic testing provide and what methods are available? Clause 2 Methods	After introducing the concepts of kinetic testing for assessing acid generation potential of sulfidic waste, this clause (Clause 2) describes what type of information these tests provide. This clause also reviews the different tests methods and the ability to meet the objectives set out for the different kinetic tests. Methods to evaluate both acid generating reactions and neutralizing reactions are described.
How can the data be interpreted? Clause 3 Interpretation and evaluation	This clause (Clause 3) gives guidance on how results from kinetic tests can be applied. Included in this clause is guidance on how results from the tests may be used to calculate the bulk oxidation rate for the material; to evaluate the leaching rates for elements within the test system; and based on the results, to evaluate mineral reactions in the system. Kinetic test relevance for describing field scale processes is discussed.

What method to select? The clause ends with recommendations on the selection of kinetic test design depending on objective(s).

Clause 4
Recommendations

1 Scope

This Technical Report describes the performance and evaluation of kinetic tests for sulfidic waste material that, according to previous testing (primarily acid base accounting), is likely to go acidic or when the result of such testing is inconclusive. This Technical Report also covers the issue of drainage from sulfidic material that is likely to be well buffered but that will produce a neutral drainage potentially affected by sulfide mineral oxidation.

This Technical Report will not include aspects of sampling and testing that are already covered in the overall guidance document for characterisation of extractive waste (CEN/TR 16376) or in the guidance document on sampling of wastes from extractive industries (CEN/TR 16365).

2 Methods

2.1 General

It is necessary to have a good understanding of the waste material before kinetic (mineral reaction rate) testing is performed. This together with well-defined objectives will aid in selecting the methods. This clause describes the planning of kinetic testing, key elements to analyse for, and the main methods used by the industry.

2.2 Planning

Figure 1 shows a flow chart of the different steps to consider when planning for kinetic testing. A number of the steps in the flow chart are not further discussed in this document. More details on topics related to sampling are found in CEN/TR 16365, e.g. supporting information, data quality, documentation and reporting are discussed in overall guidance document (CEN/TR 16376). Additional information that puts kinetic testing in a wider context may also be found in the overall guidance document.