

**The development of a European handbook on sustainable
design, operation and closure of mine waste facilities**

November 2013

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The Extractive Waste Directive was originally targeted at mineral operations but, following the October 2010 Hungarian incident, a subsequent Commission Decision might be interpreted as extending the scope to any waste covered by an IPPC licence and the EU Waste Catalogue.



Extractive Waste Directive

The Extractive Waste Directive (EWD) incorporates two principal elements which will promote the safe, stable and sustainable management of mine waste in Europe, namely:

- the institution of a common level of regulation and mine waste management throughout the EU**
- the provision of key technical guidance to regulators and developers**

Annexes

Prepared under TC292

General guidance

Facility characterisation

Sampling

Static and Kinetic testing

Prepared under separate EU remit

Inspection

Guidance documents have been prepared by consultants appointed under standard EU competitive tender arrangements

The relevance of the Extractive Waste Directive Annexes (TC292)

The TC292 Annexes were prepared to provide EU guidance on sampling, waste and facility characterisation and geochemical testing **both to Regulators and to industry.**

The importance of good guidance is recognised by Regulators in particular due to the lack of familiarity with technical aspects of mine waste facilities and the limited availability of competent personnel across the EU.

At the commencement of the TC292 contract the industry indicated the need for the consultants appointed to have the requisite technical knowledge, a fact emphasised at a series of EU workshops at which international experts were requested to assist in defining the scope of each document.

The need for authoritative geotechnical guidance was clearly identified at these workshops.

EWD Annexes

It was recognised that the introduction of a common level of regulation, as required by the EWD, would be hampered by the apparent lack of expertise amongst Regulators, **even in those countries with a well-developed regulatory framework.**

Unfortunately the consultants engaged under TC292 exhibited limited geotechnical knowledge, as evident in the workshops and in early drafts of the guidance documents. By the 5th Draft it became clear that both sampling and general characterisation guidance were deficient in geotechnical insight.

These EWD Annexe guidance documents have, with the exception of that for kinetic testing, now been published.

They remain inadequate for regulatory guidance due, in particular, to the deficient geotechnical content.

TC396

Coincident with the preparation of these Annexes a European Normative document on earthworks (CEN/TC396) was being initiated, and included in its framework a working group tasked with the preparation of a standard for hydraulic filling (dredging).

As a result of an initiative by the UK HSE in 2010 the scope of hydraulic filling was extended to cover mine wastes (tailings).

TC396 was subsequently recognised by sections of the European mining industry as a potential opportunity to provide the necessary geotechnical guidance for compliance with the EWD currently missing from the Annexes.

The UK principal expert was invited to join TC396, which included five working groups of which WG5, Hydraulic Filling, was initially targeted at the geotechnical aspects of dredging (Task Group TG1). However, with BSI support, WG5 was subsequently extended to include hydraulic filling of mineral wastes (Task Group TG2).

An industry-wide expert group has since been convened and a handbook is being prepared with aim of ensuring the sustainability of both operating and closed mining waste facilities in the EU and elsewhere.

Proposed definition of Task Groups TG1 and TG2

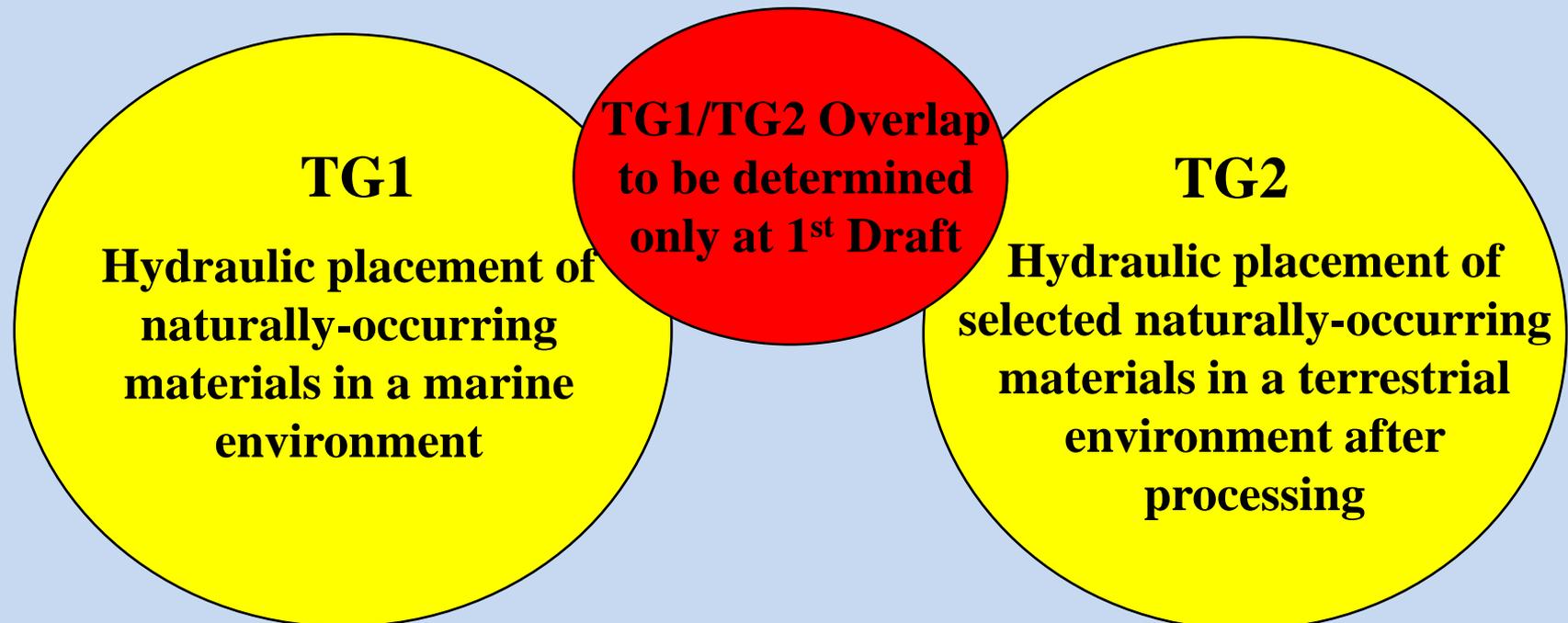
WG5 has been sub-divided into

TG1 hydraulic filling (dredging)

TG2 hydraulic filling of soils and mineral wastes

**Standard for dredged hydraulic fills
commercially driven**

**Standard for hydraulically placed
mineral wastes regulation driven**



TG2 relates principally to **terrestrial mineral activities, i.e. to land-based mineral extraction and other operations for the disposal of particulate materials as defined by the EU Waste Catalogue.**

The common elements are the placement of the soils as a slurry, but also the need for both:

- safe and stable confinement during placement**
- surface stabilisation on cessation of operations to aid rehabilitation**

However, the principal driver for the TG2 documentation, due to its ubiquitous and enduring nature and to the accepted need for hazard reduction, will be the Extractive Industry.

The key design aspects of hydraulic fill placement which differentiates between dredged and mineral waste soils are:

- the implications for their geotechnical characteristics arising from the industrial process**
- the interaction between their geotechnical and geochemical properties, and thus the influence on long-term stability of the placed earthworks**

Chemical changes may impact on the geotechnical characteristics of soils in both the short-term (exposure and processing) and the long-term (physical and chemical alteration).

The parameters are interrelated, geotechnical techniques being used to control and manage the environmental effects of any geochemical changes and ensuring long-term stability.

Guidance during design, construction and operation



The paramount rationale for safe and stable confinement during placement is the prevention of failure

Guidance during closure and rehabilitation



The rationale for surface stabilisation on cessation of operations is the achievement of early and effective rehabilitation

The starting point for TG2 was the current State of the Art comprising both technical and regulatory documentation as follows:

- 1. EU Guidance documents to Extractive Waste Directive or similar**
- 2. National guidelines, e.g. French, German, Iberian, Swedish and UK**
- 3. BREF**
- 4. ICOLD Bulletins**
- 5. Other non-EU guidance, principally Australian, Canadian and USA documentation, but also South African, Chilean et al**
- 6. Expert papers**

Note that relevant national guidance for the hydraulic disposal of minerals, power station ash and sewage sludge, including dam guidance, was also requested.

The Application of TC292 to TC396

The contents of TC292 Sampling, Testing and General Guidance provide a suitable basis for the geochemical elements of the standard, and will as a result be heavily referenced.

Note

A separate EU project provides guidance on the inspection of mine waste facilities as defined by Extractive Waste Directive and will also be featured in the proposed standard.

The following support team has been co-opted

Drafting team

Current leader: Mike Cambridge, (CCL)
Kris Cjaweski, SRK
Nick Coppin, Wardell Armstrong
Miguel Diaz, AMEC
Gavin Ferguson, Seltrust Associates
Ciaran Molloy, AMEC
Jason Saint, Metifex

Industrial support/mirror group

Anglo American plc
BDS
Euromax Resources Ltd
Euromines
ICOLD
Lundin Mining Limited
MAUK

Initial review team

Annika Bjelkevik, independent (Sweden)
Johannes Drielsma, Euromines
Mafalda Oliveira, Somincor (Portugal)

Metifex Ltd
Somincor sa
Rosia Montana Gold Corporation
Scotgold Resources Ltd
Wheal Jane Ltd
Wolf Minerals Limited

Note: support from other EU countries has been requested but none has been forthcoming.

The proposed schedule for preparing an EN document under TG2:

- 1. Definition of contents and scope of standard based on guidance provided by WG1 and as agreed with WG5**
- 2. Preparation in parallel of a pre-standard (handbook) similar to the hydraulic fill manual – target 12 months**

All documentation to be compatible with, but not repeat, that being produced under TC292 to ensure that the Standard has a regulatory, as well as technical, function.

The above schedule was agreed in principle with BSI (UK) and with industry representatives.

Draft Definitions/Scope for TG2

Definition

This part of the European Standard on Earthworks deals with the use of hydraulic fills for the placement, stabilisation, reclamation and rehabilitation of processed soils and mineral wastes in a terrestrial environment.

Scope

The document provides guidance to all stakeholders with regard to all geotechnical aspects of the investigation, design, implementation, monitoring and rehabilitation of processed soils and mineral wastes deposited using hydraulic filling techniques.

The role of BS/CIRIA in TC396

1. Agreed the pre-standard handbook to be the basis of the TC396 EN document

2. Results of discussions with BSI and CIRIA

Note: CIRIA involvement in ensuring publication seen as important

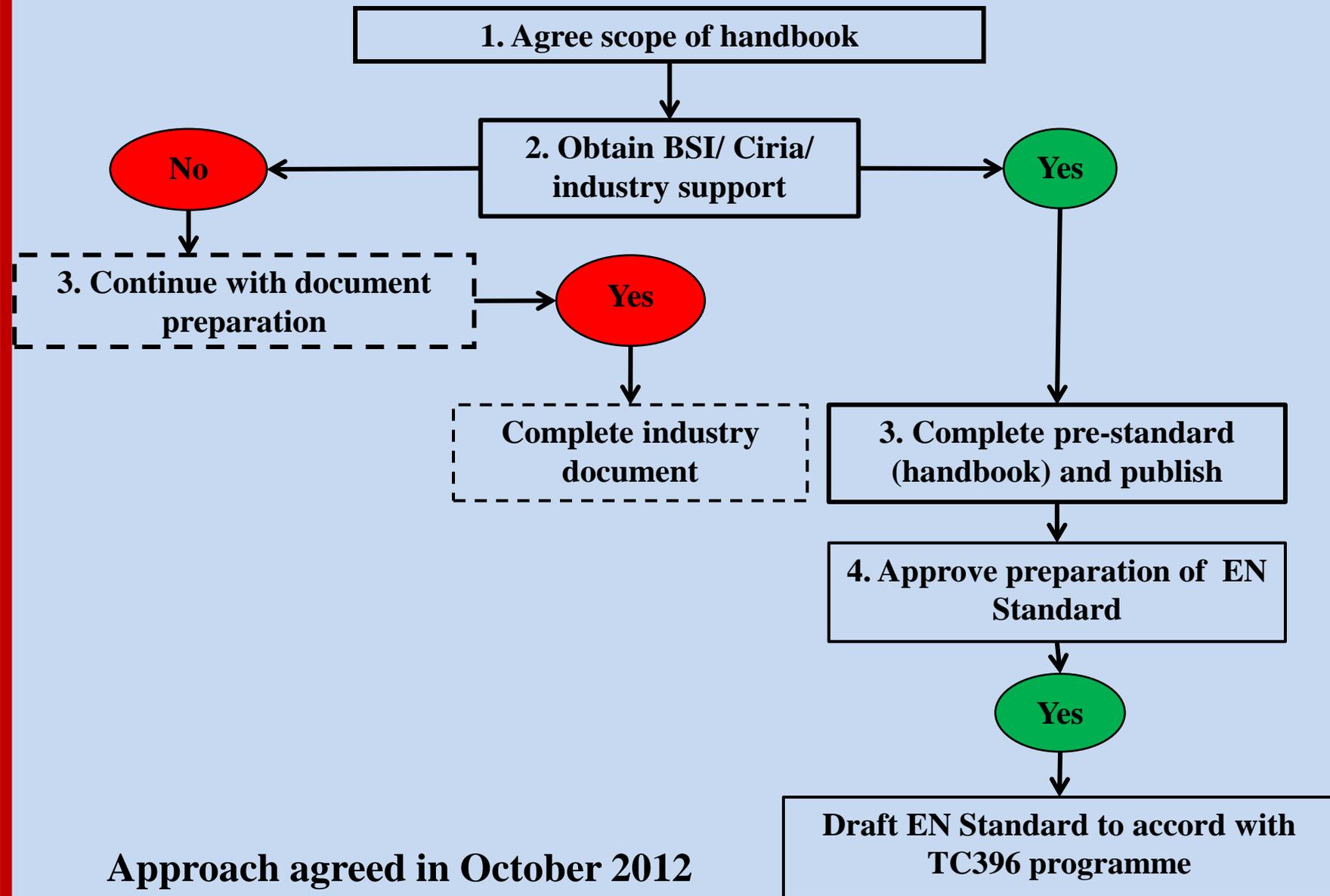
3. Other options for publication

Additional industrial support will be required

4. EN Standard prepared in addition

This document considers the design of the execution of the hydraulic placement facility from inception to closure.

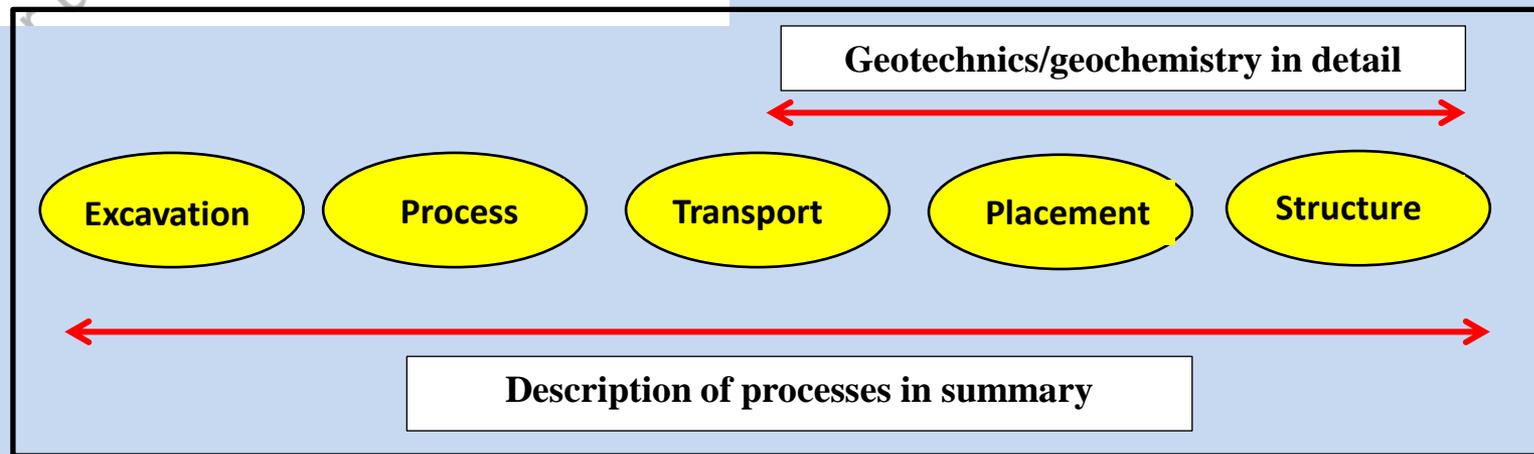
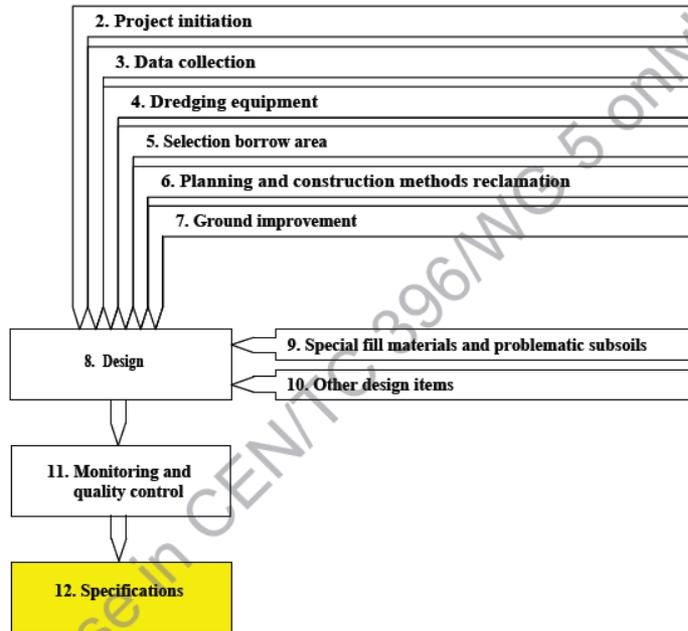
5. Timetable needs to be fixed or succession planning will be required



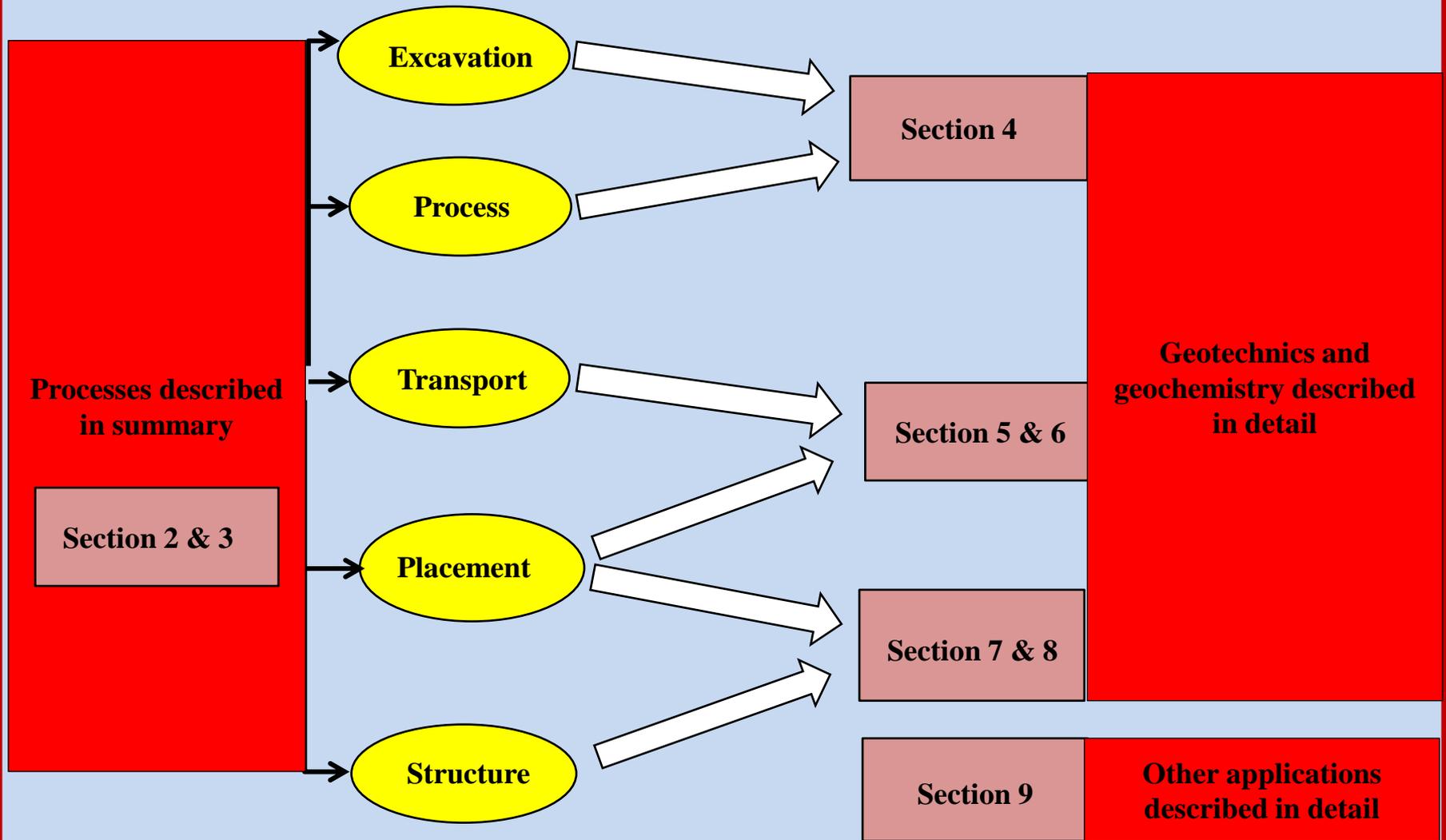
Approach agreed in October 2012

- 1. CIRIA keen to publish/promote publication**
- 2. Peer review process proposed as follows:**
 - Final high level review by UK technical expert/CIRIA representative**
 - UK Expert review committee to be chaired by MC and to comprise members from BDS, EA, HSE, and Euromines plus EU representatives and others to be agreed**
 - Industry mirror group**
 - Drafting committee**

1 Technical specifications



Introductory flow sheet



Alternative introductory flow sheet

Contents	Author
1. Introduction	
Scope/Objectives/References Terms and Definitions	
2. Development of hydraulic placement projects	
Industrial background Legislative context Hydraulic fill Generic disposal objectives	
3. Design and implementation process	
Hydraulic placement Facility development	
4. Material characterisation	
Introduction, scope and flow sheet Sampling Geotechnical Geochemical Test procedures, standard and non-standard	
5. Design basis	
Introduction, scope and flow sheet Risk assessment Confining embankment construction Hydraulic transport and placement techniques Disposal management Water management Emergency planning Closure and rehabilitation	

6. Development of the facility	
Introduction, scope and flow sheet Facility description Site optimisation Depository arrangement Principal hydraulic disposal elements	
7. Quality control and monitoring	
Introduction, scope and flow sheet Disposal quality control Inspection and monitoring Instrumentation	
8. Application of geotechnical techniques in rehabilitation	
Introduction, scope and flow sheet Storage optimisation Geotechnical stability Geochemical stability Rehabilitation techniques	
9. Specialist application of the geotechnical techniques	
Introduction, scope and flow sheet Hydraulic backfill Power station fly ash Industrial minerals	

References Bibliography	
Appendices	
Appendix A: Geotechnical testing standards	
Appendix B: Geochemical testing standards	
Appendix C:	
Appendix D: International standards of relevance	
D1. Australia	
D2. Chile	
D3. Sweden	
D4. Canada	
D5. USA	
D6. South Africa	
D7. Others	

Current TC396 Programme for 2013

July

WG5 TG2 Completion of first full draft of handbook

TC396 WG5 Meeting – report on progress

August

ICOLD Conference – report on progress

September

Initiation of membership of technical review committee

TC396 WG1 Meeting – report on progress

November

TC396 WG5 Meeting – report on progress

Completion of first edit of draft Handbook

December

Complete second draft

Early 2014

Presentation of draft handbook to industrial supporters in London

Conclusions

- 1. A draft handbook providing geotechnical guidance to all stakeholders has been produced with wide industry support**
- 2. Discussion with other potential industrial supporters, including banks and financial institutions, is underway**
- 3. CIRIA has agreed in principal to aid publication**
- 4. Discussion of the format of the EN will be initiated on completion of the pre-standard guidance document (handbook)**
- 5. Development of the EN style document will be consequent on the WG1 decisions re the schedule defining contents and scope of the EN standard, and will be subject to approval by relevant stakeholders**