GERMAN
ATV-DVWK-RULES AND STANDARDS

ADVISORY LEAFLET
ATV-DVWK-M 503E

Basic Information on Investigation and Remediation of Tailings Impoundments

December 2001

Bundesministerium
für Umwelt, Naturschutz
und Reaktorsicherheit

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Joint Advisory Leaflet by the
German Association for Water, Wastewater and Waste (ATV-DVWK)
German Society for Geotechnical Engineering (DGGT), and the
German Committee on Large Dams (DTK)

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The German Association for Water, Wastewater and Waste, DWA (former ATV-DVWK), is the spokesman in Germany for all universal questions on water and is involved intensely with the development of reliable and sustainable water management. As politically and economically independent organisation it operates specifically in the areas of water management, wastewater, waste and soil protection.

In Europe the DWA is the association in this field with the greatest number of members and, due to its specialist competence it holds a special position with regard to standardisation, professional training and information of the public. The ca. 14,000 members represent the experts and executive personnel from municipalities, universities, engineer offices, authorities and businesses.

The emphasis of its activities is on the elaboration and updating of a common set of technical rules and standards and with collaboration with the creation of technical standard specifications at the national and international levels. To this belong not only the technical-scientific subjects but also economical and legal demands of environmental protection and protection of bodies of waters.

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Preamble to the English translation:

The German original of this paper was already published in December 2001. In the meantime the work of the Committee on Tailings Dams and Waste Lagoons of the ICOLD has been updated. The additional bulletins which have resulted in this connection are in particular to be mentioned:

- Bulletin No. 121: Tailings Dams – Risk of Dangerous Occurrences. Lessons learnt from Practical Experience,
- Bulletin (ICOLD/UNEP in preparation): Increasing Tailings Dams Safety: Critical Aspects of Management, Design, Operation and Closure.

The bulletins mentioned result with the background of the fact that damage and catastrophic disasters in connection with tailings impoundments continue to be deplored. With regard to the various aspects of the safety of tailings impoundments – in particular in the construction and operation phase – attention is drawn to the latest ICOLD Bulletins as a whole and also to the previous editions.

This paper resulted under the specific conditions as they exist in large parts of Europe and especially in Germany and which are characterised by a decrease in mining activities. Accordingly, emphasis has here been placed on aspects of decommissioning as well as on preservation and long-term safety. The paper as a whole has nevertheless to cover the subject broadly. This has prompted the German Association for Water, Wastewater and Waste (DWA) to produce an English language version.

Josef Brauns December 2005

Foreword

Tailings impoundments – also known regionally as clarification ponds or sedimentation ponds, and referred to throughout the former Eastern Germany as industrial settling facilities – are frequently a special form of dam systems. There is little literature available in German on the state of the art for such facilities. By present-day standards and in certain respects, tailings impoundments may also be regarded as equivalent to landfill sites, for which regulations now exist from quite different quarters.

Today the recognised rules on the state of the art for tailings impoundments are set out in DIN 19700 - 15 and – insofar as is appropriate for such facilities – DIN 19700 -10 (General Specifications) (work on a revised version is currently in progress). In the former GDR the most recent set of rules for industrial settling facilities was introduced by statute in 1988 (Law Gazette 1998/I/2).

In view of the nature of their structure and the way they are operated, and also because of the nature of the sediments deposited, tailings impoundments may present hazards for humans and the environment. This was made abundantly clear by the disastrous accident at Stava (Upper Italy; failure of two successive tailings impoundments with 268 deaths in July 1985) and the catastrophic environmental damage caused by the failure of the Los Frailes facility in Spain in April 1998 and the escape of water containing large amounts of cyanide from a pond near Baia Mare (Romania) in January 2000.

There are a large number of facilities of various sizes and various ages. In some places there is seen to be a need for inspections, which can give rise to remediation requirements, or in old facilities to measures designed to ensure sustainable safe integration in the environment. The present set of rules is not adequate for this purpose.

For this reason the German Association for Water, Wastewater and Waste (DVWK) set itself the task of drawing up guidelines on the inspection and remediation of tailings impoundments. These guidelines are not intended primarily as an overview of current knowledge in this field; they are rather designed to assist in the task of inspection and assessment, and also remediation, of tailings impoundments and the methodical approach that is necessary for this purpose. They may nevertheless also be helpful when planning new facilities.

This publication on “Basic Information on Inspection and Remediation of Tailings impoundments” is the result of an initiative by the DVWK Expert Committee on “Dams” and was prepared by a working group with members drawn from the ATV-DVWK, the German Society for Geotechnical Engineering (DGGT) and the German Committee on Large Dams (DTK). The focus of this advisory leaflet is thus on plant safety from a constructional and hydraulic engineering point of view. It nevertheless seeks to devote adequate space to the environmental aspects of such facilities which are receiving increasing recognition. In view of the rapid pace of developments in the field of waste management, waste legislation and the fast-growing regulatory systems in this sector, and also the considerable time taken to compile this publication, this was bound to meet with limited success.

The working group nevertheless hopes that this advisory leaflet, the contents of which are primarily keyed to existing plants, whether still in service or decommissioned, will prove a useful guide for owners and operators of tailings impoundments and for technical specialists, inspecting experts and approval authorities.

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Karlsruhe, September 2001 Josef Brauns

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User Notes

This Advisory Leaflet is the result of honorary, technical-scientific/economic collaboration which has been achieved in accordance with the principles applicable therefore (statutes, rules of procedure of the ATV-DVWK and the Standard ATV-DVWK-A 400). For this, according to precedents, there exists an actual presumption that it is textually and technically correct.

The application of this Advisory Leaflet is open to everyone. However, an obligation for application can arise from legal or administrative regulations, a contract or other legal reason.

This Advisory Leaflet is an important, however, not the sole source of information for correct solutions. With its application no one avoids responsibility for his own action or for the correct application in specific cases; this applies in particular for the correct handling of the margins described in the Advisory leaflet.

1 Introduction

Author's afternote

A majority of failures have been due to inadequate attention being paid to decant and overflow systems. Through the many years of construction there can become partly inoperative leading to rising water level, causing rising piezometric levels within the retaining dam structure causing collapse. In extremes the structure may be overtopped. Bulletin No. 121 gives many causes of failures and should be considered in relation to the wording of this advisory leaflet. [See Incident No. 194, p 99 of Bulletin No. 121]

1.1 General

Tailings impoundments are (according to DIN 19700-15 and DIN 4048-1) impounding systems with impounding basins whose sole purpose is to retain solids suspended in liquid. This implies systems for mostly permanent disposal of residues produced in large quantities and over lengthy periods in connection with the extraction of raw materials or in the course of other technical processes (e.g. burning of coal). Depending on the circumstances, such systems may also include systems for capturing solids that are retrieved at regular intervals from the relevant basins. By contrast, wastewater ponds for the treatment of municipal wastewater are not counted as tailings impoundments.

In view of the economic sector in which they are classified, the tailings impoundments meant here were known in the former German Democratic Republic (Eastern Germany) as "industrial settling facilities", for which rules were laid down in the "Order on Industrial Settling Facilities" of December 1987 (Law Gazette 1998/I/2). The present document consistently and exclusively uses the term "tailings impoundments".

Depending on how tailings impoundments are integrated in the hydrological environment in the individual case, and also depending on the different legal situations in the German *Länder* (states), tailings impoundments have been or still are treated and approved in accordance with operating plan procedures under mining law or in accordance with procedures under water law or – in view of their landfill character – waste law (cf. in this connection Section 1.5).

As a result of the historical development and the present state of the raw materials industry, the tailings impoundments that exist in Germany today are mostly old tailings impoundments that are no longer in use; a number of facilities are still operating and will continue to do so indefinitely. Only a comparatively small number of new facilities are being planned and built, namely in the fields of limestone washing, gravel washing, coal dressing and the sugar industry.

Tailings impoundments constitute encroachments on the natural environment and have a certain hazard potential in view of the quantities and substances accumulated in the relevant impounding systems. The residual sediments are deposited in areas that have an impact on human