Electric Power Industry Standard of the People's Republic of China

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DL/T 5045—2006
To replace DL/T 5045—1995

Code for Design of Ash and Slag Damming of Fossil Fuel Power Plants

火力发电厂灰渣筑坝设计规范

（英文版）

Issue Date: May 6, 2006

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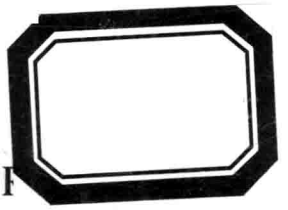

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Code for Design of Ash and Slag Damming of Fossil Fuel Power Plants

Translation sponsored by : China Electric Power Planning & Engineering Association
Translated by : SUNTHER Consulting Co., Ltd.
Reviewed by : Northeast Electric Power Design Institute

CHINA ELECTRIC POWER PRESS
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Foreword

This code is a revision to DL/T 5045—1995 *Technical Rules for Design of Ash and Slag Damming of Fossil Fuel Power Plants* based on the requirement of the *Notice on Issuance of Plan for Supplementing Electric Power Industry Standard 2003* issued by the *General Office of National Development and Reform Commission* (FGBGY [2003] 873) and is renamed the *Code for Design of Ash and Slag Damming of Fossil Fuel Power Plants*.

This code has played a positive role in accelerating the power construction and enhancing the design level and technical standard of ash and slag damming since its promulgation in 1995. As new requirements have come out for the design of ash and slag damming in fossil fuel power plants with the deepening of reforms and technical progress in power industry, this code is to be revised accordingly.

The main revisions and modifications are as follows:

——Following are added in accordance with the requirements of relevant codes:

——Chapter 2 "Normative References".

——Section 6.3 "Seepage Drainage Facilities for Subdam".

——Section 6.4 "Ash and Slag Damming by Hydraulic Filling".

——Clause 6.5.3 "Vibro-stone Piling Method Used in Ash-slag Dam Base Treatment".

——Chapter 10 "Requirements for Construction Quality Control".

——Some other clauses are modified, perfected and refined.

——The relevant contents in this code are adjusted commensurate

with the revisions to the concerned design codes.

This code replaces DL/T 5045—1995 upon implementation.

Appendix A to this code is normative, Appendix B is informative.

This code is initiated by China Electricity Council.

This code is managed and interpreted solely by the China Electric Power Planning and Engineering Standardization Technical Committee.

This code is drafted by the Northeast Electric Power Design Institute.

The participants in drafting this code are Shandong Electric Power Engineering Consulting Institute, Shaanxi Electric Power Design Institute, and Central Southern China Electric Power Design Institute.

The leading authors of this code are Chen Dezhi, Wei Xiaodong, Sun Wen, Ren Yanchao, Liu Jingyan, Li Jingsheng, Cui Kegang, Qiu Chenglong, Ji Chaochou, Tong Weipeng, Hua Zhongnan, Guo Fengqi.

This code is translated by SUNTHER Translation & Solutions under the authority of China Electric Power Planning & Engineering Association.

Contents

1 Scope

This code specifies the principles and criteria that shall be followed when using ash and slag damming technique to design dam bodies in wet-type ash storage yards of coal-fired power plants.

This code is applicable not only to the design of ash dams of valley ash yards that employ hydraulic ash handling technique, but also to the design of ash embankments in ash yards on the beaches of rivers, lakes and sea (hereinafter referred to as beach ash yard) and ash yards on plains. It is not applicable to the design of dry-type ash storage yards.

The provisions specified herein for ash dams are also applicable to ash embankments, unless specifically prescribed otherwise.

2 Normative References

The following normative documents contain provisions which, through reference in this text, constitute provisions of this standard. For the dated references, all their subsequent amendments (excluding errors corrected) or revised editions shall not apply. However, parties who have reached agreements based on this code are encouraged to investigate the possibility of using the most recent editions of these references. For undated references, their latest editions shall apply to this code.

GB 18599 *Standard for Pollution Control on the Storage and Disposal Site for General Industrial Solid Wastes*

GB 50286 *Code for Design of Levee Project*

GB 50290 *Technical Standard for Applications of Geosynthetics*

DL 5073 *Specifications for Seismic Design of Hydraulic Structures*

DL/T 5129 *Specifications for Rolled Earth-Rockfill Dam Construction*

JTJ 213 *Code of Hydrology for Sea Harbour*

JTJ 298 *Code of Design and Construction of Breakwaters*

SDJ 280 *Technical Specifications for Electric Power Project Construction and Acceptance (Hydraulic Structures)*

SL 60 *Technical Specifications for Safety Supervision of Earth-Rock Fill Dams*

SL 237 *Specification of Soil Test*

SL 274 *Design Code for Rolled Earth-Rock Fill Dams*

3 Terms and Definitions

The following terms and definitions apply to this code.

3.0.1

Ash dam

Hydraulic structure used to store ash and retain water in valley ash yard.

3.0.2

Ash embankment

Hydraulic (marine) structure used to store ash and retain water in plain and beach ash yards.

3.0.3

Dam body

Entire ash dam consisting of a primary dam, subdams and deposited ash and slag.

3.0.4

Primary dam

Initial dam body when ash dam being constructed by stages.

3.0.5

Subdam

Dam body heightened on top of deposited ash on dam front when ash dam being constructed by stages.

3.0.6

Ash and slag

Mixture of pulverized coal ash collected by precipitators and slag discharged from bottom of boilers in a coal-fired power plants.

3.0.7

Ash and slag damming

A by-stage damming technique to gradually heighten dam bodies by building subdams on deposited ash on dam front with earth-rock material or ash-slag material in ash yard.

3.0.8

Ash and slag filling-siltation damming

Ash and slag damming by hydraulic filling.

3.0.9

Terminal dam height

Maximum possible dam height determined by taking into account natural topography and geological conditions of ash storage yard, requirements by power plants and other factors.

3.0.10

Aggregate capacity

Total volume of ash, slag and flood that can be accommodated by ash yard with terminal dam height.

3.0.11

Length of dry bank

Horizontal distance from the point where water surface crosses ash surface to the point where ash surface crosses upstream slope of dam on the cross-section perpendicular to dam axis.

3.0.12

Limited length of dry bank

The length of dry bank that can be maintained to restrict height of phreatic line and ensure safety of dam body during operation.

3.0.13

Ash storage elevation

Elevation where surface of ash deposited in ash storage yard

joins upstream slope of dam.

3.0.14

Limited ash storage elevation

Maximum ash storage elevation permitted by dam top elevation in each design stage.

3.0.15

Subdam height

Elevation difference between two contiguous dam tops.

3.0.16

Subdam placement height

Height of subdam built on deposited ash surface.

3.0.17

Dam extra height

Height from limited ash storage elevation to ash dam top.

3.0.18

Free board

Height from flood storage level to ash dam top under limited ash storage elevation condition.

4 Basic Design Provisions

4.1 General Provisions

4.1.1 The environmental protection of ash storage yards shall meet the following requirements:

1 The ash storage yards shall be provided with safe and stable dam bodies that comply with relevant design standards to prevent ash, slag and ash water from flowing away.

2 The ash storage yards shall be equipped with reliable drainage systems, with drainage structures being located at a distance sufficient to clarify ash water and able to recycle the clarified ash water.

3 During the operation of ash storage yards, the limited length of dry bank shall be maintained to ensure the safety of dam bodies, while the ash surface of dry bank shall be wetted, when necessary, by diverting ash water thereto or sprinkling water to prevent dust pollution.

4 The ash storage yards shall be covered with soil and reclaimed promptly once they are filled up.

5 Where an impermeable layer is necessary at the bottom of ash storage yard as required by environmental impact report, it can be constructed of rolled clay or geomembrane. Vertical anti-seepage measures can be taken where geological conditions are permissible.

6 The pollution control criteria of ash storage yards shall comply with GB 18599.

4.1.2 Ash and slag damming shall meet the following requirements:

1 The dam bodies shall meet the requirements of design code in terms of stability.

2 The dam bodies shall be equipped with effective seepage drainage facilities to lower phreatic lines and accelerate solidification of ash and slag.

3 Ash discharging pipes shall be arranged reasonably in dam front to discharge ash evenly and deposit coarse ash and slag.

4 The ash storage yards shall be equipped with reliable drainage systems to discharge ash water and flood promptly and form a sufficient length of dry bank.

5 Perfect and efficient organizations shall be set up to ensure satisfactory construction quality and safe operation through professional management.

4.1.3 In the design of ash dams, types of dam and seepage discharge facilities shall be selected according to construction material, method and environmental protection requirements, and dam seepage & anti-sliding stability calculations and static and dynamic analysis be conducted for various options by taking into account factors such as limited ash storage elevation, length of dry bank, flood, earthquake and etc. so as to determine optimal cross section of dam body and limited length of dry bank.

4.1.4 The stability of downstream dam slopes shall be calculated with following operating conditions:

1 Normal operating conditions.

1) Steady seepage occurring with limited ash storage elevation and limited length of dry bank;

2) Steady or non-steady seepage occurring with limited ash storage elevation and limited length of dry bank in case of design flood.

2 Abnormal operating conditions.

1) Steady or non-steady seepage occurring with limited ash

storage elevation and limited length of dry bank in case of check flood;

2) Occurrence of earthquake with limited ash storage elevation and limited length of dry bank.

4.2 Design Criterion and Phases

4.2.1 The capacity of ash storage yards shall meet the following stipulations:

1 In planning phase, ash storage yard shall be able to hold ash and slag generated over a period of about 20 a operation of power plants as calculated based on its planned capacity, thus meeting the requirements for power plants establishment.

2 In design phase, designers shall determine the initial land acquisition for ash storage yard which shall be able to hold ash and slag generated over a period of about 10 a of operation as calculated based on the designed capacity and coal type of power plants for this phase.

3 In case of ash and slag damming, the capacity formed by primary dam shall be able to hold ash and slag generated over a period of at least three years as calculated based on the designed capacity and coal type of power plants for this phase. The capacity formed by each subdam added should be able to store ash and slag actually discharged thereto over a period of about 3 a.

4.2.2 The aggregate capacity of ash storage yard shall be calculated per Formula (4.2.2) as below:

$$V=V_{ef}+W=(G-U)T/(\rho\,\eta)+W \qquad (4.2.2)$$

Where:

V —aggregate capacity of ash storage yard, m^3;

V_{ef} —effective capacity of ash storage yard, m^3;

W —pondage of ash storage yard, m^3;

G—annual amount of ash and slag calculated based on design type of coal, kg/a;

U—annual (average) amount of ash and slag actually reclaimed, kg/a;

T—service life of ash storage yard, a;

ρ—dry density of ash and slag, based on actual data measured during the operation of ash storage yard(1000 kg/m^3 if no actual data is available), kg/m^3;

η—effective capacity utilization factor of ash storage yard.

4.2.3 The design criterion of ash dams in valley ash storage yards shall be determined in accordance with following requirements based on aggregate capacity and terminal dam height as well as degree of hazard to neighboring and downstream areas after collapse.

1 Design criterion for ash and slag damming in valley ash yards shall comply with Table 4.2.3.

2 Where there are major industrial and mining enterprises or densely populated areas at the downstream, design criteria for ash dams may be raised by one class through demonstration.

3 When terminal dam height is different from aggregate capacity in class, the higher class shall prevail. If the difference is larger than one class, the class below the higher one shall be adopted.

4 The dam top of Class Ⅰ ash dam shall have at least 1.5 m extra height; and those of Class Ⅱ and Ⅲ ash dams 1.0 m-1.5 m extra height.

5 The terminal dam height is generally determined according to the natural topography and geological conditions of ash storage yard. Where conditions are favorable, the terminal dam height may be determined based on ash storage required for 30 a design service life of fuel-fired power plants.