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NB

ENERGY INDUSTRY STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

NB/T 1002-2012

Guides for preparation of preliminary design of underground oil storage in rock caverns project of national oil strategic reserve (provisional)

国家石油储备地下水封洞库工程项目初步设计编制规定（试行）

Issued on: October 29, 2012 **Implemented on: March 1, 2013**

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Foreword

This document was issued on 29 October 2012 by the National Energy Administration of the PRC and takes effect on 1 March 2013.

It is a NB/T standard: recommended rather than compulsory, but it is the text a Chinese reviewer applies when assessing a submission.

It is classified under ICS 75.010, Chinese classification P71.

This specification was organized by the National Energy Administration and completed by a drafting group led by China International Engineering Consulting Corporation, together with Haigong Yingpaier Engineering Co., Ltd. and China Petroleum Pipeline Engineering Co., Ltd.

In 2010 construction started on the national oil strategic reserve underground oil storage in rock caverns (water-sealed cavern storage) projects. To unify and standardize the construction standards and technical level of water-sealed cavern storage, to guide the design and construction of such projects so that they comply with national policies and achieve safety and environmental protection, energy saving, advanced technology and economic rationality, the drafting group carried out extensive investigation of water-sealed cavern storage in China and abroad, drew on existing domestic construction standards for similar projects and on foreign construction experience, listened carefully to the opinions of the departments, organizations and experts concerned, discussed and revised the specification several times, and finalized it after a review organized by the National Energy Administration.

The specification consists of 22 chapters and 1 appendix. Chapters 17 to 22 are the special volumes submitted for review by the competent government administrative departments: the fire-fighting design volume, the environmental protection volume, the safety facilities design volume, the occupational hazard protective facilities design volume, the seismic fortification volume and the energy conservation volume. Each volume shall be bound as a separate book.

The specification is under the day-to-day administration of the Oil Reserve Office of the National Energy Administration, and China International Engineering Consulting Corporation is responsible for the explanation of its specific technical contents. Comments and suggestions arising during implementation should be sent to the Oil and Gas Division, Petrochemical, Light Industry and Textile Development Department, 18th Floor, Zhongzi Building, No. 32 Chegongzhuang West Road, Haidian District, Beijing, postcode 100048.

Drafting organizations: China International Engineering Consulting Corporation; Haigong Yingpaier Engineering Co., Ltd.; China Petroleum Pipeline Engineering Co., Ltd.

The Foreword also lists the principal drafters of the specification and the principal reviewers who examined it.

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1 Scope

NB/T 1002-2012 fixes the content and the level of detail of the preliminary design for underground crude oil storage in unlined rock caverns built for China's national strategic petroleum reserve. It is a provisional regulation. Water-sealed rock cavern storage holds crude in large excavated galleries below the water table: the groundwater pressure around the cavern is kept higher than the pressure of the oil inside, so the water seals the rock and the oil cannot escape. The design therefore depends on hydrogeology and on the water curtain system as much as on the excavation. The regulation sets the general provisions and defined terms, then specifies chapter by chapter what the preliminary design report must contain: the project basis and scale, the site conditions with the geological and hydrogeological investigation, the general layout of caverns, shafts and access tunnels, the water curtain system with its boreholes and the monitoring that proves the seal, the oil storage and transfer process with the pumps installed at the bottom of the shafts, the surface facilities and the connection to pipelines or terminals, the electrical, instrumentation and control systems, fire protection, building and structural works, heating, ventilation and air conditioning, water supply and drainage, safety and environmental protection, energy conservation, organisation and staffing, and the investment estimate. For each chapter the drawings and calculations to be presented are listed. It applies to the national strategic reserve projects of this type.

1.0.1 This specification is formulated in order to unify the content and depth of preliminary design documents for national oil strategic reserve underground oil storage in rock caverns projects.

1.0.2 This specification is applicable to the preliminary design of newly built national oil strategic reserve underground oil storage in rock caverns projects.

1.0.3 Preliminary design documents shall be prepared on the basis of the design commission, the feasibility study report, the approval documents of the competent government departments, the geotechnical investigation report, the basic design data and similar documents.

1.0.4 The depth of the preliminary design documents shall meet the requirements of review by the relevant national departments, of carrying out construction drawing design, of procurement of engineering materials and of construction preparation; the underground works part shall in addition meet the requirements of construction bidding.

1.0.5 This specification does not prescribe uniform formats for the drawings and tables of the preliminary design; the design organization may prepare them according to its own rules.

1.0.6 The arrangement of chapters and sections of the preliminary design documents may refer to this specification.

2 Terms

2.0.1 underground oil storage in rock caverns: an underground space system excavated in rock mass at a certain depth below a stable groundwater table, which stores crude oil by the principle of water sealing; also called underground water-sealed rock cavern oil depot, or water-sealed cavern storage for short.

2.0.2 cavern: an underground space excavated in rock mass and used for storing crude oil.

2.0.3 cavern tank: an underground space consisting of several interconnected caverns.

2.0.4 connecting tunnel: a passage connecting caverns with each other.

2.0.5 access tunnel: a dedicated passage from the ground surface to the caverns, meeting the needs during construction for equipment passage, muck removal, ventilation, water supply and drainage, power supply, personnel passage and the like.

2.0.6 shaft: a vertical connecting passage from the top of a cavern to the ground surface or to an operation tunnel.

2.0.7 shaft operation area: the area around the shaft head used for operation, maintenance and management of oil pumps, water pumps, instruments, electrical equipment and the like.

2.0.8 water curtain hole: a borehole drilled for artificial water injection in order to ensure the groundwater sealing conditions.

2.0.9 water curtain tunnel: a passage used for construction of the water curtain holes and for water injection.

2.0.10 operation tunnel: a passage leading from the ground surface to each shaft operation area.

2.0.11 concrete plug: a reinforced concrete member placed in a tunnel or shaft and used for plugging the cavern tank.

2.0.12 pump pit: a pit below the shaft in which submerged oil pumps, submerged water pumps and instruments are installed.

2.0.13 water bed: a water layer maintained to a certain height at the bottom of a cavern, used for settling impurities in the crude oil and collecting water seeping from the surrounding rock.

2.0.14 groundwater logging hole: a borehole used for monitoring the groundwater level and water quality.

2.0.15 wanter curtain logging hole (water curtain monitoring well): a well hole used for replenishing water to the water curtain system and for monitoring the water level and water quality within the water curtain system.