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COMMISSION OPINION

of 28.2.2012

relating to the draft permit for the permanent storage of carbon dioxide in block section P18-4 of block section P18a of the Dutch continental shelf, in accordance with Article 10(1) of Directive 2009/31/EC of 23 April 2009 on the geological storage of carbon dioxide

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1. THE LEGAL FRAMEWORK

The legal framework is set out in Articles 10(1) and (2) of Directive 2009/31/EC of 23 April 2009 on the geological storage of carbon dioxide¹ (CCS Directive) as follows:

"Member States shall make the permit applications available to the Commission within one month after receipt. They shall also make available other related material that shall be taken into account by the competent authority when it seeks to make a decision on the award of a storage permit. They shall inform the Commission of all draft storage permits and any other material taken into consideration for the adoption of the draft decision. Within four months after receipt of the draft storage permit, the Commission may issue a non-binding opinion on it. If the Commission decides not to issue an opinion, it shall inform the Member State within one month of submission of the draft permit and state its reasons.

The competent authority shall notify the final decision to the Commission, and where it departs from the Commission opinion it shall state its reasons."

2. THE PROJECT AND NATIONAL PERMITTING PROCESS

The CCS Directive has been transposed in the Netherlands by amending existing legislation. The competent authority for issuing the storage permit is the Ministry for Economic Affairs, Agriculture and Innovation. The Mining Inspectorate (SodM) is responsible for inspections.

The project concerns the intended permanent storage of carbon dioxide (CO₂) in storage reservoir P18-4, located in block section P18a on the Dutch continental shelf.

In the first instance, storage will take place within the framework of the ROAD project.² The ROAD project comprises a CO₂ capture installation where CO₂ is

¹ Directive 2009/31/EC of the European Parliament and of the Council of 23 April 2009 on the geological storage of carbon dioxide and amending Council Directive 85/337/EEC, European Parliament and Council Directives 2000/60/EC, 2001/80/EC, 2004/35/EC, 2006/12/EC, 2008/1/EC, OJ L 140, 5.6.2009, p.114.

² ROAD is the Rotterdam Opslag and Afvang Demonstratieproject (Rotterdam Capture and Storage Demonstration Project), an initiative by E.ON Benelux and Electrabel Netherlands / GDF SUEZ Group.

captured from the flue gases of the Maasvlakte Power Plant 3 located in the port and industrial area of Rotterdam. The designed capacity of the capture installation and compressor is 1.5 Mt per year, with an expected average production of 1.1 Mt per year. The CO₂ from the capture installation will be transported by pipeline with a length of 25 km and diameter of 40 cm in the gas phase (design specifications: 80°C and 175 bar) to an offshore platform. At the platform, the CO₂ will be injected into well P18-4A2 into the storage reservoir P18-4 at a depth of over 3 km. The reservoir pressure during and after injection is expected to be maintained below the initial pressure of 348.5 bar, with the project expected to leave the site filled with CO₂ at below 320 bar. Injection will start between 2015 and 1 January 2018 at the latest. The period of injection will be limited to a maximum of 8 years. The maximum amount of CO₂ to be stored is 8.1 Mt.

The prospective operator TAQA Offshore B.V. submitted an application to the competent Dutch authorities for a storage permit on 30 June 2010 under the terms of Articles 25 and 31(b) of the Dutch Mining Act. On 30 June 2011 and 2 August 2011, TAQA Offshore B.V. submitted supplements to the application to the competent Dutch authorities. The original permit application and the supplements constitute the storage permit application. On 14 June 2011 the competent Dutch authorities published a tender to give other parties the opportunity to submit competing applications for a storage permit in storage reservoir P18-4. Within a period of thirteen weeks, no competing applications were submitted. An Environmental Impact Assessment, including public consultation on the draft permits for capture, transport and storage, is ongoing. Development consent has not been granted at the time of writing of this Opinion.

TAQA Offshore B.V. is a wholly owned subsidiary of TAQA Energy B.V. which is involved in the exploration, production and transportation of oil and natural gas in the Netherlands. TAQA Energy B.V. is a wholly owned subsidiary of TAQA International B.V. (formerly known as TAQA Europa B.V.), a company registered in Amsterdam, The Netherlands. The ultimate parent company is Abu Dhabi National Energy Company PJSC "TAQA", a company registered in Abu Dhabi, United Arab Emirates. TAQA Energy B.V. is currently the permit holder for extraction of natural gas from block section P18a.

3. THE DUTCH SUBMISSION TO THE COMMISSION

On 19 July 2011, the Dutch Government submitted to the Commission the application for the permanent storage of CO₂ in block section P18-4 of block section P18a of the Dutch continental shelf. On 16 August 2011, the Dutch Government submitted to the Commission a draft storage permit for the permanent storage of CO₂ in block section P18-4 of block section P18a of the Dutch continental shelf, dated 10 August 2011. Several additional documents taken into consideration for the adoption of the draft decision and further clarification on various elements of the draft permit were submitted to the Commission subsequently. Two meetings between representatives of the Dutch Government and of the Commission were held in Brussels on 13 September 2011 and on 21 November 2011. As a result of the clarification process, a final revised draft permit was submitted to the Commission on 16 December 2011. This final revised draft permit constitutes the basis for the Commission's review, and for this Opinion. The clarification process and the

submission of the final revised draft permit should be reflected in the proceedings ("Procesverloop"), point 11, of the final permit.

4. SCOPE OF THE REVIEW

The Commission has reviewed the draft permit in light of the requirements set out in the CCS Directive and with a view to the purpose of the review, set out in Recital 25 of the Directive, to ensure consistency in implementation of the requirements of the Directive across the Union. The review is based on the documents submitted by the Dutch Government and has concentrated on those main requirements of the CCS Directive, which are considered essential for the long-term safety and security of storage.

The review was based in particular on Articles 8 ("conditions for storage permits") and 9 ("contents of storage permits") of the CCS Directive which is further detailed below. The review did not cover the proposed monitoring plan (Article 9, point 5, of the CCS Directive), the proposed corrective measures plan (including the risk management plan) (Article 9, point 6, of the CCS Directive), and the provisional post-closure³ plan (Article 9, point 7, of the CCS Directive), as, by own admission of the Dutch Government, none of those plans submitted along with the draft permit are sufficiently mature to be operational at this point in time. The Dutch Government has committed to ensure that those plans are further elaborated in due course, and to submit the finalised plans to the Commission for review pursuant to Article 10 of the Directive, prior to commencement of injection.

5. COMMISSION OPINION

Based on its review of the draft permit as set out above, the Commission has the following observations on the draft permit:

- Suitability of the geological formation for use as storage site (Articles 8(1)(a), 4(3) and (4)⁴)

The review appears to confirm the suitability of the storage site and complex, demonstrated by a detailed characterisation and assessment of the storage site and storage complex. According to the submitted assessment, the storage site contains reservoir P18-4. It comprises a Triassic reservoir interval about 200 meters thick, made up of the Hardegsen, Upper Detfurth, Lower Detfurth, and Volpriehausen rock layers. The P18-4 reservoir is entirely surrounded by faults that act in this case as structural trap. The reservoir is overlaid by an extensive cap rock of about 150 to 180 meters thickness represented by Triassic age layers with variable lithology consisting of impermeable claystones, siltstones, evaporites and dolostones. This primary top seal directly overlies the reservoir and is known to have been an effective seal for the P18-4 gas field. Above the Triassic top seal, there is a 400 to 500 meters thick layer

³ The Dutch Government refers however to "closure plan" which covers in essence all elements of the provisional post-closure plan as required in the CCS Directive. This potential difference in the definition of closure between Dutch law and the CCS Directive will be assessed up separately.

⁴ Articles referred in the headings are those of the CCS Directive.

of Jurassic age clays that could also form part of the top primary seal interval. Fault integrity study using fault reactivation tool and seismic imaging showed there is possibly a small amount of juxtaposition between reservoirs (P18-4 and P15-9; 30 meters) in the northwest but none in the southeast. Due to the gouging effect in the fault zone and pressure difference between compartments, the fault juxtaposition appears to be sealing and does not represent a significant risk factor for CO₂ plume migration between neighbouring reservoirs. However, to further reduce the uncertainty and to improve the quality of the reservoir model prior to commencement of injection, it is recommended that reinterpretation of the faults using the 3D seismic datasets is conducted and that fault integrity and reservoir models are updated. The reservoir within the storage site is penetrated directly by a single well. This well is still in production but prior to injection it will be tested for integrity and converted for injection and storage of CO₂. The risk of fault reactivation has been assessed as very low and there appear to be no pathways providing hydraulic communication between the well and faults. The stress change, being at a maximum when the reservoir is depleted, will be gradually reduced during the injection period when the reservoir is re-pressurized. The scientific advice provided to the Dutch authorities comes to the conclusion that the risk of leakage is negligible and that there is no significant environmental or health risk.

- Precise location and delimitation of storage site and storage complex (Articles 8(1)(a) and 9 point 2)

The storage site is well defined with the demarcation of specific geological units in the P18-4 reservoir, as well as the areal extent of these layers in which the CO₂ plume is expected to be contained. The storage complex includes the storage site, the adjacent P15-9 reservoir at the main reservoir level and all geological layers above the P18-4 and P15-9 reservoirs up to the base of the Chalk Group, consisting of the Upper Germanic Triassic Group, Altena Group, Schieland Group, Rijnland Group, and aquifer intervals Rijn/Rijswijk sandstone, Holland Greensand, and Texel Greensand. It includes the formations below the P18-4 and P15-9 reservoirs, consisting of Rogenstein and Main Claystone as well as the fault zones around storage site P18-4. Finally, the storage complex includes the well trajectories of the wells penetrating the storage site and the P15-9 reservoir.

- The requirements for storage operation, the total quantity of CO₂ authorised to be geologically stored, the reservoir pressure limits, and the maximum injection rates and pressures (Articles 8(1)(a), 9 point 3)

The draft permit contains relevant requirements. The period of injection of CO₂ is for a maximum of 8 years, commencing no later than 1 January 2018.⁵ The maximum permissible injection capacity is 47.56 kg CO₂ per second. The pressure in the well at the level of the storage compartment cannot be higher than 348.5 bar during CO₂ injection.⁶ The maximum amount of CO₂ that can be stored is 8.1 Mt.⁷

⁵ Article 5 of draft storage permit

⁶ Article 7 of draft storage permit

⁷ Article 8 of draft storage permit

- The requirements for the composition of the CO₂ stream and the CO₂ stream acceptance procedure (Articles 8(1)(a), 9 point 4, 12)

The draft permit contains relevant requirements. The CO₂ stream will initially come from the ROAD project and will consist of nearly pure CO₂ with a water content of less than 50 ppm and is therefore expected to be non-corrosive. CO₂ streams from other capture installations will have to consist predominantly of CO₂ and must not damage the integrity of the storage complex. In case of significant changes to the CO₂ stream composition, the permit holder must report to the competent authority and prove that it has no effect on the safety and integrity of the system and storage process.⁸ SodM will monitor compliance with these obligations. The Dutch Mining Act states that the holder of a licence for the permanent storage of CO₂ is required to keep in a register the quantities and characteristics of the CO₂ streams, including their composition delivered, stored and (if any) leaked.

- The requirement to notify the competent authority in the event of leakages or significant irregularities (Articles 8(1)(a), 9 point 6, 16)

This requirement is not contained in the draft permit, but in the Dutch Mining Decree, which requires the operator to notify the competent authority in the event of leakage or significant irregularities on their causes, their nature and seriousness of the consequences, the measures that have been taken or are being considered to prevent, limit or undo the significant irregularity or leakage, and the measures that are being considered in order to prevent a significant irregularity or leakage from reoccurring. According to the Dutch authorities, the Dutch Mining Decree is directly applicable. However, it is suggested that a reference to the Dutch Mining Decree be made in the final permit.

- Conditions for closure (Articles 8(1) (a), 9 point 7, 17(1))

Closure conditions are contained in the draft permit. Closure shall take place when 8.1 Mt CO₂ are injected⁹ or before pressure will become higher than 348.5 bar¹⁰. Furthermore the wells in the adjacent P-15-9 reservoir need to be CO₂ secure, once these are closed.¹¹

- Provisions on changes, review, updating and withdrawal of the storage permit (Articles 8(1)(a), 9 point 8, 11)

The draft permit does not contain specific provisions on changes, review, updating and withdrawal of the storage permit. While such provisions are regulated under the Dutch Mining Act, it is recommended that references to those provisions are included in the final permit.

- The requirements concerning the financial security or other equivalent (Articles 8(1)(a), 7 point 10, 9 point 9, 19)

⁸ Article 15 of draft storage permit

⁹ Article 8 of draft storage permit

¹⁰ Article 9 of draft storage permit

¹¹ Article 13 of draft storage permit

The development of the financial security for the project appears to be at a very early stage. Some evidence has been provided that a bank would take a request to issue a bank guarantee from TAQA Energy B.V. into consideration. It is recommended that this is reflected in the final permit under consideration 15, bullet 3. On the other hand, the draft storage permit contains clear requirements to establish and maintain the financial security or any other equivalent, as required by Article 9 point 9. It provides a breakdown of financial security amounts for different obligations and by yearly period. Based on this breakdown and as far as could be deduced from the documents submitted by the Dutch authorities, it seems that all potential obligations under Directive 2009/31/EC, as well as under Directive 2003/87/EC are adequately covered. If the financial security proves inadequate, adjustment of the financial security at the initiative of the Minister is regulated under the Dutch Mining Act. Adjustment of the financial security after each five-year period is regulated under the Dutch Mining Decree. The type of financial instrument will be determined and approved by the competent authority at least six months prior to commencement of CO₂ injection. The permit requirements of the draft storage permit states that a bank guarantee and an escrow account are the preferred types of financial instruments. These two instruments involve independent third parties and can therefore be considered to allow compliance with the requirements as set out in the draft storage permit which is to ensure that the funds available under the financial security will be available to the Dutch authorities under all circumstances independently and without the cooperation of the permit holder, the former permit holder or third parties.

- The requirements that the operator is financially sound and technically competent and reliable to operate and control the site and that professional and technical development and training of the operator and all staff are provided (Article 8(1)(b))

TAQA Energy B.V. has demonstrated its financial soundness on the basis of the annual accounts for 2009 and 2010. It can rely on its own financial resources or on the financial resources of its parent company Abu Dhabi National Energy Company PJSC. While no balance sheets were submitted for TAQA Offshore B.V., TAQA Energy B.V. has issued a 403 statement ("instemmingsverklaring") for its fully owned subsidiary TAQA Offshore B.V., by which TAQA Energy B.V. becomes fully liable for the financial situation of TAQA Offshore B.V. It needs to be ensured that this statement covers also future financial liabilities related to obligations under the CCS Directive. The draft storage permit confirms that TAQA Energy B.V. has extensive experience in the fields of geology and mining engineering. Given that TAQA Offshore B.V. is the prospective operator of the storage site, the final permit should include specific evidence that TAQA Offshore B.V. is technically competent and reliable to operate and control the storage site. It is recommended that professional and technical development and training of the operator and all staff are provided on a regular basis. The distinction between TAQA Energy B.V. and TAQA Offshore B.V. should be clearly made in the final permit.

- The requirements concerning the environmental impact assessment (Articles 8(1) (a), 7 point 9, Directive 85/337/EEC)

The storage permit application includes information pursuant to Article 5 of Directive 85/337/EEC¹². It includes Environmental Impact Assessment studies for the capture, transport and storage of CO₂. The studies conclude that against the background of other activities and natural processes in the area, the adverse impacts are overall negligible.¹³ Environmental Impact Assessments (EIAs), including public participation, are being carried out by the Dutch authorities pursuant to Article 4(1), Annex I, points 23 and 24, Article 4(2), Annex II, point 10(i), and Articles 5 to 10 of Directive 85/337/EEC. As development consent has not been granted, no further comments can be made at this stage.

Done at Brussels, 28.2.2012

For the Commission
Connie Hedegaard
Member of the Commission

¹² Council Directive 85/337/EEC of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment, OJ L 175, 5.7.1985, p. 40.

¹³ Milieueffectrapport ROAD-project (CCS Maasvlakte) Samenvatting Definitief, June 2011.