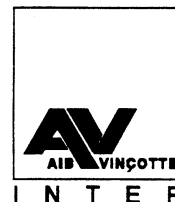


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ZEEPIPE IV

**LEIDING NOORSE NOORDZEESECTOR - BRUGGE ND1000
(AANLANDING - STATOILTERMINAL DUDZELE)**

januari 1995

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Environmental Impact Assessment Report

ZEEPIPE IV

**PIPELINE NORWEGIAN NORTH SEA SECTOR - BRUGES ND1000
(LANDFALL - STATOIL TERMINAL AT DUDZELE)**

February, 1995

DECLARATION

The Environmental Impact Assessment Report at issue, concerning the construction of the "Norwegian North Sea sector - Bruges ND1000" ZEEPIPE IV pipeline (landfall - Statoil terminal at Dudzele) was drawn up under order of the Norwegian State Petroleum Company STATOIL (Den norske stats oljeselskap a.s, Postboks 300, 4001 Stavanger - Norway), by the following members of the College of Experts.

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13.1. DESCRIPTION OF THE PROJECT

At the moment Statoil investigates the technical and financial feasibility of the construction of a second undersea pipeline between the Norwegian Sector of the North Sea and the European Continent. This project has to be seen in the context of the continuing increasing demand for natural gas in Western Europe, the striving for a continuance of supply and the diversification of the supply sources.

13.1.1. SPATIAL SITUATION

The design of this pipeline is presented on annexed situation plan (figure 13.1.1/1). The pipeline starts in the Norwegian Sector of the North Sea and lands at the LNG-peninsula at Zeebrugge, south from the landfall of ZEEPIPE I. From the landfall the pipeline runs to the Statoil terminal at Dudzele. Within the boundaries of the current terminal at Dudzele, some of the installations will be doubled.

13.1.2. EIA DUTY

According to the Regional Development Plan the planned pipeline route which is studied in this EIA, crosses two nature and/or reserve areas, namely the nature area between the out harbor and the north side of the Elisabeth road, and the nature area the "Clay Pits of Heist" along the Isabella waterway. In order to obtain a construction permit for this project, an EIA, declared in conformity, has to be submitted.

In this EIA study the effects concerning fauna and flora, soil, landscapes, water and noise are thoroughly studied and discussed.

13.1.3. TECHNIQUES

For the construction of the underground gas pipelines the following techniques are used:

- the method of digging a trench in which the pipeline is laid.
- performing drillings and compressions by means of a tubular coat in which the product transporting pipeline is inserted.
- the horizontally directed drilling or directional drilling.

The last two methods are only used if the pipeline crosses important obstacles or construction works, like rivers, highways, sluices and suchlike. In this case one of the methods will be used with the crossing of the Leopold and Schipdonk canal and the railway.



Figure 13.1.1/1
(the same figure as figure 2.2.1/1; not annexed with the draft version)

13.1.4. SITUATION OF THE STUDY

The study area of this EIA is the wider environment of the project area or in other words the area in which effects of the project can be expected. This area is not strictly defined.

The project area, which can be seen as the area used by the initiator for the construction of the pipeline, has a length of about 5,5 km (from the high-water line to the Statoil terminal) and a width of maximal 30 m with local widenings at the compressions.

The crossing of the most valuable nature area "The Clay Pits of Heist" was extensively studied in this EIA. The polder zone, less vulnerable for this intervention, and the other partly disappeared nature area between the outport and the Elisabeth road are subject of a more general study.

13.1.5. ALTERNATIVES

The proposed pipeline route was already realized with the construction of ZEEPIPE I after extensive consultation with the different parties and authorities involved. During the making of this EIA it was assumed that no alternatives existed for the overall pipeline route. For these reasons this EIA is limited to the study of limited location and execution alternatives.

13.2. REFERENCE SITUATION

13.2.1. ABIOTIC ENVIRONMENT

Concerning the abiotic environment of the study area soil is more thoroughly investigated, shallow soil (to 1,25 m deep) as well as the deeper underground). Coupled to this aspect, the problems of the ground water are studied. Also the situation of the surface waters and of the noise levels in the study area are described.

13.2.1.1. Soil

The first part of the pipeline route, from the LNG peninsula until the natural coast line, runs through imported grounds. From the coast line until the Isabella waterway only peat reclaimed grounds can be found. Next to the canal dike different soil types are found, which are all anthropogenically influenced in a very strong way.

The global overview of the drillings shows us that the soil in the surroundings of the Clay Pits of Heist is very heterogeneous by nature. For this the following three explanations can be formulated:

- (1) de natural nature of the different marine sediments
- (2) the peat reclamation and /or the clay reclamation for the brick making
- (3) the construction and the raising of the railway lines and related bank strengthenings

The phreathic level is located 0 to 1 m below the surface level dependent on the specific micro relief.

Between the LVS and the Clay Pits of Heist the pipeline mainly crosses grounds with an industrial character. The original dune strip was in the past strongly influenced by the expansion of the harbor activities and the related infrastructure works. Large parts of the terrain lie fallow. The nature area around the pits of Heist is controlled by swampy grounds and terrain. South east of the nature area, after crossing the railway line, the pipeline route crosses meadows of agricultural nature. Further on an area of industrial character (water treatment plant) and a residential area are crossed.

13.2.1.2. Water

Within the framework of this study one water carrying layer is of importance, namely the one in the mainly sandy quaternary sediments which together with the Section of Oedelgem and the Section of Vlierzele form one water carrying layer.

The quality of the ground water in the study area is mainly determined by the "natural" saltening. The interface fresh - salt ground water occurs, according to the saltening map, at a depth of 0 to 10 m.

The vulnerability map of the ground water in West Flanders defines the water table as very vulnerable. The reason for this is the lacking of a bad permeable covering layer or the small thickness of the covering layer.

In the study area, besides a few small brooks, the following larger surface waters occur: the Isabella waterway, the Leopold canal and the diversion canal of the Leie. The brooks in the immediate surroundings of the Isabella waterway drain of course directly to the waterway.

13.2.1.3. Noise

In order to determine the original ambient noise near the planned pipeline route, a limited statistical analysis of the noise pressure levels on several well picked measurement points at the nearest located houses was carried out, and this during the daytime. The results of these limited measurements show an interesting and indicative image of the present acoustical level near the coast and south of the Royal road.

The results show that around the nature area the background noise (sea, heavy traffic along the Royal road) is significantly higher than the current standards of the Flemish Region. The results in the polder zone are influenced by the more distant arterial road N31 and Royal road and by the generation station, but the current standards are not exceeded here.

13.2.2. BIOTIC ENVIRONMENT: FAUNA AND FLORA

On the planned pipeline route the two following areas of interest were studied:

- the nature area "The Clay Pits of Heist",
- the meadow complex of Ramskapelle, along the Leopold canal

Table 13.2.2/1 shows for the selected areas the destination according to the map of the Regional Development Plan and of the draft of the Green Main Structure of Flanders. Both areas of interest do not belong to a special protected zone according to the Directive 79/409/EEC on the conservation of the bird population.

The selected areas of interest were locally investigated more deeply and inventoried. When literature data were available, they were used in the study. The ecological assessment of the areas of interest happened by means of an integration of the three following criteria: rarity, naturalness and possibilities towards the future. In table 13.2.2/1 the global ecological assessment is mentioned, obtained on the basis of the field

and literature research of the areas involved, and this taking into account the flora as well as the fauna elements.

13.2.3. LANDSCAPE

The landscape within the study area is part of the traditional landscape type "Flemish Coast and polder landscape". It is a polder landscape characterized by artificial water balance. Dikes and ditches are the landscape elements most frequently occurring. The coast belongs to the traditional landscape of the eastern middle coast. The polders belong to the eastern middle land.

The most important historical development period for the coast is the beginning of the 20th century with the coming of the elite tourism, which after the second World War further grows to mass tourism. The impoldering progresses in different phases, coupled to maritime transgressions and regressions. The origin of the dunes and the specific dune pools and dune swamps is coupled with the battle against the sea and the construction of dikes.

The studied was also changed to a large extent by the drastic infrastructure works for the extension and opening up of the harbor of Zeebrugge. The construction of the railway lines to Knokke and Zeebrugge also left their marks indelibly on the original polder landscape. The integrity of the area was hereby strongly affected.

The area is also valuable by the presence of rare element for the coastal region, namely the rather intact reed lands "The Clay Pits of Heist". The wet meadows of Ramskapelle present a typical landscape image for this region which have also their ecological importance.

Summarizing it can be said that the area is characterized by a cultural historical landscape of which the image determinant structures refer to the origin and the reclamation. The inheritance value of the coast and the polders is high; some belong to the oldest impolderings of the world and possess therefore a specific value, still increased by the present natural elements.

Table 13.2.2/1: Overview of the studied areas located on the planned route (not one of the areas belongs to a special protected zone according to the Directive 79/409/EEC on the conservation of the bird population).

Areas of interest	Regional Development Plan Brugge-Oostkust (Heist 5/5)	Green Main Structure of Flanders (draft 1.09.93)	Location with regard to the planned route	Global ecological assessment (1)
Clay Pits of Heist Section I (2) : - dry meadow - meadow with ditches - humid and wet reed land Section III : - raised terrain: roughened reed with shrubs - humid meadows Section IV : - ruderal terrain	nature area (N)	nature development area	O/N O/N O/N N O/N O/N	valuable valuable very valuable valuable valuable less valuable
Meadow complex of Ramsk.-Leopold canal - grazing land - meadow complex	buffer zone (T)	nature development area	O/N O/N	valuable valuable

N = next to the planned route, O = on the planned route

(1) = the ecological assessment of the areas of interest is done by means of an integration of the following three criteria: rarity, naturalness and possibilities towards the future,

(2) = Section II is not located on the planned route

13.3. EFFECT PREDICTION

13.3.1. EFFECTS ON THE ABIOTIC ENVIRONMENT

13.3.1.1. Effects on the soil and the underground

The construction phase causes in the polder area damage to the cultivation, the meadows or vegetation. The occupation of terrain is temporary; after the works the condition restores. Due to the project the agriculture is temporarily, but not permanently disturbed or mortgaged.

The disturbance of the soil profile and the current soil processes are restricted to the immediate surroundings of the pipeline (for the open trench route) and up to the work pits (tunnel method) or in and outlet point of the pipeline (directional drilling). The effect on the soil is small and only a relative small volume of ground will disappear. The effects of these permanent modifications are small; the restoration of the soil processes will however take a while longer. The exploitation of the gas pipeline has no specific effects for the soil profile.

Soil condensation can occur in the polder zone at the construction works in the clayish and peaty soils. The tearing open of the ground up to a depth of about 70 cm will be sufficient to counter the effects condensation and raised bulk density. With the underground crossings condensation can occur at the work pits or drilling wharfs.

The underground, with the "open trench" construction as well as with the underground crossing, is to a limited extent disturbed. Environmental effects on the underground are negligible.

13.3.1.2. Effects on the ground water

The lowering of the ground water table in the polder zone due to the drainage is small because of its short duration, the small drainage depth and the limited pumping flow rate. The height of rise pattern and the ground water table will be restored quickly after the stopping of the drainage, likely the interface between the fresh and salt water.

The present tunnel methods permit to realize the underground crossings without significant modification of the ground water flow pattern or modification of the ground water quality.

The dry method for the construction of the work pits (dry sucking before excavating the pit) has to be avoided; the drainage during the whole duration of the compression (sheet pile walls alternatively) and/or the drainage during the breaking through of the compression pit wall are coupled with a lowering of the ground water table and an

important level lowering in the layer right beneath the work pit. The depth location of the fresh - salt - water interface is influenced by this. In the case drainage is not used (wet construction), the changes are restricted to the immediate environment of the compression and receiving pit and the tubular coat and are not very relevant.

The "directional drilling" has just a little influence on the ecology of the obstacle to be crossed and of its direct environment. There are no quantitative and qualitative influences to be expected for the ground water. Only in the vicinity of the in and outlet point and the drill chuck, the drilling liquid has a limited influence. Important with this method is that the drilling is completely carried out without ground water lowering.

13.3.1.3. Effects on the surface water

In the study area the drainage function of the hydrographical system will be maintained during the whole construction period. For the draining of the drainage water one has to consider the drainage flow rate and the salt content. Because the saltening boundary along the planned route varies strongly in function of time and place, the salt content of the waterways can increase considerably with the drainage water. The Leopold canal is the best suitable water course for the discharge of the drainage water.

13.3.1.4. Effects on the ambient noise

During the construction period of a pipeline one has to take into consideration the permanent noise sources, which also work at night, like drainage pumps, and the noise sources inherent to the excavation of the trench, the underground crossing and the construction of the pipeline which only takes place during the daytime. In the Flemish Region however there are currently no specific noise standards for construction wharfs. Indicative comparison of the expected noise levels with the guiding values from the current standards in the Flemish Region shows that these values are still respected in the polder zone on a distance of 100 m from the wharf.

The residential areas along the coast and south of the Elisabeth road are influenced by the construction works. With a possible crossing below ground of the railway line by means of the tunnel method (dry method), these standards are exceeded in large parts of the residential areas. During the evening and the night, when possibly only the drainage pumps work, and with the tunnel method (wet method) no exceedings in the residential areas are expected.

13.3.2. EFFECTS ON FAUNA AND FLORA

In table 13.3.2/1 a summary of the assessment of the predicted effects on fauna and flora for each area of interest is given. A comparison with the ecological evaluation permits to estimate the global effect of the works on each area. The period of the works is not considered here.

Due to the planned route in the nature area "The Clay Pits of Heist", destruction of reed vegetation and peat pits, usually to the western side of the railway Brugge-Knokke, will occur. Due to the destruction of vegetation in the work strip and pumping of the trench, local drainage of the other reed lands could occur. This could lead on the one hand to drying out and on the other hand to saltening, not only for the work strip itself, but for all adjacent reed lands and peat pits.

A decrease of the characteristic avifauna related to this specific environment of humid reed lands will also occur.

In the meadow complex, located along the diversion canals, the work strip will lead to temporary destruction of the vegetation. Specific plant species of the humid, wet depressions can be destroyed this way.

Concerning the noise, a negative effect during the activities can be expected for little mammals and the avifauna. The east-north side of the Clay Pits of Heist is located along a traffic road and the area is crossed by the railway line Brugge-Knokke and the freight railway line to the outport of Zeebrugge. Therefore it can be assumed that there is always a relevant noise background level present in the area. Although a certain habituation in these parts will have taken place, the fact must be considered that additional flight reactions are possible due to the temporary noise overload caused by the activities.

13.3.3. EFFECTS ON MAN

The most nuisance for the inhabitants occurs during the construction phase: increased noise levels and heavier traffic. After the construction there are no important effects for the population

13.3.4. EFFECTS ON THE LANDSCAPE

In order to assess the effects, the existing situation is compared with the future situation on the basis of 5 criteria: landscape structure, landscape typology, landscape view, perception and land use. The quotation of the effects is done according to a scale with 5 gradations: from -2 to +2. The -2 is assigned when a limiting value was exceeded.

Table 13.3.2/1 : Assessment of the expected effects on fauna and flora due to the works and the exploitation

- 0 : negligible effects
 - : less significant effects
 -- : significant effects
 --- : very significant effects

Areas of interest	Location with regard to the planned route (1)	Global ecological assessment	Assessment of the expected effects on flora due to the works	Assessment of the expected effects on fauna due to the works	Assessment of the expected effects on fauna and flora due to exploitation
Clay Pits of Heist					
Section I (2)					
- dry meadow	O/N	valuable	-	-	0
- meadow with ditches	O/N	valuable	--	--	0
- humid and wet reed land	O/N	very valuable	---	---	0
Section III					
- raised terrain: roughened reed with bushes	O/N	valuable	--	--	0
- humid meadow	O/N	valuable	--	--	0
Section IV					
- ruderal terrain	O/N	less valuable	-	-	0
Meadow complex of Rams-kapelle-Leopold canal					
- meadow for grazing (Hp)	O/N	valuable	-	-	0
- meadow complex (Hpr)	O/N	valuable	--	--	0

(1) N = next to planned pipeline route, O = on the planned pipeline route

(2) Section II is not located on the planned route

Limiting values for the different criteria are exceeded:

- landscape structure: when a structural element is destroyed or irreparably modified (e.g. filling of a creek, leveling out of a land dike,...);
- landscape typology: when the typology is destroyed (e.g. compartmentalizing open landscape);
- landscape image: when image carriers are destroyed (e.g. removal of characteristic dune or polder elements);
- perception: when the perception of the area changes in such a way that there is no recognition anymore of the starting situation;
- land use: when a wanted function disappears by the intervention.

13.3.4.1. Coastal strip

	during construction works	after construction works
Landscape structure	0	0
Landscape typology	0	0
Landscape view	-1	0
Perception	-1	0
Land use	-1	0

13.3.4.2. Harbor area

	during construction works	after construction works
<u>First part</u>		
Landscape structure	0	0
Landscape typology	0	0
Landscape view	-1	0
Perception	-1	0
Land use	0	0
<u>Second part</u>		
Landscape structure	-1	-1
Landscape typology	-1	-1
Landscape view	-1	-1
Perception	-1	-1
Land use	-1	-1

13.3.4.3. Polder area

	during construction works	after construction works
<u>Clay Pits of Heist</u>		
Landscape structure	-2	-1
Landscape typology	-2	-2
Landscape view	-1	-1
Perception	-1	-1
Land use	-2	-2
<u>Wet meadow complex</u>		
Landscape structure	-1	0
Landscape typology	-1	0
Landscape view	-1	-1
Perception	-1	-1
Land use	-1	0

13.4. MITIGATING MEASURES

13.4.1. SOIL AND WATER

13.4.1.1. Temporary effects

The execution of the project occupies temporary land by which the ground can not be used for other purposes. Mitigating measures are:

- letting the construction works taking place during the periods of minimal use intensity at the Elisabeth road (tourism) as well as in the polder area (agriculture),
- an optimal use of the spaces on the in and out wharfs (directional drilling) or on the compression and receiving wharfs (tunnel method) with the underground crossings.

For the polder area the trench is kept dry by drainage and/or pumping. The influence of the pumping on the depth of the ground water table remains restricted to 300 m of the trench. The effects can be restricted to adjusted pumping methods. In the case of a drainage the influence is less.

The tunnel method is coupled, according to the execution method, with little or with strong negative effects concerning the ground water quantity. These effects are mainly associated to the work pits and to the drilling of these pits. The effects can be mitigated by technical execution modalities (wet method).

Due to the drainage and / or pumping of the trench (polder area) the salt water can be moved into the zones where this last occurs in shallow places. After the stopping of the drainage this salt water will slowly take up its original place. Because the interface area between the salt and the fresh water is usually deep, no noticeable effects need to be expected here.

13.4.1.2. Permanent effects

The disturbance of the soil profile and of the soil processes is restricted to the immediate environment of the pipeline and to the work pits. By taking the original soil structure into consideration during the refilling of the trench and work pits and by excavating and refilling selectively, environmental effects remain limited.

The mechanical load of the wharf machines causes a soil condensation and increased soil density which can have consequences for the altitude of the surface level and for the penetration of roots.

Mitigating measures (the whole polder area) are:

- breaking the top layer open once again (harrowing,...),
- providing the access roads and the wharf with a temporary road-metal layer on filter screen or with steel planking.

The effects of the tunnel method on the composition of the ground are mainly situated at the drilling shield, the tubular coat and at the compression and receiving pit. Although the modifications do not cause any direct effects on the quality of the soil, the work pits signify an important modification of the original condition.

For the tunnel method as well as for the directional drilling the composition and the characteristics of the drilling liquid are chosen in such a way that no soil, ground or ground water contamination is associated with it.

13.4.1.3. Conclusion

table 13.4.1/1 gives an assessment of the effects, with or without mitigating measures, on water and soil.

Table 13.4.1/1: impact matrix soil and water: assessment of the effects

environmental effect	open trench
occupation terrain and damage soil use	-1
profile & structure disturbance	-2/-1
condensation and increase bulk density	-2/-1
change composition soil and underground	-1
change ground water height of rise and/or depth ground water table	-2/-1
change fresh - salt water distribution	-1
extension of existing ground and ground water contamination	0
change hydrographical system and surface water level	-1
change surface water quality	-1

- ./ : without / with mitigating measures
 -3 : strong negative effect
 -2 : negative effect
 -1 : small negative effect
 0 : no negative effect

13.4.2. NOISE

It is not very useful in this project to talk about mitigating measures, because it only concerns mobile noise sources here, which will only be present during a very limited period on each of the considered places.

Regarding the underground crossings, the directional drilling has the least impact and is therefore preferable. If for other reasons the tunnel method would be chosen, the noise pollution can be restricted to an acceptable level by use of wet sinking down of the work pits.

13.4.3. FAUNA AND FLORA

Table 13.4.3/1 gives an overview of the assessment of the expected effects after the use of proposed mitigating effects. The proposed mitigating measures for fauna and flora are:

- replacement of the planned pipeline route in the nature area in order to avoid for the most part the reed vegetation and the peat pits;
- limiting the work strip to a maximum width in the meadow complex;
- taking measures to prevent that activities would take place outside the work strip;
- considering the original soil structure with the filling of the trench;
- construction works are not recommended during the breeding period of the birds, between the beginning of March and the middle of August.

With the utilization of the proposed mitigating measures, the project will probably have less significant measures on the fauna and flora of the study area and is therefore more acceptable.



Table 13.4.3/1: Assessment of the expected effects on fauna and flora if mitigating measures are used

- 0** negligible effects
 - less significant effects
 -- significant effects
 --- very significant effects

Areas of interest	Location with regard to the planned route (1)	Global ecological assessment	Assessment of the expected effects on flora due to the works	Assessment of the expected effects on fauna due to the works	Assessment of the expected effects on flora with mitigating measures	Assessment of the expected effects on fauna with mitigating measures	Assessment of the expected effects on fauna and flora with mitigating measures
Clay Pits of Heist Section I (2) - dry meadow - meadow with ditches - humid and wet reed land	O/N O/N O/N	valuable valuable very valuable	- -- ---	- -- ---	- - -	- - -	0 0 0
Section III - raised terrain: roughened reed with bushes - humid meadow	O/N O/N	valuable valuable	-- --	-- --	- -	- -	0 0
Section IV - ruderal terrain	O/N	less valuable	-	-	-	-	0
Meadow complex of Rams-kapelle-Leopold canal - meadow for grazing (Hp) - meadow complex (Hpr)	O/N O/N	valuable valuable	- --	- --	- -	- -	0 0

(1) N = next to the planned route, O = on the planned route

(2) Section II is not located on the planned route

13.4.4. MAN

Most nuisance for the population occurs during the construction and can be minimized by:

- using noise suppressing drainage pumps when drainage has to be carried out in the immediate surroundings of houses;
- using the work strip as much as possible for the transport in order to minimize the negative effects of the transport;
- not carrying out the construction works in the surroundings of the beach during the typical holiday seasons in order to prevent the disturbance of the tourist activities.

13.4.5. LANDSCAPES

The mitigating measures in the beach strip are reducible to the fact of avoiding the construction works of taking place during the tourist season.

In the polder zone the temporary effects of the construction works can be reduced by adjusting the execution methods (see above). Attempts must be made to protect the existing pools in the nature area as much as possible.

13.5. GENERAL CONCLUSION

The studied project ZEEPIPE IV aims at the construction of a gas pipeline east of the harbor of Zeebrugge, from the landing on the LNG peninsula to the Statoil terminal at Dudzele.

The EIA shows that the environmental effects of the proposed project are acceptable, provided that the execution method and term are carefully chosen. The following conclusions can be taken from the EIA study:

1. Considering the options taken with the construction of ZEEPIPE I, at which already the possibility of the construction of a second pipeline was taken into account, it seemed impossible to elaborate realistic place or location alternatives.
2. The construction of ZEEPIPE IV, parallel to and at short distance of ZEEPIPE I, is also ecologically acceptable in the sensitive areas like the Clay Pits Heist, if the necessary preventive measures are taken into consideration with the execution of the construction works.
3. Concerning the underground crossings, the directional drilling causes almost no permanent effects. This method scores slightly better than the tunnel method, as far as the work pits are realized with wet sunk down shafts. Other execution methods of tunnels score considerably worse.
4. In order to minimize the nuisance for avifauna and man, it is preferable to construct the pipeline outside the high tourist seasons and the breeding periods of the birds.