SURVEY REPORT

TNO Environment, Energy and Process Innovation

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1. Introduction

The client has carried out exploration drillings in order to further develop the offshore production of gas on the German continental shelf. The exploration drillings were undertaken at the locations ‘Bunter G’ and ‘Chalk B’. Both areas may in the future be designated as areas of special interest for conservation within the NATURA 2000 network. the client was requested to prepare a full environmental impact assessment in order to obtain approval for the exploration drilling activities from the competent authorities

In 2004 TNO completed baseline studies in both areas which described the state of the environment before the exploration drilling started. These studies were aimed at defining the current state of the environment at the proposed drilling sites in order to make an assessment of the environmental effects of the activity. It provided detailed information on the biological and geomorphological characteristics of the seabed of both areas.

TNO is requested to describe the state of the environment in both areas after completion of exploration drillings ('effect-monitoring'). In order to make such a description a field survey was carried out taking into account the Guidelines for monitoring methods described in PARCOM 88/2.

The objective of the effect-monitoring of 2005 is to describe the state of the environment after the exploration drilling at both Bunter G and Chalk B sites, and more specific, to identify changes in the (chemical) composition of the sediment in the study area in comparison with the previous baseline survey.

1.1 Choice of sampling stations

Figure 1 shows the layout of the sampling grid, which was used in 2004 in the completed baseline studies in both areas and was used again in the environmental effect study. The grid is based on OSPAR guidelines for environmental impact studies in the North Sea. In agreement with the competent authorities the monitoring program was adjusted in such a way that only the stations at distances of 250, 500 and 1000 m from the two exploration drilling locations would be sampled together with an additional reference station. This reference station was located at a distance of approximately 6 km from the central drilling location.

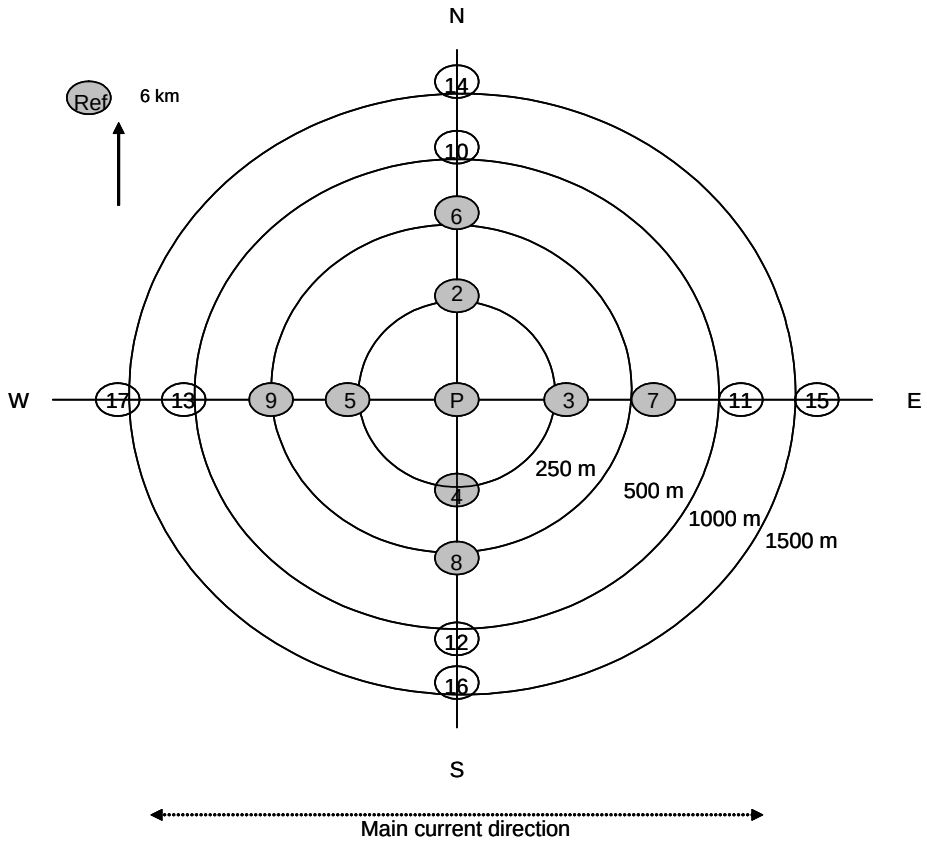
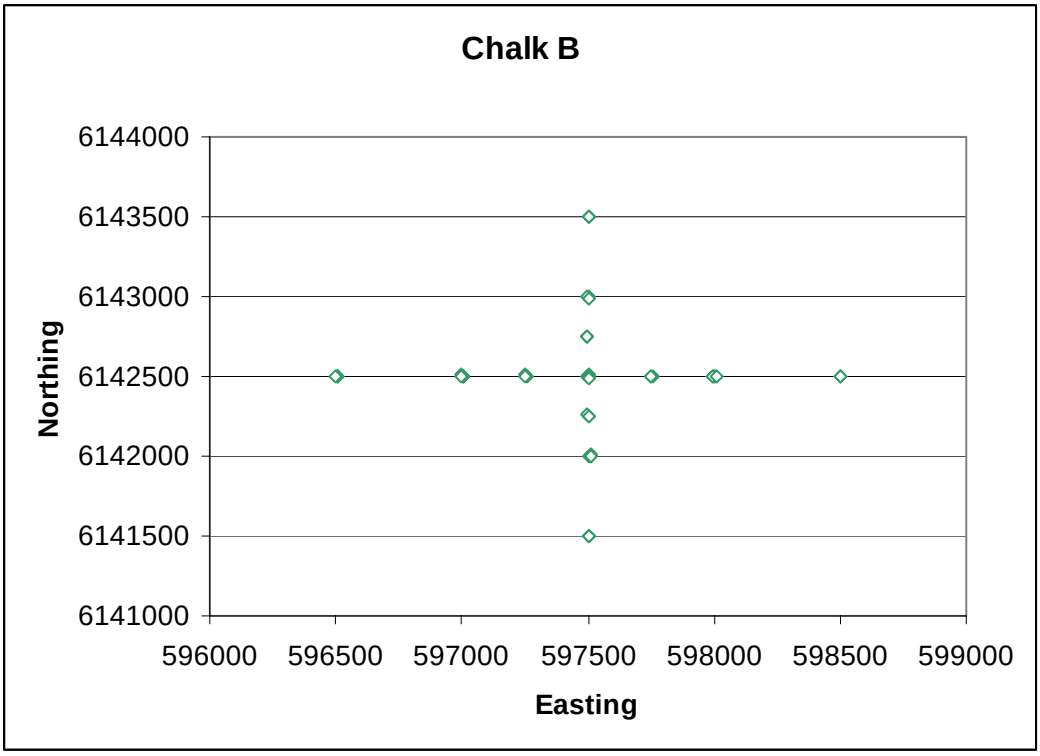


Figure 1:Schematic layout of the sampling grid that was used at both exploration drilling sites during the surveys in 2004. Only stations within the 1500 m circle around the envisaged drilling site (P) were sampled, as indicated by the numbering. The sampling scheme is derived from OSPAR guidelines. At each site only the 13 stations within the 1000 m radius will be re-sampled in the proposed 2005 effect monitoring, although only those indicated with a grey shading will be analysed for metals and hydrocarbons (9 locations and a reference station) in phase 1.

The positions of the actual sampling stations are given in the Appendix and shown in figure 2**.** At all stations the positions of the subsamples were within a range of circa 15 m meters except at station Bunter G-P, where the range of the subsamples was 20 m.



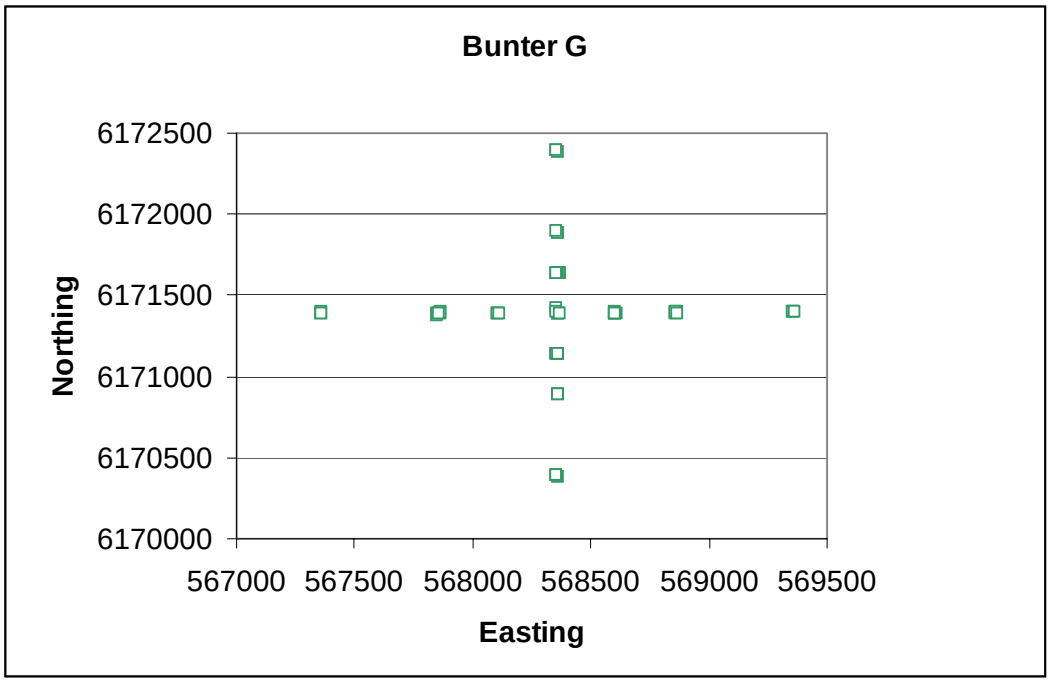


Figure 2: Actual sampling locations at Bunter-G and Chalk-B.

1.2 Sampling and techniques

For the survey the ship ‘Oil Express’ from Vroon Offshore Services B.V. was used which was equipped with a crane capable of handling the sampling equipment very well. It was equipped with a GPS navigation system for the positioning of the sediment samplers. General information on water depth, time of sampling and allocation of samples was recorded at each sampling station. Mr. Hans Sink of Geocom surveyed the positioning of the ship with an offset for the positioning of the crane and therefore of the grab sampler.
Sediment samples were all taken with a Reineck boxcorer or a Van Veen grab.

A visual inspection of the sediment was made directly on deck in order to make a sediment description based on the colour and type of sediment. Also a close observation was made whether any suspicious traces revealing the presence of hydrocarbons (colour, smell, oil layer) were found our not.

At each station three (replicate) samples were collected for chemical analysis (metals and hydrocarbons). From each sample the top 2 centimetres was scrapped of and mixed. The sediment was divided in two portions, one for metal analysis and one for hydrocarbon analysis. The sediments were stored in glass jars with a Teflon cap inlay. The samples are stored at -20 °C pending analysis.

The content of each of the three replicate samples taken for a macrobenthic analysis was washed through a sieve with 1 mm diameter. From each sample the material left behind on the sieve was collected separately into polyethylene containers and preserved with 4% buffered formaldehyde in seawater solution. From each macrofauna sample a small subsample to a depth of 10 cm was collected for the analysis of grain size and TOM using a small corer of Ø2.6 cm. The sediment samples were stored in a freezer at about 4° C.

1.3 Results

Due to repeating technical problems with the box corer samples could only be collected at Bunther-G at the central station P and stations 2 & 3 with a boxcorer. Because of the sturdy substrate, an insufficient depth sampling for benthic fauna was observed using the Van Veen grab. As reparation of the box corer was not possible and continuing with the Van Veen grab would not delivere macrobenthic samples of sufficient quality that could also be compared to the macrobenthic samples taken in 2004, it was decided to stop the sampling for benthos.

As the main objective of the environmental effect monitoring is to identify possible changes in the (chemical) composition of the sediment in the study area in comparison with the previous baseline survey, it was decided that this objective could still be reached when shifting from the boxcorer to the Van Veen Grab. The Van Veen grab is capable of collecting the necessary top cm’s of the sediment needed for the chemical analysis. Contact was made with Wintershall to discuss further actions. Agreed was to continue with sediment sampling for chemical analysis.The sampling for chemical analysis was continued at all remaining stations at both Bunter-G and Chalk-B area using the Van Veen grab..

At every station in the Bunther-G area, including the reference station, an extra sediment sample was taken which can be used in case an ecotoxicological analysis using a bioassay (Microtox) is wanted.

During the direct visual and olfactory inspection of the samples at neither location nor in any sample an indication for the presence of hydrocarbons was found. We therefore feel confident that no relevant hydrocarbon pollution has occurred in the areas. Therefore, the initially proposed macrofauna samples taken to study possible changes in benthic fauna in case of severe hydrocarbon pollution (phase 3), will most likely not be needed for analysis.

2. Daily Reports

Tuesday 19th and Wednesday 20th April
Start mobilization at Vroon 'Oil Express' at 13:00 hrs. Leaving Den Helder harbor at 15:00 hrs, taking sampling gear at NIOZ and start sailing to Bunter-G & Chalk-B at 16:00 hrs
Weather conditions decreased during night up to wave height 3 m improving during the morning of 20th April. Weather has calmed down to wind force 3, wave heights 1.5 m.
Arrival and start preparations at Bunter-G on Wednesday 20th april at16:00hrs, completed central station P and stations 2 & 3. Because of technical problems with sampling gear it was decided to shift from boxcorer to Van Veen Grab. Completed activities at 21:30 hrs.
Weather prognoses are good. For reasons of time efficiency sailing over night to location Chalk-B.

Thursday 21th April.
Start of sediment sampling for chemical analysis and benthic fauna at central station P of Chalk-B area at 8:00hrs. Because of the sturdy substrate, insufficient depth sampling for benthic fauna was observed using the Van Veen grab. Because of this and for time efficiency reasons it was decided to continue and finish first the grab sampling for chemical analysis at each station using the Van Veen grab only. The technical problem with the boxcorer was solved in the meantime during the morning. After finishing all chemical sediment samples at 15:30 hr, benthic sampling was started but had to be stopped at 16:00 hrs due to breakdown of the boxcorer. At 20:00 hrs sampling for chemical analysis at the Reference station for Chalk-B was finished using the Van Veen Grab.
Contact was made with Wintershall to discuss further actions. Agreed was to continue with sediment sampling for chemical analysis.
Weather prognoses still good. The ship will sail over night to Bunter-G area.

Friday 22th April.
Return to Gunther-B area during night, start of sediment sampling for chemical analysis at remaining stations at 8:00hrs. Finish of sediment sampling at 14:45 hrs. All stations in the Bunther-G area have been sampled including the reference stations at app. 6 km. At every station extra sediment was taken which can be used in case an ecotoxicological analysis using a bioassay (Microtox) is be wanted.
Visual or olfactory traces of oil contamination were observed, neither at the Chalk-B nor at the Gunter-B area.
Return to port at 15:00 hrs. Expected arrival Saturday 23th at 11:00 hrs.

3. Appendix

Table 1 Overview of location Bunter-G. Positions are given in ED50 - UTM31, local time.

Puntnaam	Positie		Tijd	Soort monster	Opmerkingen
	Easting	Northing			
WH05-BG-P	568348	6171428	16:44		
WH05-BG-P	568359	6171395	17:01		
WH05-BG-P	568356	6171396	17:09		
WH05-BG-P	568359	6171391	17:17		
WH05-BG-P	568354	6171402	17:28		
WH05-BG-P	568368	6171392	17:44		
WH05-BG-2	568367	6171640	18:56		
WH05-BG-2	568364	6171636	19:05		
WH05-BG-2	568366	6171640	19:12		
WH05-BG-2	568359	6171645	20:04		gemonteerd
WH05-BG-2	568348	6171640	20:12		
WH05-BG-2	568352	6171644	20:20		
WH05-BG-3	568605	6171392	20:32		
WH05-BG-3	568599	6171399	20:40		
WH05-BG-3	568599	6171395	20:48		
WH05-BG-3	568601	6171391	20:55		
WH05-BG-3	568603	6171394	21:01		
WH05-BG-3	568603	6171397	21:11		Klaar voor vandaag 20 april
WH05-BG-4	568358	6171144	8:12	Sediment	Start op 22 april, opnieuw
WH05-BG-4	568360	6171138	8:18	Sediment	
WH05-BG-4	568353	6171146	8:28	Sediment	
WH05-BG-4	568348	6171146	8:39	Sediment	Opnieuw, geen goed monster
WH05-BG-4	568359	6171147	8:43	Sediment	
WH05-BG-5	568099	6171396	8:54	Sediment	
WH05-BG-5	568104	6171393	8:59	Sediment	
WH05-BG-5	568114	6171394	9:05	Sediment	
WH05-BG-6	568360	6171894	9:15	Sediment	
WH05-BG-6	568359	6171889	9:21	Sediment	
WH05-BG-6	568348	6171897	9:26	Sediment	
WH05-BG-7	568853	6171394	9:40	Sediment	Opnieuw, geen goed monster
WH05-BG-7	568861	6171400	9:46	Sediment	
WH05-BG-7	568852	6171399	9:51	Sediment	
WH05-BG-7	568860	6171387	9:57	Sediment	
WH05-BG-8	568359	6170899	10:08	Sediment	
WH05-BG-8	568360	6170896	10:13	Sediment	
WH05-BG-8	568361	6170898	10:18	Sediment	
WH05-BG-9	567850	6171383	10:27	Sediment	Opnieuw, geen goed monster
WH05-BG-9	567859	6171400	10:33	Sediment	
WH05-BG-9	567850	6171390	10:39	Sediment	Opnieuw, geen goed monster
WH05-BG-9	567862	6171389	10:44	Sediment	
WH05-BG-9	567856	6171389	10:50	Sediment	
WH05-BG-10	568350	6172395	11:03	Sediment	
WH05-BG-10	568355	6172391	11:09	Sediment	
WH05-BG-10	568354	6172398	11:15	Sediment	
WH05-BG-11	569353	6171399	11:28	Sediment	
WH05-BG-11	569353	6171402	11:34	Sediment	
WH05-BG-11	569359	6171400	11:51	Sediment	
WH05-BG-12	568357	6170387	12:46	Sediment	
WH05-BG-12	568354	6170400	12:52	Sediment	
WH05-BG-12	568353	6170394	12:57	Sediment	
WH05-BG-13	567357	6171398	13:15	Sediment	
WH05-BG-13	567357	6171396	13:20	Sediment	
WH05-BG-13	567360	6171394	13:25	Sediment	
WH05-BG-Ref	566853	6177393	13:57	Sediment	
WH05-BG-Ref	566858	6177390	14:02	Sediment	Opnieuw, geen goed monster
WH05-BG-Ref	566855	6177392	14:07	Sediment	
WH05-BG-Ref	566850	6177396	14:13	Sediment	

Puntnaam	Positie		Tijd	Soort monster	Opmerkingen
	Easting	Northing			
WH05-BG-P	568348	6171428	16:44		
WH05-BG-P	568359	6171395	17:01		
WH05-BG-P	568356	6171396	17:09		
WH05-BG-P	568359	6171391	17:17		
WH05-BG-P	568354	6171402	17:28		
WH05-BG-P	568368	6171392	17:44		
WH05-BG-2	568367	6171640	18:56		
WH05-BG-2	568364	6171636	19:05		
WH05-BG-2	568366	6171640	19:12		
WH05-BG-2	568359	6171645	20:04		Boxcorer verbogen; veenhapper
WH05-BG-2	568348	6171640	20:12		
WH05-BG-2	568352	6171644	20:20		
WH05-BG-3	568605	6171392	20:32		
WH05-BG-3	568599	6171399	20:40		
WH05-BG-3	568599	6171395	20:48		
WH05-BG-3	568601	6171391	20:55		
WH05-BG-3	568603	6171394	21:01		
WH05-BG-3	568603	6171397	21:11		Klaar voor vandaag 20 april
WH05-CB-P	597504	6142506	8:02		Start op 21 april om 08:00 Opnieuw
WH05-CB-P	597504	6142510	8:08	Sediment	
WH05-CB-P	597497	6142499	8:16	Sediment	
WH05-CB-P	597502	6142495	8:22	Sediment	
WH05-CB-P	597507	6142491	8:32	Sediment	Er blijft niet genoeg materiaal in de
WH05-CB-2	597498	6142754	8:43	Sediment	
WH05-CB-2	597493	6142751	8:50	Sediment	
WH05-CB-2	597499	6142749	8:58	Sediment	
WH05-CB-3	597754	6142500	9:11	Sediment	
WH05-CB-3	597747	6142503	9:19	Sediment	
WH05-CB-3	597747	6142498	9:25	Sediment	
WH05-CB-4	597502	6142255	9:39	Sediment	
WH05-CB-4	597497	6142259	9:46	Sediment	
WH05-CB-4	597502	6142256	9:52	Sediment	
WH-05-CB-5	597255	6142504	10:02	Sediment	
WH-05-CB-5	597252	6142509	10:11	Sediment	
WH-05-CB-5	597251	6142494	10:18	Sediment	
WH-05-CB-6	597506	6143004	10:28	Sediment	
WH-05-CB-6	597498	6142995	10:35	Sediment	
WH-05-CB-6	597507	6142991	10:42	Sediment	
WH-05-CB-7	598004	6142497	10:59	Sediment	Opnieuw, geen goed monster
WH-05-CB-7	598002	6142500	11:06	Sediment	
WH-05-CB-7	598003	6142494	11:13	Sediment	Opnieuw, geen goed monster
WH-05-CB-7	597996	6142495	11:21	Sediment	Opnieuw, geen goed monster
WH-05-CB-7	597998	6142494	11:27	Sediment	
WH-05-CB-7	598008	6142498	11:33	Sediment	
WH-05-CB-8	597509	6142008	11:49	Sediment	Opnieuw, geen goed monster
WH-05-CB-8	597511	6141999	11:55	Sediment	
WH-05-CB-8	597505	6142003	12:01	Sediment	
WH-05-CB-8	597510	6142000	12:09	Sediment	
WH-05-CB-9	597006	6142500	13:06	Sediment	
WH-05-CB-9	597008	6142506	13:12	Sediment	
WH-05-CB-9	597007	6142501	13:18	Sediment	
WH05-CB-10	597501	6143494	13:45	Sediment	
WH05-CB-10	597505	6143500	13:51	Sediment	
WH05-CB-10	597505	6143495	13:56	Sediment	
WH05-CB-11	598503	6142502	14:16	Sediment	
WH05-CB-11	598505	6142502	14:22	Sediment	
WH05-CB-11	598503	6142506	14:28	Sediment	
WH05-CB-12	597507	6141504	14:47	Sediment	
WH05-CB-12	597506	6141499	14:53	Sediment	
WH05-CB-12	597507	6141502	14:59	Sediment	
WH05-CB-13	596505	6142499	15:17	Sediment	
WH05-CB-13	596508	6142503	15:24	Sediment	
WH05-CB-13	596505	6142498	15:31	Sediment	
WH05-CB-13	596506	6142500	15:42	Bentos	Boxcorer opnieuw gemonteerd voor
WH05-CB-13	596504	6142497	15:52	Bentos	Boxcorer afgebroken, veenhapper
WH05-CB-13	596499	6142500	16:07	Bentos	
WH05-CB-9	597004	6142505	17:00	Bentos	
WH05-CB-9	597000	6142507	17:06	Bentos	
WH05-CB-9	596995	6142502	17:11	Bentos	
WH05-CB-Ref	595994	6148503	18:50	Sediment	Er worden geen Bentos monsters
WH05-CB-Ref	595994	6148502	18:56	Sediment	
WH05-CB-Ref	595997	6148497	19:01	Sediment	Klaar voor vandaag 21 april

Table 2 Overview of location Chalk-B. Positions are given in ED50 - UTM31, local time.