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Abstract : Norway has been a member of the international research team on CO₂ ocean sequestration since 1997, along with Japan, USA and Canada. Following a decision in the project's Steering Committee in 2001 an application for a permit to conduct an experiment with injection of CO₂ offshore Norway was sent to the Norwegian State Pollution Control Authority (SFT) in January 2002, and a permit was given by SFT shortly thereafter. In May, 2002, a representative from the socialist party in the Norwegian Storting (Parliament) raised a question about the background and legality of the permit to the Minister of Environment. A suspension of the permit with new treatment and hearing round followed. After this, SFT still upheld it's original decision and reissued the permit in July, 2002. However, protests and pressure from some environmental groups led to the final decision by the Minister of Environment on 22 August 2002 to deny a permit. The decision by the Ministry implied a demobilisation of the project, and caused a lot of concern and disturbance among the project group and all it's contracted logistics suppliers etc. This report gives a summary of the events and arguments through 2002 that may have led to the Minister's final decision, and also some review of what happened afterwards. No objective evaluation or interpretation of the permitting process and the decision was attempted.

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The international project on CO₂ ocean sequestration

**A summary
of the experiment permitting process
in Norway, 2002**

Preface

The Norwegian Ministry of the Environment suspended and later denied the permit originally given to NIVA to conduct an experimental release of CO₂ offshore Mid-Norway in the summer of 2002. This rejection created a contingency situation in the project collaboration with international and national demobilisation, dismissal of chartered vessels, personnel and contractors etc. Additionally, a lot of partially negatively biased press and news releases appeared in Norway and also abroad.

In light of this, one of the main sponsors and participating organisations in the project, RITE (Research Institute of Innovative Technology for the Earth) of Japan in October, 2002, asked NIVA to make a summary of the major events leading to the Ministry's decision, and give an overview of the related legal/political process. Due to the rather political nature of the issue, no attempt was made to evaluate or rank the different arguments and opinions.

We hope that the present report will serve the purpose as a log of events, and as a background document for future negotiations on international collaboration on climate mitigation which we think surely will continue to happen despite the temporary setback in Norway.

NIVA are thankful to RITE to get the opportunity and resources to wrap up what happened, also for the sake of possible follow-up in Norway. Primary contact persons for the contract at RITE were Dr Shigeo Murai and Ms Kimiko Nakanishi.

Bergen/Oslo, 27 December, 2002

Lars G. Golmen

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Summary

This report gives a summary of events and arguments in connection with the Norwegian Minister of Environment's decision to withdraw a permit to conduct a climate technology experiment with releases of CO₂ at 800 m depth offshore Norway in 2002. Some review of what happened after the decision was made, is also given. The report is made in a tabular form to give an overview and chronology of what happened when, with no analysis of why it happened. No objective evaluation or interpretation of the political permitting process was described.

In Kyoto, December, 1997, a project agreement among Japan, USA and Norway on CO₂ ocean sequestration research was signed at the COP-3 meeting for the Kyoto Protocol. Later Canada and ABB-Switzerland joined the project. The main aim of the international project was to conduct an experiment by releasing a certain amount of liquid carbon dioxide (CO₂) in the deep ocean, and to study the behaviour and possible environmental effects from the CO₂.

Following a decision by the project's Steering Committee, an application for a permit to conduct the experiment with injection of CO₂ at 800 m depth offshore Norway was sent by the Norwegian Institute for Water Research (NIVA) to the Norwegian State Pollution Control Authority (SFT) in January 2002. A permit was given by SFT shortly thereafter.

In May 2002 a representative from the socialist party in the Norwegian Storting (Parliament) raised a question about the background and legality of the permit to the Minister of Environment. The minister responded by temporarily suspending of the permit by requiring a public hearing and new evaluation by SFT. Following a 3 weeks hearing round and subsequent evaluation, SFT still upheld it's original decision and reissued the permit on 5 July, 2002.

By this time, the project group had already been forced to shift the schedule for the experiment from July to August.

Following the SFT decision on 5 July, there was a round of further public appeals to the Ministry. Two appeals were filed from environmental groups. After political or internal discussions that we have no details about, the Minister of Environment, Mr Børge Brende, made his final decision on 22 August 2002 to deny the permit to do the CO₂ experiment that was initiated in Kyoto, December 1997. This decision by the Ministry forced the international project group to demobilise in Norway and elsewhere.

The decision caused a lot media attention and concern and disturbance among the science community, among the project participants and all its contracted personnel and logistics suppliers etc.

1. Introduction

1.1 Background and scope of the report

1.1.1 The international project on CO₂ sequestration

Several international scientific workshops and conferences in the early/mid 1990'ies were arranged to discuss CO₂ ocean sequestration as a climate mitigation method. The ocean already holds vast amounts of CO₂ and according to the scientific knowledge the potential to sequester or store additional anthropogenic CO₂ in the ocean e.g. by direct injection is also formidable.

On this background, the governments of Japan, USA and Norway agreed to establish a joint research project on this topic under the UNFCCC/OECD Climate Technology Initiative during the summit meeting for the Kyoto Protocol, December 1997.

The Article 2 of the Kyoto Protocol has specific statements about carbon sequestration:

Each Party included in Annex I, in achieving its quantified emission limitation and reduction commitments under Article 3, in order to promote sustainable development, shall:

(a) Implement and/or further elaborate policies and measures in accordance with its national circumstances, such as:

.....

*(iv) Research on, and promotion, development and increased use of, new and renewable forms of energy, of **carbon dioxide sequestration technologies** and of advanced and innovative environmentally sound technologies.*

The Norwegian Ministry and Environment appointed the Norwegian Research Council (NRC) to represent the Norwegian national interests and subsequently the Norwegian institute for water research, NIVA, was selected to become the 'implementing organisation' in this international joint research project. Later Canada, Australia and ABB (Switzerland) joined the project. In USA DOE/FETC is the governmental representative and MIT the implementing institution, while in Japan NEDO/CRIEPI and RITE have had these roles, respectively.

Figure 1 outlines the management structure of the project.

The project aimed at experimental in-situ work to study near-field distribution and dispersion of the CO₂ plume emerging at about 800 m depth where liquid CO₂ would be emitted from a nozzle. Results from the experiment would firstly be available to all participating institutes for evaluation and publication and for further use in models and preparing for follow-up experiments.

The experiment was originally to take place in Hawaii, in 2000. This plan was later abandoned in favour of planning the experiment for the deep waters offshore Norway. The reason for this selection was that Norway has a large pool of suitable vessels and equipment/logistics, they have a significant offshore/marine theoretical and engineering expertise in this or related fields, and there are recent good experiences with running similar deep water experiments with release of natural gas (e.g. the SINTEF "Deep Spill" experiment).

The project revised its scientific plan and submitted an application for a discharge permit to the State Pollution Control Authority (SFT) in Norway in January, 2002. SFT gave the permit shortly thereafter. However, in May, 2002, the Norwegian Ministry of Environment (ME) intervened and suspended the permit, by requesting a public hearing round. Following a rather eventful summer, the ME finally decided on 22 August to withdraw/deny the permit. This decision has had wide consequences for all partners to the project and a report on these unexpected events has been requested by the organising team.

1.1.2 Scope of the report

Since it was partly difficult to follow what was going on in Norway at all times, the project wanted to get a summary of events related to the permitting during the summer of 2002. The present report attempts to achieve this goal, with no extra cosmetics. Thus, this report is made in a "tabular" and chronological form to give an overview of what happened when, and not analysing in-depth why it happened.

Since a lot of extra emergency activities in the project had to be undertaken, both in Norway and abroad, the present summary may serve as a partial documentation on these efforts as well.

The summary is "neutral" in the respect that no particular attempt has been made to evaluate or comment on the different arguments from various sides.

Likewise, no attempt has been made to quantify the full economic and scientific consequences of the Ministry's decision. One can only say at the moment that these are very significant (see Para. 7.4).

1.2 Tabular summary of major events/milestones in Norway

We have made a chronological table where major events have been placed in, with reference made to a particular chapter or paragraph in the present report, where applicable.

Mo	Date	Event	Para.
Jan	18	NIVA submits application to SFT	1.3
	25	SFT issues permit to NIVA (e-mail and letter)	2.2
May	31	Question by Ms Malvik in the Parliament	3.1
June	1	Letter from Greenpeace to OSPAR	5.3
	7	Answer to Ms Malvik by the Minister of Env. in the Parliament	3.2
	11	SFT initiates hearing round	3.3
	24-27	OSPAR meeting, Amsterdam	5.4
	28	End of hearing round	3.4
July	4	Letter, NIVA to SFT, with comments to the hearings	3.5
	5	Letter from SFT to NIVA reissuing the permit, after hearing round	3.6
	5	Start of Appeal round	3.7
	15	Press release from NIVA (web site)	3.8
	26	End of Appeal round	3.9
Aug	5-8	SFT offers NIVA to comment on the complaints from GP and WWF	3.0
	8	SFT sends letter to ME, on the appeals	3.10
	22	Rejection letter from ME	4.1-4.3
	28	NIVA Board gives statement	7.3
Sep	11	NIVA issues short press release	4.4
Oct	10	NIVA sends letter to ME, asking for comments	7.4

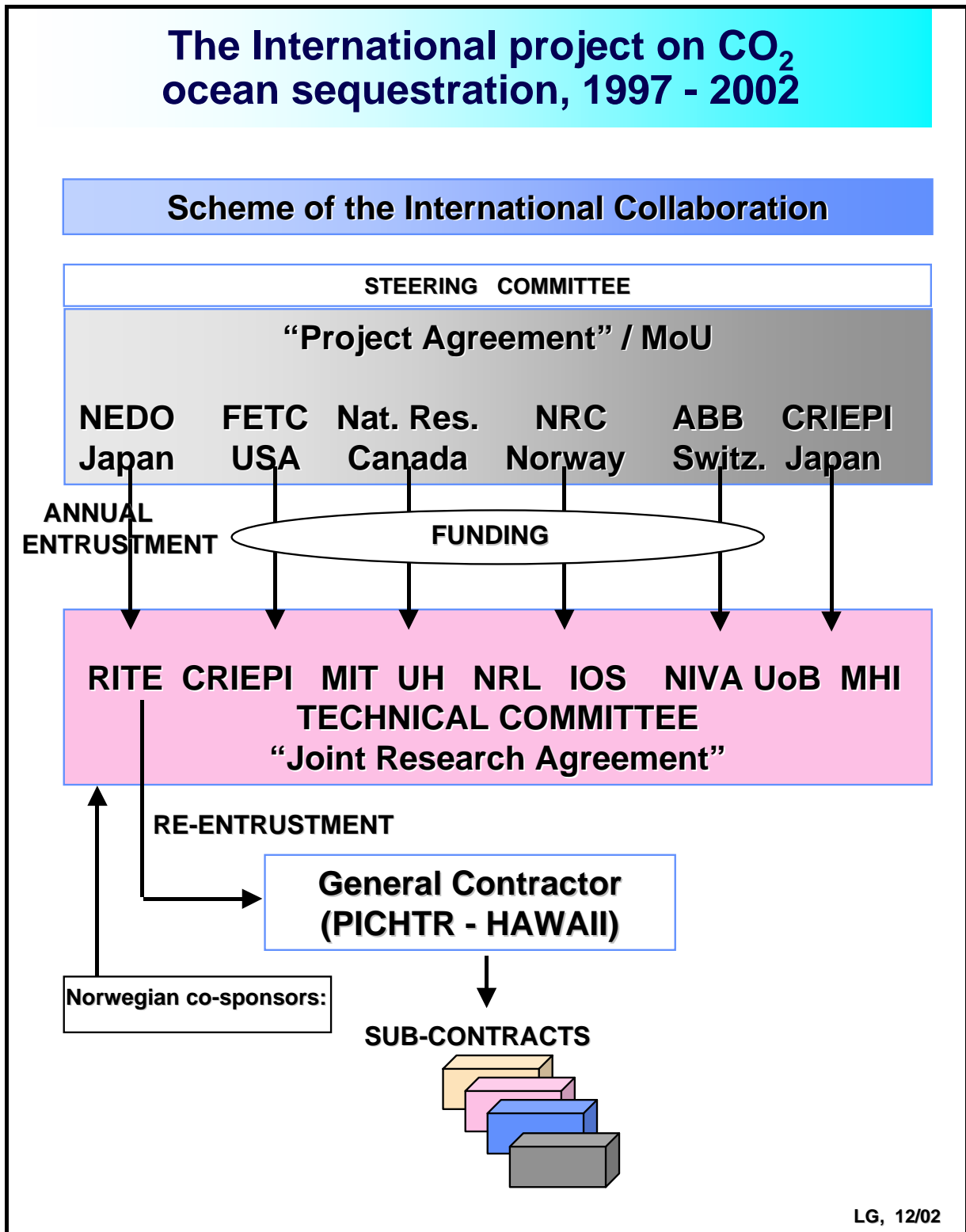


Figure 1. Outline of the organogram for the international project, 2002.

1.3 Summary of the permit application to SFT

On behalf of an international group of scientific organisations, NIVA, The Norwegian institute for water research, is planning an experimental release of carbon dioxide in the Norwegian Sea (west of the Storegga) during the period 22 July-11 August (weeks 30-32), 2002. The release of 5,4 tons of pure CO₂ will be from the ocean floor at a depth of 800 m. The experiment is motivated by the need for increased knowledge about the chemical, physical, and biological effects of releasing carbon dioxide in seawater. In the future, CO₂ may have to be released and dissolved in the deep ocean in order to reduce CO₂ build-up in the atmosphere.

Applicant

The applicant for the release is NIVA, the Norwegian institute for water research, on behalf of an international scientific group that consists of

- AIST, National Institute of Advanced Industrial Science and Technology, Japan
- CRIEPI, Central Research Institute of Electric Power Industry, Japan
- CSIRO, Commonwealth Scientific and Industrial Research Organisation, Australia
- HPU, Hawaii Pacific University, USA
- IOS, Institute of Ocean Sciences, Canada
- KU, Kyoto University, Japan
- MIT, Massachusetts institute of Technology, USA
- NERSC, Nansen Environmental and Remote Sensing Center, Norway
- NIVA, the Norwegian institute for water research, Norway
- PICHTR, Pacific International Center for High Technology Research, USA
- RITE, Research Institute of Innovative Technology for the Earth, Japan
- UH, University of Hawaii, USA
- UoB, University of Bergen, Norway

Each organisation is sponsored by governmental funding bodies in the respective countries; Department of Energy (DOE) in the USA, New Energy and Industrial Technology Development Organisation (NEDO) in Japan, Natural Resources Canada (NRC), Norwegian Research Council (NRC), ABB Corporate Research in Switzerland and CSIRO in Australia. The agreement to plan and perform the joint experiment was formed under the IEA/OECD Climate Technology Initiative and signed at COP-3 in Kyoto in December, 1997.

Time and place for the releases

The planned release will last one week within the 3 weeks time frame applied for. The extra time is for mobilisation, demobilisation and waiting time in the case of bad weather.

The release site will be located ca 75 n miles NW of Kristiansund. The site will be located within a small area specified by the co-ordinates

63° 20' – 63° 55' N
05° 10' – 05° 40' E

What and how much will be released

10 experimental releases are planned, each comprising no more than 540 kg CO₂. Each release will last for maximum 2 hours. Momentary fluxes of CO₂ will be adjusted according to the limits 0.1 kg/s (minimum) and 0.3 kg/s (maximum). The release platform is a well-proven unit containing 20 CO₂ canisters that are charged with CO₂ on board the supply vessel and then lowered to the seabed prior to each release. Valves that can be operated both remotely from the sea surface and mechanically by a ROV are controlling the release of the gas. There will be one or two releases per day. Each release will be accompanied and followed by careful monitoring, measurements and observations of the CO₂ droplets and the plume of CO₂ enriched seawater.

Basis for the releases

There is growing concern that increased CO₂ levels in the atmosphere from burning of fossil fuels such as coal, oil and gas will cause climate change and severe damage to both property and the environment. Such damage is probably already taking place and projections of fossil fuel consumption strongly indicates that actions need to be taken very soon in order to reduce the emissions to the atmosphere.

Ocean sequestration of CO₂ is considered a possible method to mitigate climate change, by first capturing the CO₂ gas from large stationary sources such as power plants and then injecting and dissolving it in the deep ocean. In this way, the captured CO₂ remains away from the atmosphere for 1.000 years or more. Several steps need to be taken in order to better understand this technology, from small scale to large scale tests.

The experiment as applied for, constitute pioneering work on the local scale to continuously release small amounts of CO₂ into the seawater in order to study behaviour of the gas before it is completely dissolved and diluted in the water. This study will also bring new insight into the fate of spurious seeps and leaks of CO₂ from the seabed either naturally or from oil and gas developments.

Environmental effects of the releases

When CO₂ is injected into the ocean during the experimental release, a plume of droplets and CO₂ enriched water will be formed. Computer simulations show that the plume will have a maximum rising height of 100 m before it is dissolved and carried away from the release point by the prevailing ocean currents. Through a carefully designed observational programme the physical behaviour of the droplets and the plume will be recorded and analysed. Some change in the seawater chemistry such as lowered pH as the seawater becomes acidic is expected to take place near the release point. Laboratory studies have provided limits of tolerance of various seawater species versus pH. Computer simulations for the experimental releases we plan in this experiment show that there will be no significant biological impacts. However, exposure to low pH for an extended time period may affect animals in the vicinity of the plume and it is also an objective of the experiment to observe and learn about such effects.

Accessibility and dissemination of results

Results will be shared among the partners to the international project. Data will be published in international peer-reviewed journals. Computer models will be improved in order to be able to provide

better projections on the efficiency and impacts from future large scale CO₂ ocean sequestration. The final evaluations of results from the experiment will help to document whether CO₂ ocean sequestration may become a viable future climate technology both in terms of environmental impact and technological feasibility.

2. Process of SFT's permission

Based on the experience from the SINTEF "Deep Spill" application process, the following guidelines were given to NIVA prior to submitting the application. Although this relates to releases within the oil sector, the proposed experiment would be quite similar to the "Deep Spill" and so similar regulations would apply, also according to SFT. I.e. the Norwegian Pollution Control Act would be the relevant document also from which a temporary exclusion from the regulations could be obtained.

Experimental oil spills in Norway application procedure

The Norwegian Pollution Control Authority welcomes research and development activities related to deep water oil exploration contingency. According to regulations, a permit is required for any experimental release of oil in Norwegian waters. The application procedure is:

- **Project presentation: Meeting between SFT and the company submitting the application.**
- **Application must be submitted to SFT no later than 4 months prior to experimental release.**
- **The application will be forwarded to 10-15 organisations for comments (hearing).**
- **Formal reply from SFT will be forwarded no later than 3 weeks prior to the experimental release.**

Experimental oil spills in Norway application content

- **Main objectives for the activities involving experimental release.**
- **Location(s) of the experimental release.**
- **Oil type, quantity and chemical/physical/environmental properties.**
- **Weather and oil drift statistics for the location(s) involved.**
- **Environmental risk analysis .**
- **Contingency plan.**
- **Surveillance plan.**
- **Reporting.**

2.1 The main principles of the Norwegian Pollution Control Act

The Pollution Control Act is from 1981. It is the first unified law in Norway concerning pollution and waste issues. It was at that time a political goal to create one basic legal framework for all types of pollution and waste.

The Pollution Control Act is a typical enabling act. This means that the details in each case are outlined in discharge permits and regulations issued by the pollution control authorities. The Act was established for the purpose of preventing and reducing harm and nuisance from pollution. This is

reflected in the main rule of the act, which says that pollution is forbidden, unless it is specifically permitted by law, regulations or individual permits.

Section 1 of the Act states that the purpose of the Act is to protect the outdoor environment against pollution and to reduce existing pollution and waste. But environmental protection is not the only relevant consideration here. The act shall secure a satisfactory environmental quality based on a balance of interests, which includes costs associated with any measures and other economic considerations.

Pollution is defined in section 6 of the Act. The definition has two aspects. In the first place, certain actions must be present. There has to be a discharge of solids, liquids or gases to air, water or ground. This discharge must be caused by human activity, not by nature itself. Secondly, there has to be a risk of adverse effects or impacts on the environment. The discharge has to effect the recipient. It is enough that the discharge may cause damage or nuisance to the environment. That is in accordance with the precautionary principle. Any damage or nuisance is relevant here, whether they affect humans, animals or nature itself.

The Norwegian Pollution Control Act distinguishes between legal and illegal pollution. Section 7, first paragraph, states the basic principle and the main rule of the act: It is not allowed to possess, do, or initiate anything that may entail a risk of pollution, unless this is specifically permitted by law.

Almost all pollution activity in Norway is based on individual permits or licences issued by the Norwegian Pollution Control Authority or the county environmental agencies. Whether a permit is granted or not, depends on the professional judgement of the pollution control authorities.

2.2 SFT issues the permit, 25 January

SFT issued the permit to do the experiment on January 25. A translation of their letter follows.

Application for release permit for CO₂ in the Norwegian Sea

SFT has received an application from the Norwegian Institute for Water Research (NIVA) regarding permission to carry out an experimental release of carbon dioxide in the Norwegian Sea, in the summer of 2002, on behalf of the Norwegian Research Council and an international scientific group. Releases amounting to a total of 5.4 tonnes of liquid CO₂ are planned at approximately 800 m depth at Storegga, approximately 110 km N-W of Kristiansund.

NIVA has accounted for the purpose, experiment plan and expected environmental effects of the release.

It is important that the experiment documents any environmental effects such as temporary decrease in oxygen content and change of pH in the water masses. SFT finds it important to have a sampling set-up that can reveal whether the release will cause injury or damage to the environment. Various biological species, such as benthic/pelagic – sessile/nektonic and invertebrates/vertebrates should be represented.

SFT assumes that all equipment used will be removed after termination of the experiment.

Based on the information the applicant has given, SFT does not find that the release requires permission, in accordance with the Pollution Control Act, §8. However, SFT asks that experience and documentation from the experiment be submitted to SFT no more than 10 weeks after the termination of the offshore activities.

3. Background of the first interventions of the Ministry of Environment

3.1 Question in the Parliament in May

**Question from Member of Parliament Ingvild Vaggen Malvik (SV)
To the Minister of Environment Børge Brende
Dated 31 May 2002**

(Ms Malvik is from Trondheim. She is representing the Socialist Party in the Parliament. She has masters degree in political science from the Technical College of Tondheim, and a background from various environmental movements and organisations).

Question, 31 May:

SFT (the Norwegian Pollution Authority) has allowed the accomplishment of an experiment in the Norwegian Sea which implies dumping of several tons of CO₂ in waters of 800 m depth north-west of Kristiansund. Despite the fact that an equivalent project did not receive permission off Hawaii, there has not been given a formal release permit nor has a public hearing been carried out. Does the Environment Minister support the judgement of the SFT in this matter, and does the Minister feel that the matter has been subject to a satisfactory treatment?

Basis for the question:

The Norwegian Institute for Water Research (NIVA) on 18 January 2002 applied for a permit to release a total of 5.4 tons of liquid CO₂ at ca. 800 m depth at Storegga, ca. 110 km north-west of Kristiansund in the summer 2002. The application has been submitted on behalf of the Norwegian Research Council (NFR) and the international scientific group. This group has been working with so-called "ocean sequestration" of CO₂ for a number of years, and has planned a CO₂ experiment that should originally have been carried out in the summer 2000. Due to local and environmental opposition, the project has been postponed several times, and finally the application was turned down by U.S. authorities. The project was then moved to Norway, where the SFT treated the matter in less than five days.

According to the project description it appears that the experiment will have some negative biological impact both on fish, benthos and other matters, even in small scale. On a larger scale, for which this is a pre-study, to be carried out later, the direct effects will be more serious. If such experiments nonetheless should be allowed to be carried out in Norwegian fishing grounds it is reasonable to expect that they would make probable the discovery of important results. In this context, even a "successful experiment" appears as wasted knowledge, since it still would be impossible for this or other scientific groups to guarantee that CO₂ which is pumped into the free water masses will not ascend into the atmosphere and cause climate changes.

3.2 Answer from the Minister of Environment, 7 June

The question addresses SFT's handling of an application from NIVA for permission to release liquid CO₂ in the Norwegian Sea in connection with an experiment with depositing CO₂ in the deep sea in the summer 2002. This experimental project is part of an international ocean sequestration project which aims at obtaining more knowledge about depositing CO₂ as a possible climate effort. The experiment is planned to take place over a period of 10 days in the time window from July 22 to August 11 this year. In this period a scientific group wishes to carry out several sub-experiments with

such depositing near the sea bottom. Every release will be of a maximum of 540 kg. The total amount of CO₂ which is to be released is of 5.4 tons.

In a letter of January 25 to NIVA this year the SFT expressed that the experiment did not need a release permit after the Pollution Act §11. SFT based this view by referring to the Pollution Act §18. According to this regulation, pollution "that does not imply serious harm or inconvenience" can take place without permission after §11.

Depositing CO₂ near the sea bottom has not been tried before. The Ministry of Environment finds that there is a some professional uncertainty about the effects of such releases of CO₂. Even though the amount to be released is very small, the releases can be expected to imply certain time-limited changes in the water chemistry in the vicinity of the release point – including pH-changes and reduced oxygen content. There does appear to be some uncertainty regarding whether and to what extent the releases might also affect the fauna around the release site. One of the goals of the experiment is exactly to increase the knowledge about biological effects of CO₂ releases in the ocean. The Ministry of Environment has noted that the U.S. environmental authority EPA (U.S. Environmental Protection Authority), as has the SFT, has received an application for an experimental project on depositing CO₂ in the ocean. The Ministry of Environment is aware that public hearings on the matter have been carried through, and that the case is still being treated by the EPA. Moreover, the U.S. experiment concerns a larger amount of CO₂.

Even though the experiment in the Norwegian Sea involves the release of very limited amounts of CO₂, there is some professional uncertainty as to whether the CO₂ releases will imply "serious harm or inconvenience". Based on this uncertainty, the Ministry of Environment believes that it is correct to treat this matter according to the pollution act. Concerned parties will thus have an opportunity to submit their opinions on the matter, and there could be posed conditions on a possible release permit. The SFT will now treat the application from NIVA according to the pollution act.

3.3 Three weeks Hearing Round, beginning 11 June

Following the statement from the ME on 7 June, the SFT started the preparations for a hearing round. The following message was issued by SFT on 10 June:

The Norwegian Pollution Control Authority is asked by the Ministry of Environment to reassess the application from NIVA. This means that will be sent on a hearing to governmental and non-governmental institutions. The hearing deadline is set to the end of June. A complaint to our concession or license can be made to the Ministry for final assessment and decision. This may have consequences with regard to the original time frame for the experiment.

3.4 Summary of the Hearing Round comments filed by SFT

SFT received about ten replies after the hearing round. This included letters from fishermen's associations, the Norwegian Petroleum Directorate, Directorate for Nature Conservation, local Counties, the Institute for Marine Research and three environmental groups. Only the environmental groups had complaints or critical arguments about the experiment.

3.5 Comments from NIVA on the Hearing Round replies

NIVA commented briefly to SFT on 4 July on the remarks from the environmental groups. The table below gives their arguments and NIVA's comments.

org.	#	Statements, English	Comments, English
Greenpeace Norge	1	<i>The discharge will affect flora and fauna in the area</i>	There is no flora at the depths we are considering. Marine flora (algae, seaweed) is found only in shallow water down to where light can reach.
	2	<i>The experiment is to a very little degree designed to map biological effects</i>	There is a significant experiment component to incorporate mapping of biological effects; bottom fauna, fish, zooplankton and bacteria.
	3	<i>The dumping of industrial waste, like CO₂ from combustion, is illegal according to both the OSPAR and London conventions.</i>	Yes, but there is no industrial waste involved in the experiment. We will use pure CO ₂ that is produced for use in human food production, mineral water etc. Thus, the reference to the LC is irrelevant. OSPAR even accepts the release (dumping) of municipal waste water in deep waters, as a mitigation to avoid reducing water quality near shore.
Greenpeace Inter national	1	<i>The experiment will not provide any meaningful data on biological impacts beyond potential simple observations of gross behaviour responses on the part of the largest species present</i>	This argument is not documented by any facts. A significant experiment component will incorporate monitoring and sampling of biological effects; bottomfauna, fish, zooplankton and bacteria.
	2	<i>Discharge of CO₂ into the marine environment has the potential to exert significant toxicological impacts...</i>	CO ₂ normally is not toxic, but may act as an anaesthetic on fish. CO ₂ is commonly used for this purpose in lab studies.
	1	<i>The experimenters need to accommodate possible impacts upon all ecological compartments in the receiving environment, including planktonic and benthic organisms at an ecosystem level.</i>	Experiments on ecosystem level are very complicated and not common. At any rate such an ecosystem approach must be based on knowledge about physical and chemical scales, as well as effects on single organisms and specific trophic levels. Such knowledge needs to be obtained before any large-scale ecosystem experiment can be done.
	2	<i>Inevitably, this would entail conducting the experiment at such a scale that the potential for observable ..impacts would be maximised.</i>	OK But the argument does not prohibit doing experiments on smaller scales first.

Greenpeace to OSPAR Commission	3	<i>The limited studies conducted into the fate of injected CO₂ (since 1999) have only served to illustrate the unpredicted behaviour of liquid CO₂ released at depth.</i>	The studies we know of have not revealed unexpected behaviour of CO ₂
	4	<i>...The practice of ocean disposal of CO₂ would contravene the London Convention</i>	LC regulates dumping from ships and platforms, not e.g. discharges via pipeline from shore. LC is a convention, not a law of nature, it can be changed. The Kyoto protocol commitments may cause such changes to take place (amendments to Annex I/II). the UNFCCC underscores the need to do research on CO ₂ sinks, including the ocean.
	5	<i>Following the cancellation (due to substantial local and regional opposition) of proposed experimental releases of CO₂ of Kona coast in Hawaii....</i>	The resistance was largely local and limited to a few individuals plus a few stakeholder groups and organisations, including a sports fishing association. No arguments were scientifically founded.
	6	<i>Moreover, the rationale of the study still relies on the highly questionable premise that the injected CO₂ will remain isolated from the atmosphere for 1000 years or more.</i>	Scientific facts gained after 100 years or more of oceanographic research tell us that 1000 years is a reasonable estimate for the average residence time of the deep ocean water. But there will be differences from one ocean to the other.
	7	<i>In addition to {the CO₂ experiment} contravening the London Convention...the dumping at sea of waste CO₂ from fossil fuel combustion also contravenes...the OSPAR Convention.</i>	The experiment will use pure and clean CO ₂ only, produced for food production etc. Thus, there will be no "dumping of waste".
WWF	1	<i>WWF says a categorical no to dumping of CO₂ in the upper layers of the ocean (less than 1000 m depth) as the risk of outgassing is high.</i>	We suppose that WWF is referring to ocean sequestration as a possible future method, not to the experiment itself. Ocean sequestration will take place deeper than 1000 m. The knowledge about deep water currents is significant and the long residence times are well documented through numerous studies. There is thus no scientific basis for the argument.
	2	<i>Existing knowledge from lab. studies and in the field indicate significant negative impact on the marine environment and organisms</i>	We will study and quantify effects on low pH and high p-CO ₂ on organisms in the experiment, enabling us to acquire new facts and knowledge. It is important to have effects studies done in-situ (at depth).

WWF, cont.	3	<i>The legality of CO₂ dumping in the ocean waters is dubious (London convention, UNCLOS, OSPAR, Rio)</i>	The UN Framework Convention on Climate Change may overrule existing/older conventions. This convention underscores the need to do research on the biosphere and ocean as CO ₂ sinks. CO ₂ ocean sequestration comes under this. If there is an acceleration in the climate change and environmental impacts from this, the precautionary principle will mean that large scale mitigating actions can be implemented even if not knowing fully about possible negative side-effects of these (UNFCCC).
	4	<i>A fundamental criticism against the experiment in Hawaii was that it was not designed to map the environmental effects.</i>	The plans since then have been altered to also cover biological impact studies.
	5	<i>We regard it as unwise both ethically and resourcewise to spend public research funding to investigate on a method that contravenes international law of the seas and environment conventions.</i>	The Law of the Sea and the env. conventions build on historic and established environmental concerns. The UNFCCC is the most recent of these conventions, covering a different topic, and it has the highest membership. It requires the partners to do research on the ocean carbon sink. The CO ₂ experiment is a concrete follow-up agreement to the Kyoto agreement organised under the UNFCCC/CTI as an international project.
Norges Naturvern-forbund	1	<i>A corresponding experiment planned to take part in the ocean off Hawaii was rejected by US environmental authorities following protests by env. organisations and others.</i>	The experiment was not refused by the US-EPA. The application is still being handled by them. They initially required us to perform wider env. assessments in connection with the application. This in addition to the long time for processing within EPA was not compatible with the timebase of our project.
	2	<i>We refer in this respect to the argument put forward by the Union of Concerned Scientists in the USA</i>	UCS was/is primarily against ocean fertilisation (iron seeding) as a climate mitigation method. Their argument that because we lack understanding in an area we should neither do any research to find out anything, is contradicting. The opposite should be the rule, referring to the UNFCCC recommendations and the precautionary principle.

3.6 SFT reissue their permit, 05 July

SFT reissued their permit on 05 July, in a letter describing the three week Hearing Round and with a list of the ten letters and comments filed by SFT. SFT would not consider the experiment as “dumping” in the terms of the London Convention or OSPAR. Based on an evaluation of legal and environmental aspects, and also after weighing the benefits from the experiment against any potential environmental impact, SFT reissued their permit to NIVA by stating:

SFT gives NIVA the permit to release 5.4 tonnes of pure CO₂ in the Norwegian Sea as part of a research project. The experiment has an expected duration of 10 days. The release is limited and the experiment cannot be expected to cause any significant damage or inconvenience. The experiment must to the largest possible extent document any negative environmental impacts.

3.7 Appeal round, 5-26 July

Immediately after reissuing the permit, SFT opened up for a three weeks period for appeals. SFT would formally handle the appeal process, and make a summary for the Ministry, which eventually would make the final decision. SFT filed two complaints during the appeal round. Those were from Nordic Greenpeace and WWF Norway.

3.8 Press release from NIVA, 15 July

A text describing the planned experiment was released to the press and put on NIVA’s web pages on 15 July, 2002. The text was in Norwegian only. An extract translation is given below.

International experiment by NIVA on ocean storage of CO₂

An international research project that is studying ocean storage of CO₂ as a climate mitigation option is preparing for an experiment at 800 m depth offshore Trøndelag this summer. The experiment that is run by the Norwegian Institute for Water Research (NIVA) will explain how CO₂ is dissolving in the seawater under such high pressure and how rapidly it is dispersed by the ocean currents. In addition to this, the scientists will study possible impact on marine life in the deepwater and on the seabed. The aim of the project is to see if it is possible or not to store large amounts of CO₂ in the deep oceans, something which theoretical studies have shown.

3.9 Official comment from NIVA to SFT, 8 August, on the Appeals

NIVA was allowed by SFT in a letter dated 5 August to make official comments to the complaints during the Hearing Round. NIVA’s reply on 08 August is repeated below.

NIVA thinks that a critical evaluation of the ocean sequestration concept and discussions about the planned experiment are useful. We want to comment briefly on some of the comments returned to SFT after the hearing round. We will at this stage defer from commenting on political and juridical issues connected with possible future large-scale ocean storage.

As maintained by e.g. the WWF in the hearings, the knowledge about both the physical, chemical and biological/ecological effects from this potential climate technology is limited.

The experiment we seek to conduct is exactly directed towards increasing the knowledge base in order to be able to evaluate both benefits and effects of ocean storage. WWF wants a more comprehensive study of e.g. long-term ecological effects. Exactly because there are many unresolved questions about both the biological impact and the behaviour of CO₂ in seawater it is essential to begin the

experimenting on a small scale to make sure that unwanted effects can be avoided, also on local scale during the experiment. In the experiment as applied for one cannot plan for observing long-term effects on ecosystems, because the discharge is so small, both in magnitude and duration. Expected effects on local biology during the experiment are also so small that it will be very difficult to do comprehensive studies on a detailed level at this stage.

It is correct to say that the present experiment is focussed on the physical behaviour of injected CO₂, and the subsequent chemical processes in the near field. Physical and chemical conditions are the baseline parameters for biological effects, and only through knowledge about these will it be possible to understand how the deepwater biology is impacted. We will otherwise remind about the extensive international research on deepwater biology, including how the pH and CO₂ of the water masses are impacting on single organisms and ecosystems.

This experiment must not be regarded as an attempt to give all answers on all questions connected with the possibility of future ocean storage of CO₂. Contrary to what some claim, the project is not designed to give any carte blanche for implementation of this method and thereby obstruct the work to reduce use of fossil fuel. The project is one out of many required to increase scientific knowledge in this field.

We are also noting that institutions of closely related fields such as the Fisheries Directorate and the Institute of Marine Research and the Society of Norwegian Fishermen have no arguments against the completion of the experiment according to the plans described by NIVA in the permit application to SFT dated 18 January, 2002.

On behalf of the Norwegian Institute for Water Research,

Odd Skogheim
(Adm. Director)

Lars G Golmen
Research scientist

Arild Sundfjord
Research scientist

3.10 SFT summary of Appeal Round, 08 August

Based on the appeals/complaints, the comments from NIVA and SFT's own evaluations, they issued a letter to the Ministry of Environment on 08 August, with a summary of the complaints and then their renewed decision, in short:

The complaints from Greenpeace and WWF do not contain any new information in relation to what came out during the Hearing Round and that was the basis for our (SFT's) evaluation of the case, before reissuing the permit. The comments deal primarily with large-scale dumping of CO₂ in the ocean as a climate technology. Both complainants assume that the proposed release will be of limited value or not have any impacts.

SFT states that the complaints do not convey any new arguments in the case of the proposed experiment and the release of 5.4 tonnes of pure CO₂. SFT maintain it's opinion that the proposed release has an insignificant potential for any damage or inconvenience.

SFT maintains it's decision whereby NIVA is given the permit to release totally 5.4 tonnes of pure CO₂ in 800 m depth N-W of the Storegga in the Norwegian Sea.

The complaints are forwarded to the Ministry of Environment, according to the regulations in the Public Administration Act, § 33, for evaluation and decision.

4. Final decision by the Ministry of Environment

After having received the letter from SFT with the accompanying appeals/complaints and SFT's eventual evaluation and decision, the Ministry issued their statement on the case on 22 August, where they overruled the decision by SFT and denied the permit.

4.1 The original final denial letter from the Ministry (in Norwegian)

Eksperimentelt utslipp av karbondioksid (CO₂) i Norskehavet - avgjørelse i klagesak

Likelydende

Deres ref

Vår ref

Dato

2002/2071- F/BL

22. aug. 2002

Ark:

Eksperimentelt utslipp av karbondioksid (CO₂) i Norskehavet - avgjørelse i klagesak

Innledning og sakens bakgrunn

Statens forurensningstilsyn (SFT) ga den 5. juli 2002 Norsk institutt for vannforskning (NIVA) tillatelse etter forurensningslovens § 11 til å slippe ut 5,4 tonn ren karbondioksid (CO₂) på 800 meters dyp nordvest for Storegga i Norskehavet. Utslippene skal inngå i et internasjonalt forskningsprosjekt i regi av Climate Technology Initiative (CTI) som tar sikte på å fremskaffe kunnskap om deponering av CO₂ på dypt vann som et mulig klimatiltak. Vedtaket er pålagt av World Wildlife Fund (WWF) Norge ved brev av 24. juli 2002 og av Greenpeace Norden ved brev av 26. juli 2002. I brev av 8. august 2002 opprettholder SFT sitt vedtak av 5. juli, og oversender saken til departementet for avgjørelse i henhold til forvaltningslovens § 33.

Klagernes anførsler

Anførselene fra henholdsvis WWF og Greenpeace er i stor grad sammenfallende og vil bli vurdert samlet. Klagerne legger til grunn at eksperimentet i seg selv vil ha nokså begrensede direkte effekter på det marine miljøet. Klagernes innvendinger er i hovedsak basert på motstand mot at havlagring av CO₂ tas i bruk i stor skala som et klimatiltak. Klagerne anfører at storskala utslipp av CO₂ i dyphavet vil kunne ha uforutsigbare, negative effekter på havmiljøet og at CO₂ som deponeres i vannmassene over tid vil kunne lekke ut til atmosfæren. Klagerne er kritiske til at forsøket ikke er innrettet med tanke på å fremskaffe mer kunnskap om dette. Klagerne anfører videre at det ikke er avklart om deponering av CO₂ i havet vil tillates som klimatiltak under Kyotoprotokollen. Klagerne anfører også at deponering av CO₂ fra fossil forbrenning vil være i strid med OSPAR-konvensjonen og Londonkonvensjonen. For øvrig vises det til klagen.

Departementets vurderinger

Departementet vil vise til at deponering av CO₂ i vannmassene ikke tidligere har blitt utprøvd. Departementet vil innledningsvis understreke nytten av forskning for å få økt kunnskap om viktige miljøspørsmål og mulige løsninger på alvorlige miljøproblemer.

SFT har i sitt vedtak lagt til grunn at de forurensningsmessige ulempene ved dette konkrete prosjektet vurderes som beskjedne. Dette synet støttes også av klagerne.

Siktemålet med eksperimentet er imidlertid å fremskaffe kunnskap om havlagring av store mengder CO₂ som et mulig fremtidig klimatiltak. Dette tilsier at det bør foretas en nærmere vurdering av hvorvidt havlagring av CO₂ kan betraktes som et aktuelt klimatiltak, og om slik bruk av havet vil være forenlig med internasjonale avtaler som Norge har sluttet seg til.

En viktig forutsetning for å vurdere om deponering av CO₂ kan være et aktuelt klimatiltak i fremtiden, vil være kunnskaper om CO₂ som lagres i havdypet kan lekke ut til atmosfæren. Det er i dag mangelfull kunnskap om dette, og spørsmålet er omdiskutert. NIVA har overfor SFT vist til at man ved dette forsøket har lagt størst vekt på å studere tekniske utfordringer og fysiske og kjemiske prosesser ved injeksjonsstedet, og at eksperimentet bare vil gi svar på noen av de mange spørsmål som lagring av CO₂ i havet reiser. Departementet legger til grunn at forsøket ikke vil gi vesentlig bidrag til økt forståelse av mulighetene for framtidig utlekking av CO₂ til atmosfæren. Etter departementet syn er dette et helt sentralt spørsmål i vurderingen av bruk av lagring av CO₂ i havet som et mulig framtidig klimatiltak.

Departementet ser behov for en bredere internasjonal diskusjon og forståelse av dette spørsmålet. Det vises i denne forbindelse til at det ikke er avklart om deponering av CO₂ i dyphavet vil tillates som klimatiltak under Kyotoprotokollen, og at spørsmålet fortsatt er under diskusjon.

Klagerne hevder at deponering av CO₂ fra fossil forbrenning vil være i strid med både OSPAR-konvensjonen (konvensjon om beskyttelse av det marine miljø i det Nordøstlige Atlanterhav av 1992) og Londonkonvensjonen (konvensjon om bekjempelse av havforurensning ved dumping av avfall og annet materiale av 1972, med protokoll av 1996).

Norge har sluttet seg til begge disse konvensjonene.

Departementet vil understreke at de ulike problemstillinger som dette forsøket reiser ikke er direkte løst i de aktuelle konvensjonene, som har til hovedformål å beskytte det marine miljø mot skadelige påvirkninger. Begge konvensjonene fastsetter som hovedregel et forbud mot dumping av avfall og annet materiale til havs. Det gjøres unntak for enkelte avfallskategorier.

Spørsmålet om hvorvidt deponering av CO₂ rammes av dumpeforbudet i OSPAR-konvensjonen ble tatt opp på det siste kommisjonsmøtet under konvensjonen i juni i år, på bakgrunn av det omsøkte prosjektet i Norskehavet. Møtet ga ingen endelig avklaring på dette spørsmålet, men det er ikke tvil om at prosjektet er omstridt og blir møtt med skepsis, både med hensyn til mulige skadevirkninger, og fordi man ikke ønsker å gjenåpne havet som dumpeplass for avfall. Den juridiske arbeidsgruppen under konvensjonen ble av møtet bedt om å foreta en nærmere vurdering av de ulike problemstillingen knyttet til mulig deponering av CO₂ i havet. Denne vurderingen vil ventelig foreligge til det neste kommisjonsmøtet som finner sted i juni 2003.

Havmiljøkonvensjonene vil først og fremst ha betydning for eventuell CO₂ deponering i større skala. Departementet mener likevel at det bør være klarere internasjonal enighet om dette er en praksis som vil være forenlig med OSPAR-konvensjonen, Londonkonvensjonen og klimaavtalen før det igangsettes forsøk med havlagring av CO₂.

Selv om de rent forurensningsmessige ulempene knyttet til dette prosjektet ikke alene begrunner et avslag på utslippssøknaden etter forurensningslovens § 11, legger departementet avgjørende vekt på at spørsmålet om hvorvidt mulig fremtidig havlagring av CO₂ vil være forenlig med de aktuelle havkonvensjonene ikke har fått noen endelige avklaring. Det er igangsatt en prosess for å vurdere dette spørsmålet innenfor OSPAR-samarbeidet. Dette tilsier at man avventer er slik gjennomgang før eksperimentet eventuelt gjennomføres.

Konklusjon

Etter en samlet vurdering er departementet kommet til at det omsøkte eksperimentet ikke bør gjennomføres før forholdet til de internasjonale konvensjoner om beskyttelse av havmiljøet som Norge er bundet av har fått sin endelige avklaring, og at havlagring som mulig klimatiltak får en sterkere internasjonal forankring innenfor det internasjonale klimasamarbeidet. Miljøverndepartementet tar klagen til følge. SFT's tillatelse av 5. juli 2002 oppheves.

Med hilsen

Inger Glad Stokland e.f.
ekspedisjonssjef
Anne Beate Tangen
avdelingsdirektør

Likelydende:

Norsk institutt for vannforskning, Vestlandsavdelingen
Greenpeace Norden
WWF-Norge
Statens forurensningstilsyn

4.2 English translation of the letter from the Ministry

Experimental Release of Carbon Dioxide (CO₂) in the Norwegian Sea – Ruling in Appeal Case

Introduction and Background

The Environmental Pollution Authority (SFT) on July 5, 2002, gave the Norwegian Institute for Water Research (NIVA) permission, based on the Pollution Act, § 11, to release 5.4 tons of pure carbon dioxide at 800 meters depth northwest of Storegga in the Norwegian Sea. The releases will be part of an international research project under the Climate Technology Initiative (CTI), which aims to produce knowledge on deposition of CO₂ in deep water as a possible climate effort.

The permit has been appealed by the World Wildlife Fund (WWF) Norway by letter of July 24, 2002, and by Greenpeace Nordic by letter of July 26, 2002. In letter dated August 8, 2002, the SFT maintains its ruling of July 5 and passes their case to the Ministry for a ruling in accordance with "Forvaltningsloven", § 33.

Remarks by the Complainants

The remarks by WWF and Greenpeace, respectively, are to a large extent coherent and will be assessed together.

The complainants state that the experiment in itself will have quite limited direct effects on the marine environment. The complainants' complaints are mostly based on opposition to ocean storage of CO₂ being used in large scale as a climate effort. The complainants note that large scale release of CO₂ in the deep ocean might have unpredictable negative effects on the ocean environment and that CO₂, which is deposited in the water masses, could, over time, leak out into the atmosphere. The complainants are critical to the experiment's not being designed with an aim to produce more knowledge on this.

The complainants further state that it has not been clarified whether deposition of CO₂ in the ocean will be allowed as a climate effort under the Kyoto Protocol. The complainants also note that deposition of CO₂ from fossil combustion will be in violation of the OSPAR convention and the London Convention.

For further reference we refer to the complaints.

The Assessment of the Ministry

The Ministry notes that deposition of CO₂ in water masses has not formerly been tested. The Ministry would initially underscore the usefulness of research to increase knowledge on important environmental issues and possible solutions to serious environmental problems.

In their ruling, the SFT has judged that the pollution problems associated with this specific project are considered moderate. This view is also supported by the complainants.

The aim of the experiment is, however, to produce knowledge on ocean storage of large quantities of CO₂ as a possible future climate effort. This implies that a more thorough assessment of whether ocean storage of CO₂ could be viewed as a possible climate effort should be conducted and if such use of the ocean will be in accordance with international agreements to which Norway has joined.

An important precondition for assessing whether deposition of CO₂ could be a possible climate effort in the future will be knowledge about whether CO₂ stored in the deep ocean could leak out into the atmosphere. Today's knowledge on this is incomplete and the question is controversial.

NIVA has stated to the SFT that in this experiment the main focus is on studying technical challenges and physical and chemical processes at the injection site, and that the experiment will only answer some of the many questions raised around deposition of CO₂ in the ocean. The Ministry states that the experiment will not give substantial contributions to increased understanding of the possibilities of future leaking of CO₂ to the atmosphere. It is the Ministry's view that this is a very central question in the assessment of use of deposition of CO₂ in the ocean as a possible climate effort. The Ministry sees the need for a broader international discussion and understanding of this issue. In connection with this it is referred to there not having been a clarification of whether deposition of CO₂ in the deep ocean will be allowed as a climate effort under the Kyoto Protocol and that the question is still subject to discussion.

The complainants claim that deposition of CO₂ from fossil combustion will be in violation of both the OSPAR Convention (Convention on protection of the marine environments in the Northeast Atlantic of 1992) and the London Convention (Convention on the prevention of marine pollution by dumping of wastes and other matter of 1972, with protocol of 1996). Norway has joined both these conventions.

The Ministry would underscore that the various issues that this experiment raises are not directly solved in these conventions, which have as their prime target to protect the marine environment against harmful influence. Both conventions put forth as a basic rule a prohibition against dumping of wastes and other matter at sea. Exceptions are made for certain categories of waste.

The question whether deposition of CO₂ is affected by the ban on dumping in the OSPAR Convention was raised at the last commission meeting under the convention of June this year on the basis of the project applied for in the Norwegian Sea. The meeting gave no final clarification on this question, but it is beyond doubt that the project is controversial and met by skepticism, both in terms of possible harmful effects and because one does not want to reopen the ocean as a dumping site for waste. The judicial workgroup under the convention was asked by the meeting to conduct a more thorough evaluation of the various questions related to possible deposition of CO₂ in the ocean. This assessment is expected to be presented at the next convention meeting to take place in June 2003.

The conventions on ocean environments will first and foremost have importance to possible CO₂ deposition at larger scale. The Ministry still maintains that there should be clearer international agreement as to whether this is a practice which will be in compliance with the OSPAR Convention, London Convention, and the climate agreement before experiments with ocean deposition of CO₂ are initiated.

Even though the purely pollution-related problems associated with this project by themselves do not justify a refusal of the release permit after the "Forurensningsloven", § 11, the Ministry puts decisive weight on the fact that the question as to whether possible future ocean storage of CO₂ will be in accordance with the relevant ocean conventions has not been finally clarified. A process has been started to assess this question within the OSPAR cooperation. This warrants that one awaits such a discussion before the experiment is eventually carried out.

Conclusion

After total evaluation, the Ministry has found that the experiment applied for should not be carried out before the relations to the international conventions on protection of the ocean environment to which Norway is bound have been finally clarified, and until ocean storage as a possible climate effort has a stronger international basis within the international climate cooperation.

The Ministry of Environment accepts the complaints. The SFT's permit of July 5, 2002, is revoked.

4.3 Press release from the Ministry

(copied from the website of the Ministry).

Date: 22.08.02

Environment Minister Børge Brende

Release of CO₂ in the Norwegian Sea May be in Conflict with International Environmental Conventions

Environment Minister Børge Brende will not agree to an experimental project with release of CO₂ in the Norwegian Sea at this time. – A possible future use of the sea as a storage place for CO₂ is controversial. Such deposits may be in conflict with today's international rules related to protection of the marine environment, and the Ministry of the Environment must therefore turn down the application, says Environment Minister Børge Brende.

The Norwegian Institute for Water Research (NIVA) has applied for permission to release 5.4 tonnes of pure carbon dioxide (CO₂) in the Norwegian Sea, as part of research into ocean sequestration of CO₂ as measures to combat climate change.

The Norwegian Pollution Control Authority (SFT) issued a permit on 5 July to NIVA to launch the experiment, with the justification that the release is limited in scope and cannot be expected to cause significant damage or harm. The decision was appealed by Greenpeace-Nordic and WWF-Norway. The Ministry of the Environment has chosen to accept the appeal, and has cancelled the permit given.

Must Be Discussed Internationally

In considering the appeal, the Ministry has emphasised that such releases of CO₂ as would be studied by this research project have not been given thorough consideration in relevant international marine environmental conventions. In the opinion of the Ministry of the Environment the use of deep marine areas as possible future storage places for CO₂ should first be thoroughly discussed internationally and the legal implications clarified.

The question as to whether the injection of CO₂ is affected by the OSPAR Convention's dumping prohibition was introduced at the most recent Commission meeting under the Convention in June this year, against the background the proposed project in the Norwegian Sea. The meeting did not reach any final conclusions on this issue, but there is no doubt that the project is controversial and has been met with scepticism, both in relation to possible negative effects and because there is a reluctance to reopen the sea as a dumping place for waste. The legal working group under the Convention was asked by the meeting to undertake a detailed evaluation of different aspects related to possible release of CO₂ in the seas. This evaluation is expected to be completed before the next meeting of the Commission which will take place in June 2003. The Ministry of the Environment will under no circumstances open up for CO₂ release in the sea until this evaluation has been completed.

Ocean sequestration of CO₂ as a possible future measure to combat climate change has only been given very limited consideration under the Climate Change Convention. In the coming discussion on this issue, the possibilities of leakage to the atmosphere will be a central topic. The Ministry of the Environment states in its decision that an international discussion of the issue is desirable and necessary, and has also based its decision on the fact that the experiment will not significantly increase understanding of possibilities for future leakage of CO₂ to the atmosphere.

4.4 Press release from NIVA, 11 September

NIVA issued a short press release on 11 September, reflecting the decision by the Ministry. The press release was posted on NIVA's web page, in Norwegian only. A translation is given below.

Brende says No to climate experiment

The minister of Environment, Mr Børge Brende issued a statement on 22 August, refusing the application from an international research project to release 5.4 tonnes of CO₂ in deep waters off Mid-Norway. The release was to be part of a research project, partly financed by the NRC, to study the possibility to store CO₂ in deep waters of the ocean.

The application which was submitted by an international group of scientists and where NIVA is a member, was previously accepted by the SFT. The argument behind the ME's decision was that "A possible future usage of the ocean for storage of CO₂ is controversial. Such storage may be in violation with international agreements on the ocean environment."

5. The OSPAR Convention

5.1 Outline of the Convention

The OSPAR Convention was apparently used by the Ministry as the main argument or institution being against the CO₂ experiment. The Convention for the Protection of the Marine Environment of the north-east Atlantic ("OSPAR Convention") was opened for signature at the Ministerial Meeting of the Oslo and Paris Commissions in Paris on 22 September 1992.

The Convention has been signed and ratified by all of the Contracting Parties to the Oslo or Paris Conventions (Belgium, Denmark, the Commission of the European Communities, Finland, France, Germany, Iceland, Ireland, the Netherlands, Norway, Portugal, Spain, Sweden and the United Kingdom of Great Britain and Northern Ireland) and by Luxembourg and Switzerland.

The OSPAR Convention entered into force on 25 March 1998. It replaces the Oslo and Paris Conventions, but Decisions, Recommendations and all other agreements adopted under those Conventions will continue to be applicable, unaltered in their legal nature, unless they are terminated by new measures adopted under the 1992 OSPAR Convention.



Figure 2. Map showing the domain of the OSPAR commission (copied from their web-pages).

5.2 The new convention

The new Convention, drafted to merge and modernise the Oslo and Paris Conventions, consists of a series of provisions and, amongst other things:

- a. requires the application of:
 - i. the precautionary principle;
 - ii. the polluter pays principle;
 - iii. best available techniques (BAT) and best environmental practice (BEP), including clean technology;
- b. provides for the Commission established by the OSPAR Convention to adopt binding decisions;
- c. provides for the participation of observers, including non-governmental organisations, in the work of the Commission;
- d. establishes rights of access to information about the maritime area of the Convention.

Contained within the OSPAR Convention, as adopted in 1992, are a series of Annexes which deal with the following specific areas:

- Annex I: Prevention and elimination of pollution from land-based sources;
- Annex II: Prevention and elimination of pollution by dumping or incineration;
- Annex III: Prevention and elimination of pollution from offshore sources; and
- Annex IV: Assessment of the quality of the marine environment.

The Convention also allows the adoption of additional annexes to protect the maritime area of the Convention, and the first new annex was adopted by the 1998 Ministerial Meeting of the OSPAR Commission (MMC 1998). This Annex V contains provisions with regard to the protection and conservation of the ecosystems and biological diversity of the maritime area. The Annex will enter into force once it has been ratified by at least seven Contracting Parties.

The Convention finally also establishes the OSPAR Commission, as successor to the Oslo and Paris Commissions, to administer the Convention and to develop policy and international agreements in this field. The Commission is supported by an international secretariat based in London.

The 1998 Ministerial Meeting of the OSPAR Commission adopted strategies to direct its future work in the following four main areas:

- a. protection and conservation of ecosystems and biological diversity;
- b. hazardous substances;
- c. radioactive substances;
- d. eutrophication.

As agreed at OSPAR/MMC 1998, the OSPAR Commission meeting in 1999 adopted a further Strategy on Environmental Goals and Management Mechanisms for Offshore Activities.

(Extracted from the OSPAR web-pages).

5.3 Input to OSPAR meeting, June 2002, from Greenpeace

Ocean Dumping of CO₂ in the Norwegian Sea, Summer 2002

Submitted by Greenpeace International

1. Introduction

- 1.1 Over the last few years there has been increasing interest in the development of techniques for the sequestration and long-term “storage” of fossil fuel-derived carbon dioxide as a component of climate change mitigation strategies. Among the options under consideration are the disposal of liquefied CO₂ at sea, either at the seafloor (forming a “lake” of liquid CO₂) or at intermediate depths in the water column (with the assumption that it will dissolve and become assimilated within the oceanic carbon reservoir).
- 1.2 Greenpeace International has for many years opposed plans for the disposal (or so-called “storage”) of CO₂ at sea, based on substantive environmental, legal and political concerns. In 1999, Greenpeace International published a detailed technical review of the options under discussion for ocean disposal and sequestration of CO₂, concluding that such an approach, (quite apart from the enormous uncertainties and indeterminacies surrounding likely impacts and likely overall effectiveness of the proposal), was inherently unsustainable. The limited studies conducted into the fate of injected CO₂ since that date have only served to illustrate the unpredictable behaviour of liquid CO₂ released at depth¹
- 1.3 The Greenpeace report also pointed out that the practice of ocean disposal (dumping) of CO₂ would contravene the London Convention (1972), as well as more broadly the provisions of UNCLOS. Neither could it be used to offset

¹ Brewer, P.G., Friederich, G., Peltzer, E.T. & Orr, F.M. Jr (1999) Direct experiments on the ocean disposal of fossil fuel CO₂. *Science* 284, No. 5416: 943-945

emissions under the terms of the Kyoto Protocol to the UN Framework Convention on Climate Change (FCCC). Additionally, Greenpeace considers that pursuit of CO₂ sequestration techniques is drawing vital resources away from the development and emplacement of renewable energy alternatives. Indeed, the possibility of such an option is being interpreted by many within industry as a “green light” for business as usual within the fossil fuel economy.

1.4 The Greenpeace International report² on ocean disposal/sequestration of CO₂ can be retrieved via the Internet at:

<http://www.greenpeace.org/politics/co2/co2dump.pdf>

2. Ocean Dumping of CO₂ in the Norwegian Sea

2.1 Following the cancellation (due to substantial local and regional opposition) of proposed experimental releases of CO₂ off the Kona Coast of Hawaii³, it has come to the attention of Greenpeace International that a similar experiment is now planned to take place off the coast of Norway, in the OSPAR region, during the summer of 2002.

2.2 According to the application submitted by the Norwegian Institute for Water Research (NIVA) to the Norwegian Pollution Control Authority (SFT)⁴, the planned experiment will involve the release of 5.4 tonnes of pure CO₂ at the seafloor (800m depth) at a location west of Storegga (75 n miles NW of Kristiansund) in the Norwegian Sea between 22nd July and 11th August 2002. Although a relatively small release in terms of tonnage, the experiment is explicitly intended as a “proof of concept” study in support of future use of ocean disposal of CO₂ generated as a waste from fossil fuel combustion as a climate change mitigation strategy. Moreover, the rationale of the study still relies on the highly questionable premise that the injected CO₂ will remain isolated from the atmosphere “for 1000 years or more”.

2.3 The study, proposed by NIVA on behalf of the Norwegian Research Council and a consortium of thirteen other institutes or organisations, will be funded by *inter alia*:-

- US Department of Energy (DOE),
- National Research Council (NRC), Canada,
- New Energy and Industrial Technology Development Organisation (NEDO), Japan &
- Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia

2.4 Given the imminence of the planned releases, Greenpeace International wishes to bring this proposal to the attention of the OSPAR Commission. In addition to contravening the London Convention, to which all countries represented in the consortium are party, the dumping at sea of waste CO₂ from fossil fuel combustion also contravenes Annex II to the OSPAR Convention (1992), given that CO₂ could not be seen to fall under any of the five categories exempted from prohibition.

3. Action Requested

3.1 Greenpeace International calls upon Contracting Parties to the OSPAR Convention to register their collective opposition to the proposed experimental releases of CO₂ to the Norwegian Sea scheduled for July and August 2002, and to any future proposals of a similar nature within the Convention area.

3.2 In this context, Greenpeace International further requests Norway to refuse permission for NIVA and the associated research consortium to conduct the proposed Norwegian Sea experiment.

5.4 Minutes of the OSPAR meeting, June 2002

Disposal of CO₂ at Sea

A summary record on CO₂ ocean sequestration of the "MEETING OF THE OSPAR COMMISSION" held in Amsterdam on 24-28 June is presented below.

² Johnston, P., Santillo, D., Stringer, R., Parmentier, R; Hare, B; Krueger, M; (1999) Ocean disposal/sequestration of Carbon Dioxide from Fossil Fuel Production and Use: An overview of Rationale, Techniques and Implications. Greenpeace Research Laboratories Technical Note 01/99, Publ. Greenpeace International

³ for details of the original proposals, see <http://www.co2experiment.org/>

⁴ Application to SFT (Norwegian Pollution Control Authority) for permission to carry out an experimental release of CO₂ (Carbon dioxide) in deep waters in the Norwegian Sea, Søknad om tester med CO₂ I Noskehavet til SFT, 18/1, 2002

9.22 Greenpeace International presented document OSPAR 02/9/4 to inform the meeting that, following the cancellation (due to local opposition) of proposed experimental releases of CO₂ at the seafloor off the Kona coast of Hawaii, a similar experiment was planned to take place at a location west of Storegga in the Norwegian Sea between 22 July and 11 August 2002. Although a relatively small release in terms of tonnage (5.4 tonnes of pure CO₂ at 800m depth), the experiment was explicitly intended as a “proof of concept” study in support of future use of ocean disposal of CO₂ generated as a waste from fossil fuel combustion, as a climate change mitigation strategy. Greenpeace International considered this experiment and techniques of long-term “storage” of fossil fuel-derived carbon dioxide as a component of climate change mitigation strategies to be a contravention of the London Convention 1972 and Annex II to the OSPAR Convention (1992), given that CO₂ could not be seen to fall under any of the five categories exempted from the prohibition on dumping.

9.23 Norway informed the meeting that the Norwegian Pollution Control Authority (SFT) had initially taken the view that no authorisation was needed. However, this kind of experiment had not taken place before, and there was not enough knowledge about possible consequences for the environment. The Ministry of Environment had therefore decided that a discharge permit would be needed. SFT was now reconsidering the application from the Norwegian Water Research Institute (NIVA) for an authorisation. It was not possible at the moment to say what would be the outcome of this consideration. In any event, an appeal to the Environment Ministry was possible against the SFT decision. **Norway would keep OSPAR informed.**

9.24 After a short discussion, OSPAR agreed that:

- a. it was desirable to establish as soon as possible an agreed position on whether such placing of CO₂ in the sea in such circumstances (or into the seabed) was consistent with the OSPAR Convention;
- b. the Group of Jurists and Linguists (JL) should be asked for advice on this question;
- c. **the Secretariat should circulate a discussion paper to JL for written comments. If need be, the Chairman of the Commission should convene a meeting of JL to discuss the question.**

5.4.1 Key representatives to OSPAR from Norway

Below is a list of participant at the OSPAR meeting in June, 2002.

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6. Assessment of Mass Media

6.1 Press articles, Radio and TV

A list of Norwegian press articles and also including a few of those appearing in international science journals, is given in Appendix A.

In addition to the press, also all major domestic radio and TV channels had significant coverage of the event. The Minister of Environment were interviewed on prime-time TV news about the experiment in mid-July, accompanied in the same program by Greenpeace. At that time, the Minister expressed himself as if the experiment was not harmful to anyone, and he also gave some concession to Greenpeace about commitments from Norway to support international agreements on the use of renewable energy (an issue at the following Johannesburg summit meeting).

NIVA participated in a debate in a popular radio program on the issue with Greenpeace and the SFT, in late July.

Foreign stations covering the event included BBC and French, Swedish, Danish and German radio and television. Some media channels also worked on plans to attend the experiment on site.

6.2 'Rainbow Warrior' in Oslo

Greenpeace and also WWF got some very spectacular coverage in the media, even without being confronted by any critical opposition or put under debate, which otherwise usually is the case in balanced news. An example of a newspaper article is given below.

Article in "Aftenposten", Oslo, 16 July:

'Rainbow Warrior' berths in Oslo

Greenpeace's famed *Rainbow Warrior* sailed into Oslo's inner harbour Tuesday morning on its first visit to Norway. The vessel was set to welcome aboard the public as Greenpeace protested earlier plans to dump liquid carbon dioxide in the Norwegian Sea.

Greenpeace is using the visit to draw attention to Norway's role in what it called "a controversial experiment" to dump 5.4 tons of carbon dioxide offshore. The dumping was postponed after international opposition, and Greenpeace claims the proposal should never be brought up again. The environmental group is firmly opposed to dumping industrial waste in the sea. The experiment threatened international laws against using the seas as a dumping grounds," Truls Gulowsen of Greenpeace claimed. "It must never happen."

Researchers from Norway, Japan, Australia, Canada and the US had proposed dumping the carbon dioxide at a depth of 800 meters in the Norwegian Sea. They postponed the attempt, which was to begin July 22 off the coast of Kristiansund.

The postponement, according to Greenpeace, was made pending evaluation by Norway's environmental ministry. A previous attempt to dump carbon dioxide off Hawaii was blocked earlier. The *Rainbow Warrior* is berthed near the historic Akershus Fortress in Oslo and will be open to the public from 4-6pm Tuesday and Wednesday.

(End of article.)

There was some discussion if NIVA and the ME/SFT should accept an invitation for a meeting on board the Greenpeace vessel. The ME refused the invitation, saying it would rather discuss the matter at a later stage, when the Minister had made up his mind. NIVA's information officer later the same week met in the Radio studio in Oslo for a prime-time debate on the issue, along with SFT and Greenpeace.

7. Other Comments

7.1 SFT

SFT has so far made no official comments to the final decision by the Ministry.

7.2 NRC

NRC has complained about the decision by the ME, through interviews and news articles, including in their own newsletter "*Forskning*" and on their web pages.

7.3 NIVA Board

During and since the decisions were made, NIVA has been in an alerted situation about the Ministry's decision which has been debated over at several management meetings etc. The matter was also

discussed during the Board meeting on 28 August, 2002. A brief report on the discussions is presented below (Odd Skogheim, pers. comm.).

The Administration gave a presentation of the research project on CO₂ ocean sequestration which has acquired a lot of attention among environmental groups and the media recently, and that was a case for the SFT, ME and in the Storting (Parliament) in connection with the permit application.

The project has given NIVA some bad press references. In addition, the projects represents a certain economic risk.

NIVA has no opinion at the moment on the issue of the viability of ocean sequestration. Our task is to acquire scientific knowledge on this; both on the possibilities, conditions, effects and risks. Ethical issues have been evaluated, and as long as our sponsor is the NRC and the experiment does not go against international agreements or conventions, NIVA has no objections against acquiring scientific knowledge on the topic.

Just prior to this Board meeting, it became known that the ME selected to comply with the complaints from Greenpeace and WWF, causing a cancellation of the experiment. This has caused both negative discussions, significant extra work for NIVA and a possible economic loss. The Board recognises that NIVA has been brought into a difficult situation due to the fact we could/would not release information that could harm the ME. The Board asked the Administration, in close communication with the Chairman of the Board, to make contacts with the ME and the NRC to discuss the matter. In addition to present the consequences already experienced to NIVA, we must get a clarification about further research in this field and get an agreement on how to avoid similar situations in the future.

7.4 MEMO from NIVA to the ME, 10 October

In retrospect and following the decision made by the Board, NIVA wrote a letter/Memo to the Ministry, explaining about the concerns and possible damage the decision had caused. It was hoped that the letter would be subject of later discussions between the ME and NIVA/NRC. A translation of the letter follows.

MEMO

10 October, 2002

To: The Ministry of Environment (ME)

From: NIVA, Odd Skogheim

Copy: Norwegian Research Council (NRC); the KLIMATEK programme

(Translation from Norwegian)

Matter: ME's blocking the research project on CO₂ ocean sequestration as a climate technology – consequences for NIVA and need for political clear-up

In February, 2002, NIVA was granted a permit from the state Pollution Control (SFT) to release 5.4 tonnes of CO₂ in connection with an international project on sequestering of the greenhouse gas CO₂ as a possible method for climate mitigation. ME decided on 22 August to follow the complaints from Greenpeace and WWF and withdraw the permit. This decision had a lot of consequences for NIVA and it creates uncertainty about further international co-operation in the field. This memo describes the concerns NIVA wants to discuss with the Ministry.

Background

In January, 2002, NIVA sent an application to SFT for a permit to conduct an experiment involving the injection of 5.4 tonnes of CO₂ in deep Norwegian waters of the Norwegian Sea. This experiment was the main objective of an international project studying the ocean's role as a "sink" particularly for CO₂ from burning of fossil fuels. The project came into place after imprinting from the ME as part of the Kyoto agreement follow-up.

Thematically the project was sorted under the Clean Technology Initiative, where the ME showed a strong engagement. A formal agreement on co-operation (MOU) among the sponsors, including the NRC was formulated and signed. NRC through its KLIMATEK programme initially took a negative stand towards participating from the conditions stated in the project plan, but still accepted the role as the Norwegian sponsoring partner.

NIVA was selected as the implementing institution in Norway, among else due to a broad range of expertise, significant international expertise and network, close relations to the ME and long experience with R&D on marine discharges (municipal, industry).

The Research Agreement among the implementing organisations was signed in 1998. The main institutions otherwise were MIT, UH and NRL from USA, IOS of Canada, RITE and CRIEPI of Japan, ABB from Switzerland and CSIRO of Australia. CSIRO is no longer a partner to the project.

In February, 2002, NIVA was granted the permit from SFT. In May, this permit was raised as an issue in the Parliament (Storting) by the representative Ms Malvik, following an approach by Greenpeace. The Minister of Environment then withdrew the permit, requesting the SFT to conduct a public hearing round about the issue. After evaluating comments from the hearing, SFT reissued the permit to NIVA. This decision was then appealed to the ME by Greenpeace and WWF (World Wide Fund for Nature). The SFT still maintained its opinion and decision.

However, the ME choose to accept the complaints and blocked the experiment by withdrawing the permit. This decision had consequences for all involved partners in the project. NIVA needs to explain about these consequences. In addition, we need to gain more insight into the material behind ME's decision, and to discuss about further international co-operation in this field of research.

Immaterial consequences

Consequence for NIVA's reputation

It becomes problematic for NIVA when the ME rejects an application from NIVA without simultaneously explaining that this experiment is part of an international co-operation that ME once initiated. NIVA was selected as the Norwegian implementing institution, on behalf of the ME, and following an agreement with the NRC. We accepted this role in the assurance that both ethical and juridical considerations had been clarified by Norwegian authorities. Unfortunately, we experience that NIVA alone is stuck with the unpleasant media comments and questions. This may affect our reputation, our market communication and the financing of new projects.

The reason claimed for the rejection is that it (the experiment) may go against international conventions. It is unclear if this reasoning is based on potential usage of the results of the experiment only, or if the ME also is claiming that the international project itself is in violation with the conventions. Our tentative interpretation is that one needs to wait with doing experiments until the issue about large scale sequestration is resolved among the conventions. If the experiment itself is not in violation with the conventions, does this restrictive policy mean that the ME may block other projects/experiments that may result in useful mitigating technologies or use of results that in turn again is – or may - be in violation with the conventions?

The press releases, including the one from the ME, the problem is formulated as a "NIVA project" that may be in violation with international conventions. The facts are rather, that an international project, originally backed by the MD and where the NRC is representing the Nation, always had the goal to study CO₂ ocean sequestration as a possible climate technology. It should at all times be clear if

possible use of this technology is in violation with international conventions. We want to remind that arguing for this technology absolutely was no part of the project, only to lay the scientific basis for the development of alternative disposal options to such as geological storage. Only after the spending of USD 4.5 mill and the complaints from Greenpeace and WWF, is this concern surfacing. NIVA is experiencing being put in a difficult situation as we could not comment on the issue without bringing the ME under criticism. It is difficult to accept bad or biased press releases about research institutions participating in international co-operation as part of the international climate policy, without responding. It is conceived as if the activities of the institutes may conflict with international conventions, while the realities are that we enthusiastically are bringing the Government's policy on climate research into action. The ME should have clearly explained the reasoning behind the it's decision, and pointed at those changes in Norwegian climate R&D policy that this will imply.

Consequence for the SFT and the oil industry.

There is increasing demand for releasing different kinds of gasses into the seawater in connection with oil activities on the Norwegian Shelf, and also in connection with tests and research projects (e.g. the SINTEF "Deep Spill in 2000 with the release of 100 tonnes of gas). SFT is dealing with related release permit applications following fixed procedures and the application from NIVA was treated following the same procedures.

Will the decision by the ME imply a change in these procedures?

Consequences for international co-operation

NIVA has been asked by several international co-operating partners to explain expressions such as: "(the ME).. has claimed that the experiment will not give a significant contribution to the understanding about possible future leakage of CO₂ to the atmosphere". This is experienced as quite difficult by us, and we are asking for an in-depth explanation for the reasoning behind this.

Economic consequences

The project has a total budget of about USD 4.2 mill. Norway is contributing ca 8% of this. It will take more time to get the full overview over direct and indirect economic consequences.

Consequences for NIVA

The consequences are split

- a) Loss of new subcontracts under the international consortium in connection with conduction and finalising of the project. Preliminary calculations estimate a loss of about 150,000 NOK.
- b) Direct losses due to extra/contingency work and contingency expenses in the interim period, May-August, 2002, and after the final rejection by the ME in August 2002. At the time when the ME took up the issue (in May), contracts and arrangements were ready to start the experiment on 20 July. Detailed plans were laid, and contracts for vessels, personnel and equipment were fixed. Significant time and efforts were spent in connection with the waiting. When the final decision came, the plans needed to be cancelled and preparatory activities cancelled. The loss suffered directly by NIVA, not covered under force majeure, is calculated to 200,000 NOK.

Consequences for other Norwegian partners

Contracts for leasing vessels corresponding to USD 640,000 for research vessel (IMR-Bergen), and supply boat (Eidesvik/Statoil) were cancelled. The vessels had already been allocated to the experiment and included in the owners' schedules. The decision to stop the experiment implies a loss of income both for IMR and Eidesvik. At the moment it is still unclear if the owners will apply legal remedies to charge NIVA for the loss of income.

The Coast Guard has also allocated one of their vessels to the experiment, and this contract has also been cancelled. We do not yet know what this may effect.

Several other institutions, such as U o Bergen and the Nansen Centre have also suffered loss of income.

Consequences for foreign partners/participants

We have been informed that the several of the international partners are working to resolve their economic consequences. We have, however, not yet received any material on this so far.

Actions

The 5-year project period is expiring in a few months time. The international team still attempts through emergency actions to conduct some experimenting elsewhere towards the end of the project period, in such a way that parts of the project goals can be accomplished and some of the efforts saved. This has been discussed in several emergency meetings recently.

On conclusion, NIVA is asking for a discussion with the ME on the following issues,

- 1) to get an explanation for the reasons behind the ME's decision
- 2) to clarify how the ME can contribute to dampen the negative consequences
- 3) to get a proposal from the ME on how the project can be brought to end and securing continued international research co-operation
- 4) to discuss actions and mechanisms that can prevent similar situations reoccurring in the future, both for NIVA and other research organisations.

7.5 Interview given to Cicerone by the Norwegian project manager

The domestic journal *Cicerone* is issued by the Cicero centre at the U of Oslo. Main topics are highlights/abstracts on literature on climate change, Kyoto Protocol follow-up, climate effects research etc (see <http://www.cicero.uio.no>). In the October issue of *Cicerone* an article with an interview of NIVA's Lars G Golmen appeared. The interview was from September. A draft translation follows:

Shocked over No to ocean sequestration experiment

Translation of an interview article by Peter Haugneland in "*Cicerone*", October 2002 issue.

This has happened

In February, 2002, the SFT approved the permit application to release 5.4 tonnes of CO₂ in connection with the ocean sequestration experiment. Greenpeace approached the issue of the permit and a question about it was raised in the Storting. The minister of environment, Mr Borge Braende suspended the permit by instructing SFT to conduct a full hearing round. Three complaints were filed, but SFT found no reasons to alter its original decision. The issue was then appealed to the ME by Greenpeace. On 22 August, the ME released it's final decision to stop the experiment until an evaluation by OSPAR on CO₂ releases into the ocean is performed and the issue of possible leakage is further clarified.

Project manager Lars G Golmen of the Norwegian Institute for Water Research (NIVA) is shocked by the Ministry of Environment's decision to stop the experiment on ocean sequestration that was scheduled to investigate the possibility of storing CO₂ in the ocean as a climate technology.

Golmen states that both the Kyoto agreement, the UN climate convention and international conventions for the ocean demand or encourage to conduct such research.

The Ministry of Environment (ME) played a central role in 1997 when an international project on ocean sequestration was started, as part of the Kyoto agreement follow-up. The aim of the project was to look at the possibilities of using the ocean for storage of CO₂ as a climate mitigation method. In the previous issue of *Cicerone* we wrote that the ME has chosen to stop the project's experiment, that was to investigate if CO₂ ocean sequestration is physically and ecologically feasible. The ME by its decision excludes any such experiments to be undertaken in the Norwegian Sea before the issue has been sorted out juridically in international ocean conventions where Norway is a party.

Shock and astonishment

The decision by the ME was received with shock and astonishment by those of us having worked on the project, explains NIVA's project manager, Lars G Golmen.

The State pollution authority, SFT, gave the permit in February, 2002. The ME received complaints on the permit from Greenpeace, the society of natural conservation and WWF-Norway in May and they finally appealed to the ME about the SFT decision.

The SFT law experts thoroughly evaluated the position of the project with respect to the ocean conventions. Their finding was that there would be no problem in conducting the experiment. Why didn't the ME stop the Norwegian participation in the project at an earlier stage if they thought the topic was controversial, asks the project manager.

Ocean sequestration is a time-limited method

The criticism from the Env. Organisations focuses on the argument that by introducing ocean CO₂ sequestration as a climate technology, a global change from a fossil-fuel to a renewable energy system will be delayed. They also claim that extensive use of CO₂ ocean storage may cause a lot of problems for our descendants, as CO₂ will begin leaking back to the atmosphere after a certain period. Additionally, they state, large-scale ocean sequestration of CO₂ may be in violation with the ocean conventions.

Golmen denies the argument that ocean sequestration is a means to transplant problems to future generations, because the method is only meant as a solution for a limited time period.

Numerous studies have shown that sequestered CO₂ will remain in the deepwater for several hundred years before any part of it may start to leak back. The ethics in this question rests on the fact that we possibly are the last generation not to experience severe impacts from climate change, irrespective of how much CO₂ we are emitting. But morally and due to the agreements we are pledged to act now, mostly on behalf of our descendants. The point about ocean sequestration is that this method will assist in bringing down the peak of the projected atmospheric CO₂ concentration that will occur in a few decades from now with continued emissions. We are in other words limiting the most serious effects that otherwise would appear a few generations after of us, says Golmen.

Realistic projections tell us that large-scale burning of fossil fuels will continue for at least 100-200 years before effective renewable energies or other supplies can substitute. Ocean sequestration may help the situation by assisting in handling parts of the CO₂ emissions in the next century or so. In combination with other climate technologies and mitigations the atmosphere, ocean and land may cope naturally with the CO₂ that still will be emitted to the air. Ocean sequestration is therefore a method meant to reduce adverse impacts a few generations down in time. No future generations will get their living conditions aggravated due to sequestration, compared with the conditions they otherwise will experience without this method being applied, claims the project manager.

The overall project is a collaborative effort among different international research institutions and is supported e.g. by the NRC (KLIMATEK). Even if the experiment in the Norwegian Sea is stopped,

the project will continue. The decision by the ME will at any rate have profoundly negative consequences for the project.

Significant damage

It will still take some time to get the full overview over economic losses suffered by the ME's decision. The project has a total budget of about 4 mill USD. Norway contributes about 8% of this. Independent of what results that still may be achieved towards the end of the project period, significant losses are inevitable for Norwegian and even more for foreign institutions, says Golmen. An even more severe impact is that potential foreign collaborating partners may have become sceptic to any future research co-operation with Norway. Norway may be perceived as relaxed relative to follow-up on international conventions. The ocean sequestration project was a direct follow-up relative to the UN Framework Convention on Climate Change. This convention encourages research on natural CO₂ sinks, inclusive the ocean, and how these sinks may be stimulated for increased uptake. The London convention and OSPAR both open up for research on ocean sequestration and are awaiting further findings in order to be able to conduct a balanced discussion on the issue, he explains.

Norway has the expertise

The reason why Norway was selected as the site for the experiment was due to the significant national expertise in this field, in addition to excellent logistic and geographic prerequisites. The experiment may be moved to another country after the ME's decision. Through the complaints from the env. organisations we at any rate got the confirmation that the experiment itself is not the problem. With this in mind, it may be easier to begin planning for a new experiment, says the project manager.

Experiment in 800 m depth

The experiment that was stopped by the ME, was about releasing ca 5 tonnes of pure liquid CO₂ in 800 m water depth offshore mid-Norway. In order for liquid CO₂ to dissolve efficiently in the seawater and not convert into a gas instantaneously the release need to take place at minimum 500-m depth. 800 was chosen as release depth in order to guarantee that all CO₂ would dissolve before reaching the lower pressure limit for phase change. During the experiment the greenhouse gas was to be released in limited amounts several times during the 10-day experiment period, and subsequently measure and observe how CO₂ dissolved in the water and dispersed by the currents. Possible impacts on marine fauna was also to be studied. As the CO₂ to some extent will acidify the water.

Not relevant for any site

Future large-scale discharges may take place from many small and dispersed point sources, or from moving ships, towing a submerged discharge pipeline. Selection of optimal release location will then become a central issue. Sufficient water depth is only one of several critical conditions for site selection. Better understanding about such issues as well was something we would expect to derive from the experiment once it was conducted, ends Golmen.

8. Conclusion and Follow-up

By the end of the 5 year project period, it is clear that the international project did not achieve it's main goal, to perform in-situ experiments with CO₂ in the ocean. Still, the joint efforts was far from worthless, as a lot of other milestones and goals have been achieved, and also, a lot of parallel work has spun off a lot of science and results.

Evidently research on CO₂ ocean sequestration will continue, despite the temporary setback for the present international collaboration. In fact, CO₂ experiments in the ocean are going on continuously by several groups at several locations around the world, such as by the Monterey Bay Aquarium (MBARI) in California, from where also several scientific publications have come out recently and knowledge is gradually accumulating, seemingly without protests.

The Norwegian Decision may at most affect further Norwegian participation. It is still unclear how the Ministry of Environment will look upon any future Norwegian engagement in CO₂ ocean sequestration research. From the arguing behind their decision, it seems they are very occupied by the question of potential "leakage" from the ocean to the atmosphere, but it is unclear if they will support research on this particular issue, or not. After all, the international project started off, after years of discussions and scientific work on this issue.

The Norwegian Government has proposed a plan to increase the domestic use of natural gas. In this respect, the issue of CO₂ storage is described as a means to cope with new CO₂ emissions, but with emphasis on underground storage. Even for this methodology, the issue of leakage has been brought up.

It is still anticipated that there will be follow-up co-operation on CO₂ ocean sequestration. Both the USA and Japan has defined plans for such (domestic) programmes. Discussions on a "Phase II" of the international project, is still going on. Probably this will go into an interim phase in 2003, as was concluded at the last Steering Committee meeting of the project, in Kyoto, 30 September, 2002.

8.1 OSPAR

OSPAR is scheduled to discuss ocean sequestration in it's meeting in June, 2003. It is unclear if they will discuss the concept of CO₂ sequestration only, or also the issue of (the legality of) performing research on this topic. The jurisdiction of OSPAR does not go beyond the NE Atlantic Ocean, so whatever decision they will make, it will probably have only local/regional impact.

8.2 The London Convention

The 1996 Protocol to the London Convention, although not yet in force, will replace the London Convention's list of banned substances with a list of allowable materials, which presently does not include CO₂. The Protocol clarifies the meaning of "dumping" and disallowed "any storage of wastes or other matter in the seabed and subsoil." With respect to research on ocean storage of CO₂, however, the Protocol apparently is allowing for this.

8.3 IPCC and other bodies

8.3.1 IPCC

During 18-21 November 2002, an IPCC workshop on carbon separation, capture and storage was held in Regina, Canada under the auspices of Working Group III. The decision to hold the workshop was made at the 19th IPCC plenary meeting in Geneva, April 2002.

About 70 participants from 24 countries participated, among those four from Norway: Peter Haugan, UoBergen, Olav Kårstad from Statoil, Øivind Christoffersen and Annicken Hoel from SFT. The purpose of the workshop was to start the preparations for a special IPCC report on CO₂ capture and storage, where CO₂ ocean storage will be included as well. The exact outline/contents of the report will be discussed at a follow-up meeting in early 2003.

8.3.2 IOC/SCOR

The Intergovernmental Oceanographic commission (IOC) has a web-site where the issue of CO₂ ocean storage is presented. IOC is keeping a watching brief on this issue through the Advisory Panel on CO₂. An extract of the text on their web-page is copied below which holds direct relevance for the present report. (See more on <http://ioc.unesco.org/iocweb/CO2panel/>).

Ocean Storage

What are the concerns? There are many scientific, legal, political, economic, and ethical issues that must be thoroughly investigated to determine the best balance between minimizing the most serious effects of human-induced climate change and protecting the natural environment.

At present, **mitigation options such as ocean carbon sequestration are considered to be too costly.** It is estimated that deep-ocean storage of CO₂ would cost between \$100-300 per ton of carbon. To be economically feasible, the price would have to decline to approximately \$10 per ton. **The legality of injecting CO₂ into the ocean is unclear.** Some international conventions encourage investigating the possibility of storing carbon in reservoirs such as deep aquifers or the ocean, while others label CO₂ an industrial waste and thus ban dumping it in the ocean. **The ethics of ocean storage of CO₂ revolves around society's perception of the risks and benefits** of such an activity. Several recent attempts to conduct small-scale research experiments in the ocean have been abandoned because of strong public objection, suggesting that public opinion may be the most important consideration in this debate.

Scientific research on direct injection of CO₂ into the deep ocean is still extremely limited, and scientists do not fully understand the chemical behaviour of CO₂ in the deep ocean or the efficiency of this technique for isolating CO₂ from the atmosphere over several centuries. Models of ocean circulation indicate that CO₂ injected at a depth of 3000 meters would remain out of contact with the atmosphere for about 200 years. As the depth of injection decreases, so does the storage efficiency. Between 800 and 3000 meters, a stream of liquid CO₂ is less dense than the seawater around it and it tends to rise to the surface, slowly mixing and dissolving into the surrounding water. Below about 3000 meters, the liquid CO₂ reacts with the seawater to form a clathrate, a solid, ice-like substance that is denser than the surrounding water. These chemical reactions at depth could yield a number of benefits for reducing potential environmental and biological impacts, yet there is still much that is not known. Much has been written and theorised about how CO₂ would behave at depth, the consequences of this for chemical interactions with the water and sediments, and the possible effects on marine organisms. But the few ocean experiments that have been conducted yielded many unexpected results and scientists argue that the only way to understand these new and complex interactions is through continued, small-scale experiments.

Perhaps the most important concern is the effect that ocean storage of carbon might have on deep marine organisms. As the concentration of CO₂ increases, the pH of the water decreases and the water becomes more acidic. Deep-sea organisms generally have slow metabolisms and would be

incapable of adapting to rapid changes in environmental conditions. There is little research on the effects of decreased pH on marine organisms, especially in the deep-sea. Ocean models suggest that the natural uptake of atmospheric CO₂ by the oceans will decrease pH levels by 0.4 - 1 pH units over the next 500 years. Since the industrial revolution, the pH of ocean water has already decreased by about 0.1 pH units. Some scientists suggest that the most severe impacts of deep-sea injection of CO₂ may be avoided, either by engineering the injection system so that the CO₂ stream entering the water is not so concentrated, or through injecting the CO₂ sufficiently deep that it forms an ice-like clathrate that dissolves very slowly.

What if we do nothing? Because of the natural uptake of CO₂ by the surface ocean, about 85% of the CO₂ released from fossil fuel burning will eventually end up in the ocean. Some scientists argue that it is not a question of whether we want to put anthropogenic CO₂ in the oceans - it's already happening. The large majority of marine life resides in the upper ocean and could be strongly affected by not only climate-induced changes such as increased temperatures and modified circulation, but also by increasing acidity. Organisms may be able to adapt to this slow invasion of CO₂, although the ultimate effects on the ecosystem composition and food-web are unknown.

Summary: No one wants to pollute the oceans and endanger marine life. But in the process of polluting the atmosphere, we have already set in motion the large-scale penetration of CO₂ into the surface oceans. The natural interactions and exchanges between the ocean and atmosphere are not fully understood. We do know, however, that we are powerless to stop or slow them. We are faced not with the choice to pollute or not to pollute, but rather with deciding which scenario of pollution will cause the least damage. Is it better to let the CO₂ continue to penetrate into the surface ocean where the majority of marine life lives ? Will organisms and the food-web be able to adapt to this slow change in the environment ? What will the ultimate effect of those changes be on the ecosystem, on climate, on fisheries, on human health ? Would it be better to try to protect the surface ocean by artificially placing the CO₂ in the deep-ocean ? What affect would this have on marine organisms there ? How effective would this storage be ? Would the CO₂ eventually reach the surface ocean anyway ? Would removing CO₂ from the atmosphere encourage society to continue polluting the atmosphere, or would it allow us to alleviate some of the worst climate-change effects while transitioning to cleaner energy sources ? Science is currently unable to adequately address these questions. Because of the global impact of this issue, it cannot be addressed by any one nation or by special-interest sectors such as the energy industry or environmental groups. It must be addressed at an international and intergovernmental level to provide sound, un-biased answers that society needs in order to make the appropriate choices.

Appendix A. Newspaper articles

The table below presents some of the newspaper headlines collected during the summer, 2002. Many more appeared.

Date, 2002	Newspaper/media	Heading (tentative translation from Norwegian to English)	Remarks
6 July	Local Radio News	SFT gives NIVA permit to release CO ₂	Explains IMR positive to the experiment
10 July	Adresseavisen	SFT gives permit to pure CO ₂ in the Norwegian Sea	Explains the project, citing GP complaints
10 July	Aftenposten	SFT permits CO ₂ disposal	Neutral small article
10 July	Fiskaren	The NGOs are sharpening their swords against CO ₂ ocean release	WWF/GP complaining about SFT decision
10 July	Dagsavisen	Greenpeace in rage against SFT	GP requires ME to stop SFT decision
10 July	Tidens Krav (Kr. sund)	Raging against CO ₂ dumping/ocean dumping is illegal	GP gets the stage
12 July	NTB State News Bureau	SFT permits CO ₂ disposal in the Norwegian Sea	
13 July	Local Radio News	NIVA postpones experiment	Interview with L G Golmen
17 July	Aftenposten	Greenpeace protests against CO ₂ disposal	After SFT reissued permit. Also WWF
17 July	NRK Norw. Radio	Prime time Radio debate, SFT-NIVA-Greenpeace	Including written report/resume on the web
20 July	Tidens Krav	Ready for CO ₂ operation	GP interview, Rainbow Warrior ready
25 July	Stavanger Aftenblad	Asks Brende to stop GHG dumping	WWF
25 July	Sunnmørsposten	Complaining against dumping of greenhouse gas	WWF asks ME to stop the experiment
26 July	Fiskaren	The ocean is no garbage bin	Before ME decided. WWF explaining
27 July	Klassekampen	Wants to stop CO ₂ dumping	WWF complains
3 August	Klassekampen	Warns civil obedience against CO ₂ discharge	Greenpeace & Rainbow Warrior
9 August	NTB State News Bureau	SFT maintains decision on CO ₂ disposal	Short notice, incl. NIVA, GP
9 August	NRK Norw Radio web	NIVA gets the permit for 5.4 tonnes, pure CO ₂	Neutral, brief
10 Aug	Bergens Tidende	Says Yes to CO ₂ dumping in the Norwegian Sea	Fairly balanced, incl. NIVA, WWF, GP
16 Aug	Aftenposten	CO ₂ experiment must be permitted	Peter Haugan
22 Aug	Ministry of Env. website	Release of CO ₂ in the Norwegian Sea May Conflict with Intern...	ME Press release
22 Aug	NTB	Brende rejects application for CO ₂ discharge	Referring to ME press release + GP...
23 Aug	Aftenposten	Brende denies permit for CO ₂ discharge	short (from NTB)
23 Aug	Bergens Tidende	Brende stops CO ₂ dumping	WWF/GP, 'victory for common sense...'
23 Aug	Adresseavisen	Brende stops CO ₂ ocean discharge	Ms Malvik jubilant about the decision
23 Aug	TV2 (National TV) web	Brende stopped international project	Balanced, incl. Ola M Johannessen

Table, Continued....

Date, 2002	Newspaper/media	Heading (tentative translation from Norwegian to English)	Remarks
23 Aug	Namdals-avisa	No to discharge in the Norwegian Sea	Brende, NIVA, SFT, fairly balanced
23 Aug	Finmark Dagblad	No to discharges	Citing ME press release
23 Aug	Fiskaren	The Minister of env. stops CO ₂ dumping in the Norwegian Sea	WWF gets final word
23 Aug	Tidens Krav	Says No to CO ₂ experiment	Neutral. Citing Mr Sørheim, NRC
27 Aug	Aftenposten	Offensive climate policy, a-la Børge Brende	Guttorm Alendal
27 Aug	Forskning, (NRC)	Ministry of Environment stops research project	Balanced, citing NIVA dir.
5 Sept	Nature	Norway sinks ocean carbon study	Editorial note
15 Sept	Cicerone	Brende stops CO ₂ experiment in the Norwegian Sea	Balanced
15 Oct	Cicerone	Shocked by No to ocean sequestration experiment	Lars G Golmen
1 Nov	Env Science & Techn.	Sequestration experiment is drowning	Editorial note, rather factual
6 Nov	Environment Daily	Scientists attack block on CO ₂ sequestration	Editorial note, rather factual
2 Dec	Forskning (NRC)	Norway – A self-satisfied ‘environment mobster’ ...	Incl. Comments on ME’s decision