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Fischer, D.W. and von Winterfeldt, D.

IIASA Research Memorandum
January 1978

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RM-78-5

SETTING STANDARDS FOR CHRONIC OIL DISCHARGES IN THE NORTH SEA

David W. Fischer
Detlof von Winterfeldt

January 1978

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Preface

This research memorandum is extracted from a larger study involving regional program management in the Management and Technology Area and standard-setting in the Energy Area. As such is was supported by funds from both IIASA and the Volkswagen Foundation of the FRG. The complete study on the North Sea environment-development interface will appear as a forthcoming book in the IIASA International Series.

Discharge standards provide a common means for attempting to control the pollution from development activities. Frequently the setting of such standards is viewed as a purely technical problem to be resolved by the engineering branch of some activity as it conforms to the standard set by some authority. Beginning with the premise that standard-setting is a socio-economic problem involving a bargaining process among actors we have attempted to show how this process has evolved for a specific case.

Summary

Public attention has frequently been directed to the large accidental oil spills connected with tanker groundings or break-ups and platform blowouts. The operational oil discharges connected with offshore production platforms could, however, have equally severe effects in the offshore environment because the pollution occurs day after day as long as the activities that produce it continue to operate. This study is concerned with such discharges in the North Sea.

The study was focussed on the central actors involved in the standard-setting process for operational or chronic discharges. Each key actor was interviewed in depth to determine their perceptions of the problem, the role of other actors, the alternatives considered and the interactions among actors. This decision-making complex thus includes a variety of decision-making units with varying abilities to influence the outcomes of the standards. Regulator, developer and environmental expert actors formed the basic focus for this effort.

The objectives of the regulators and developers are described along with the alternative regulations, treatments and uses of the environment that are considered. Then a comparison and evaluation is made of the decision process by which Norwegian and U.K. regulators arrived at standards.

Major findings include the near similarity of the standards set even though the approaches to such standards are perceived to be quite different in each country. Another finding is that entrepreneurial endeavor for oil discharge treatment equipment is a key parameter in deciding on standards since both countries must rely on such effort for what is available. Lack of information on the effects of oil in the sea is another finding along with a minimal role for environmental quality factors in setting standards. Such findings make it difficult to trace trade-offs in the selection process for standard-setting. Finally, some suggestions for improvements in this process are noted.

Contents

Setting Standards for Chronic Oil Discharges in the North Sea

1. AN INTRODUCTION TO THE PROBLEM OF OIL DISCHARGE REGULATION IN THE NORTH SEA

Public attention and environmental concern with North Sea oil operations have traditionally centered on tanker accidents and oil blowouts from drilling and production platforms. This emphasis on accidental oil spills is quite understandable considering the dramatic nature of such events, the publicity they receive, and the damages they can do to the environment. Oil slicks on amenity beaches and disabled sea gulls come to mind when one thinks of accidental oil spills.

Meanwhile, another type of oil pollution has received relatively little public attention: pollution through chronic (operational) oil discharges from ships and offshore production platforms. Washing and ballast water are the main sources of chronic oil pollution from ships. Production water from oil-water separation processes and displacement water from storage tanks are routinely discharged from production platforms. Although accidental spills are more visible and can have a large and immediate local impact, chronic discharges with low oil concentration levels continue over the years and may have long term environmental effects.

The total amount of oil entering the sea through chronic discharges is by no means small in comparison to accidental discharges. Table 1 presents estimates of the United States Academy of Sciences for the early 1980s. [1]

Table 1

Estimates of world wide oil pollution in the seas resulting from from offshore oil activities
(tons per year; source: US Academy of Sciences, 1975)

	ACCIDENTAL	CHRONIC
TANKERS	150 000	200 000
PLATFORMS/ PIPELINES	150 000	50 000

These discharges are part of a total of 4.57 million tons of discharges from all sources including natural seeps, river runoff, etc. The figure of 200 000 tons for chronic discharges from tankers cited here refers only to ballast water, and it is an optimistic estimate based on a strict enforcement of recent international tanker regulations. According to the US Academy of Sciences report chronic discharges from tankers are presently more in the area of 1 million tons per year.

How do these world-wide figures translate into the North Sea context? Estimates of the increase in oil pollution produced by North Sea oil operations vary widely. An early report by the Norwegian Ministry of Finance [2] stated a figure of 12 000 tons of total oil discharges per 50 million tons of oil produced, shipped, and stored. At present peak production estimates of about 200 million tons for 1981, this would amount to approximately 48 000 tons of oil discharges per year, including accidental and chronic discharges.

The Central Unit on Environmental Pollution (CUEP) of the UK made some estimates of chronic oil discharges from UK operations including the Norwegian Ekofisk field. [3] Assuming rather severe treatment levels for oily water they calculated that oil operations would result in approximately 2000 tons of chronic discharges per year.

Based on MIT statistics of accidental spill rates and amounts, US Academy of Sciences statistics of chronic spill rates, and North Sea statistics cited by two reports of the CUEP, [4,5], estimates for chronic and accidental oil pollution resulting from North Sea oil development in 1981 were made by the authors. These are summarized in Table 2.

Table 2

Estimated increases in oil pollution resulting from North Sea oil operations (tons per year)

	ACCIDENTAL	CHRONIC
TANKERS	1300	2400
PLATFORMS/ PIPELINES	5000	2200

Chronic oil discharges thus emerge as an equally severe problem as accidental discharges if one looks at total discharge figures.

Some regulatory measures to reduce chronic oil discharges from ships and platforms had already been taken by the UK and Norway before North Sea oil production began. Both countries follow the tanker regulations set forth by the Intergovernmental Maritime Consultative Organization (IMCO). [6] Oil discharges from platforms were strictly forbidden by the Prevention of Oil Pollution Act of 1971 (United Kingdom). [7] In practice, this regulation became obsolete with growing oil development in the North Sea. The initial solution to the dilemma that was posed by the Act of 1971 was to issue exemptions to offshore operators under the Petroleum and Pipelines Act of 1975. [8] This Act allows an exemption to be issued to operators provided they use "best practicable" means to reduce the oil content in discharged water. But neither the strict prohibition of 1971 nor the loose exemption rules of 1975 could be the final word about chronic oil discharge regulations. More precise definitions of "best practicable" means were needed.

With respect to offshore platform discharges, Norway faced a similar situation as the UK. Norwegian pollution control policy was to require operators to use "best applicable" means to reduce the oil content in discharge water. But again there was no firm rule or procedure by which the regulator could establish or communicate what was meant by "best applicable" means.

In both countries the main problem was to operationalize their respective regulatory definitions. Both countries are taking the route of setting standards on oil concentration, although levels and application rules differ in each.

The following sections present an analysis of the processes by which Norwegian and UK set standards on chronic oil discharges from offshore production platforms, and how they apply these standards in the day-to-day process of handling individual applications from oil developers. The information on which this analysis is based was collected during two field studies in Norway and the UK during which researchers, governmental officials and industry representatives were interviewed.

The formal structure of the analysis borrows some elements from decision theory and decision analysis. (See [9,10]) Decision theory has developed a set of tools which can be used to aid decision makers in such complex tasks as setting and applying standards. Among such tools are structural tools (decision and goal trees), quantification methods (measuring intangibles, quantifying uncertainty), and evaluation methods (multiattribute utility methods).

For a descriptive analysis of the Norwegian and UK standard setting process the structural elements are probably as far as one can go. In the following sections the decision makers and

other actors involved in the standard setting process will be described, including their goals, alternatives, and information linkages. Then the actual decision process will be discussed in terms of the information used to set standards and the institutional, engineering, and economic constraints and criteria. Finally, the paper will compare UK and Norwegian decision making and point out some problem areas.

2. ACTORS IN THE STANDARD-SETTING PROCESS

Standard-setting is a socio-economic and political process. This statement has been made previously by Majone [11] and Holden [12]. Majone has noted the following points in line with this thesis:

- a standard cannot be set on a purely scientific basis;
- a standard provides only an appearance of precision and hence of "scientific" character;
- a standard always represents an implicit evaluation of human well being;
- a standard is only one of other alternative means of regulation;
- the institutional framework often determines the decision on a standard;
- self-interest of regulatees moves them to attempt to modify the terms of the regulator, including any standards set.

In addition, Holden has noted that regulatory processes, including standard-setting, are based on a bargaining process between regulators and regulatees. [13] As an example of the political nature of standard-setting Schon notes that an attempt to set standards in the lumber industry for the "2x4" developed more political response than any other issue in the recent history of the US Department of Commerce. [14] Lumber producers both large and small, building interests, federal agencies, state governments as well as US Congressmen and Senators were all engaged in attempting to influence the thickness standard of the "2x4".

In regulatory decision making no simple decision making framework can be readily adopted, since a number of decision making units are involved. A complete system of actors that could be included in a regulatory process may represent:

- regulatory actors,
- developers,
- experts,
- impactees,
- exogenous actors.

For the present discussion only some aspects of these complex "decision making units" are emphasized. The exogenous actors, usually international institutions, often function as a constraint in regulatory decision making (e.g., the necessity to meet international standards). The experts function in their capacity to provide information pertinent to the regulation problem (e.g., information on biological effects of oil discharges).

Figure 1 shows an attempt to delineate the potential actors capable of being involved and impacted upon through chronic oil discharges from offshore platforms and tankers in the UK. For Norway (Figure 2) many of these actors are the same even though some of the governmental actors have slightly different names and responsibilities.

Before discussing the single actor groups in detail some interlinkages between actor groupings should be mentioned. As is readily discernible the development actors attempt to influence opinion and regulation in both the international (exogenous actors) and national (regulators) spheres. They have created the Exploration and Production Forum (E&P Forum) and Offshore Operator's Associations to perform the function of generating an informal network into related policy formation systems. In addition, other coordinating roles are occupied by the Central Unit on Environmental Pollution (CUEP, UK) and the State Pollution Control Agency (SPCA, Norway) which act as information sources to the oil-related Energy and Trade Ministries and as coordinating bodies in discharge control functions. The CUEP also acts as liaison for environmental matters at the international level.

One could expect a priori that each of the five actor subsystems would be tied together for the setting of standards for offshore chronic oil discharges. The following discussion will show that the actual actor configuration, their interlinkages and contacts are in fact more limited. In the discussion a distinction has to be made between the setting of guideline standards and the actual day-to-day process of reviewing applications to discharge oily water. In Norway, the standards are set almost exclusively on a case-by-case basis. In the UK, however, prior to individual platform arrangements an attempt was made to create some guideline standards that would provide the basis for day-to-day regulations.

2.1 Regulatory Actors

Both governments attempt to organize their environmental standard-setting process to interconnect with the offshore developers. Both countries have similar agencies to accomplish their tasks. The major difference is that the UK relies on its Petroleum Production Division to regulate offshore oil discharges while Norway uses its State Pollution Control Authority.

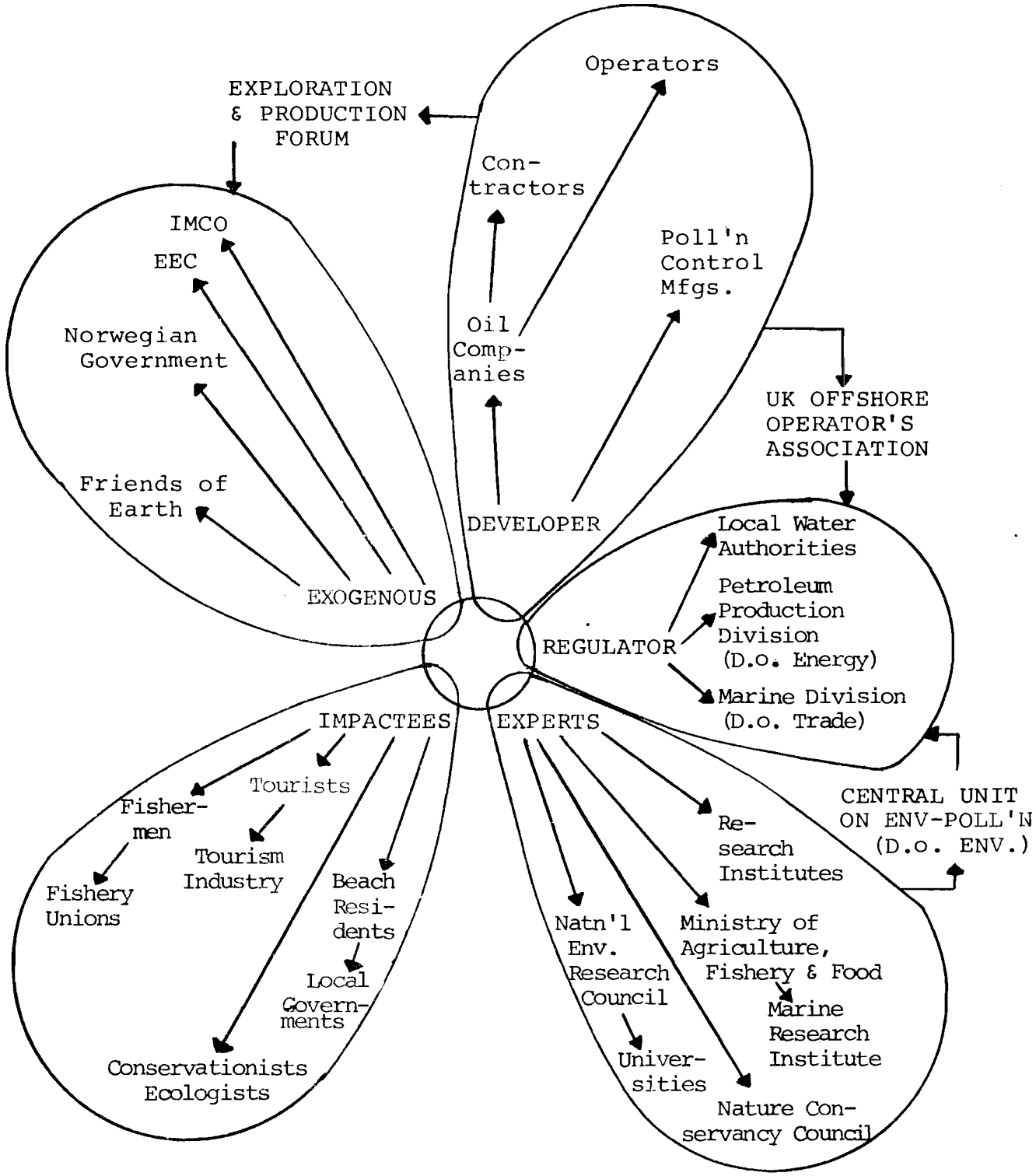

Figure 1 POTENTIAL ACTOR CONFIGURATION IN SETTING STANDARDS FOR OFFSHORE CHRONIC OIL DISCHARGES IN THE UK

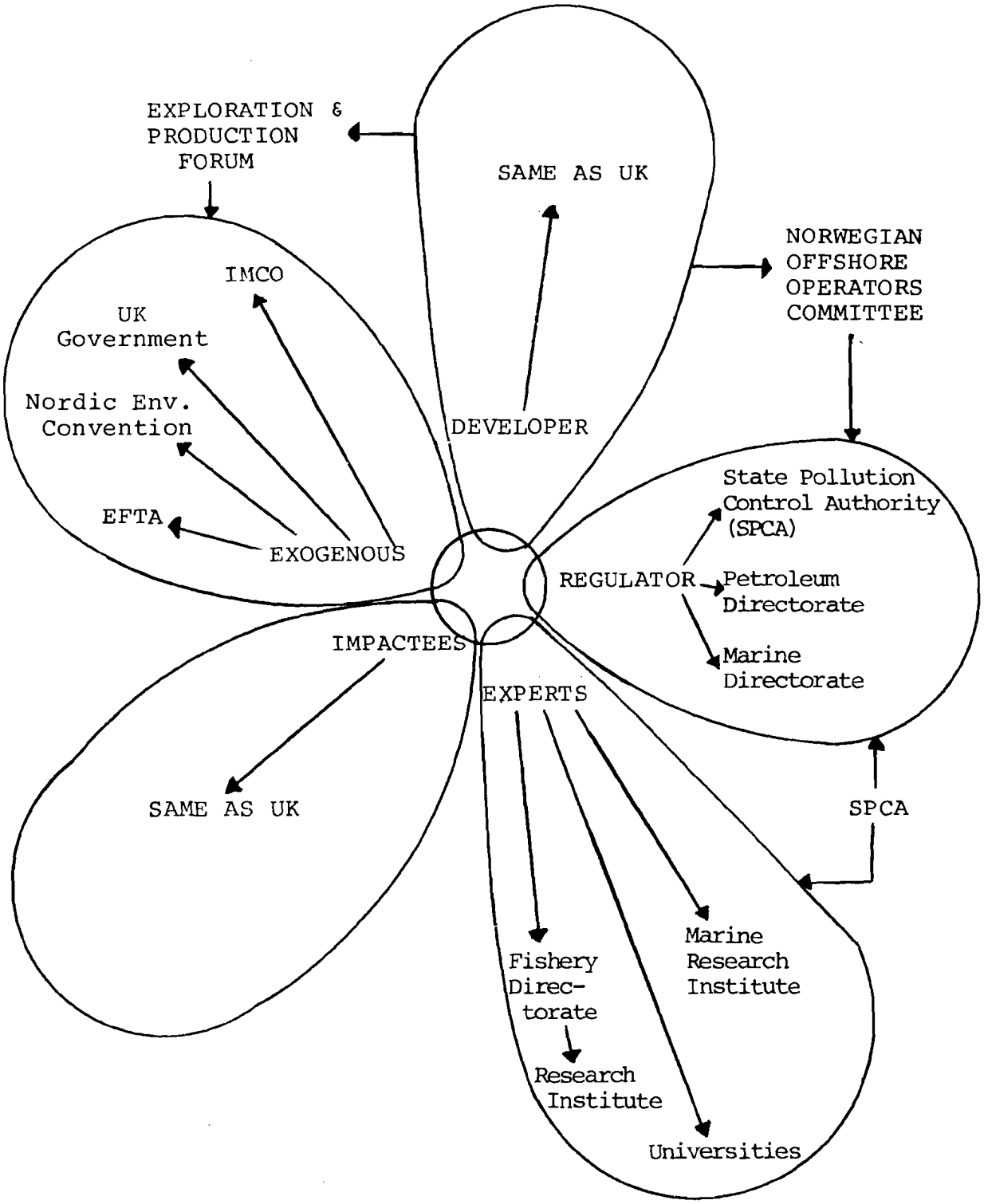

Figure 2 POTENTIAL ACTORS CONFIGURATION IN SETTING STANDARDS FOR OFFSHORE CHRONIC OIL DISCHARGES IN NORWAY

In the UK the CUEP performed the bulk of the work for studying the chronic oil discharge problem and for working out guideline standards. The main partner with which the CUEP consulted during the process was the Petroleum Production Division (PPD) of the Department of Energy, the division responsible for implementing offshore discharge standards. Contact with local regulators and authorities existed through the Scottish Office and Her Majesty's Industrial Pollution Inspectorate for Scotland. The Department of Trade was consulted in the standard-setting process through its Marine Division which is responsible for oil pollution from ships.

The Petroleum Production Division of the UK is in charge of the day-to-day implementation and adjustment of standards (the exemption to discharges under the 1975 act). In the process it interacts with a variety of government actors, including the CUEP, the Marine Division of the Department of Trade, as well as several expert actors such as the Ministry of Agriculture, Fisheries and Food and other divisions in the Department of Energy. However, this process takes place exclusively in-house in an interaction between key governmental actors.

In Norway the State Pollution Control Agency is responsible both for setting standards and for implementing them. As of now Norway has not decided to adopt firm standards for offshore platforms but deals with discharge applications on a case-by-case basis. Similar to the link between the CUEP and the PPD, the SPCA interacts closely with the Petroleum Directorate and to some extent with the Marine Directorate in its regulatory activity. However, unlike the PPD, the SPCA also provides information about discharges from proposed platforms to non-governmental experts, impactees, and exogenous actors on a routine basis.

The main difference in the regulatory actors involved in standard-setting between the UK and Norway is that in Norway the central actors is the SPCA, an environmental actor; while in the UK the main responsibility is in the hands of the PPD, an energy actor aided in its research by the CUEP, a unit in the Department of Environment. Furthermore, in the routine application of standards to platforms the SPCA has a wider range of linkages with actors outside of the industry-government sphere than the PPD. Thus the UK has placed the standard-setting process for offshore environmental protection directly into the agency that has the responsibility for overseeing continued petroleum production from offshore. Norway, on the other hand, has sought a counter-balance in its standard-setting process where an environmental agency regulates oil company pollution instead of an oil production agency.

2.2 Development Actors

The oil industry is the generic term for various development actors involved in the standard-setting for chronic oil discharges in Norway and the UK. The large private oil companies such as BP,

Esso, Total, together with the national oil producers, the British National Oil Corporation and the Norwegian STATOIL, form the main body of what would fall under the heading of "developer". Included also are the various contractors (equipment producers, shippers, etc.), non-company operators and, in particular, the treatment equipment manufacturers.

In CUEP's research on determining the basis for offshore standards the oil industry was involved at several stages. First of all, they provided data to the CUEP about equipment availability, equipment performance, etc. Treatment manufacturers were contacted for this CUEP study, to provide data on costs and performance ranges of oily water treatment equipment. Second, they were involved through representatives in a public seminar which was held at Heriot-Watt University [15] in which the main issues related to chronic oil pollution standards were considered. Yet the oil industry feels that their involvement in setting these guideline standards was limited.

The oil companies and platform operators are in direct contact with the respective regulation agency (SPCA in Norway and PPD in the UK) in questions of oily water discharges from a specific production platform. The companies submit a design proposal or equipment specification with operating characteristics to the regulator for approval. This is then reviewed, and either accepted or modified. Furthermore, the SPCA and PPD are in contact with treatment manufacturers, when it comes to specific questions relating to treatment or monitoring equipment for a specific platform.

2.3 Expert Actors

Various governmental and non-governmental experts are involved in the standard-setting process both in Norway and the UK. In the work of the CUEP on chronic oil discharges the Sea Fisheries Laboratory of the Ministry of Agriculture, Fisheries and Food (MAFF) provided expertise about the possible effects of chronic oil pollution on fish and other marine organisms. The Warren Springs Laboratory provided technical expertise on oily water treatment. University researchers and expert councils, such as the Nature Conservancy Council or the National Environmental Research Council, were not directly involved in the analysis of chronic oil pollution by CUEP.

Experts are to some degree involved in the case-by-case standard-setting in the UK and Norway. The PPD sends the discharge application of the operator to various governmental groups, including MAFF, Warren Springs Laboratory, and the Marine Division of the Department of Trade. These applications are reviewed and commented on by experts from these Departments. The SPCA sends applications for discharges not only to governmental experts, but also to fishery union experts, and non-governmental environmental experts.

Thus the main difference between the UK and Norway with respect to the involvement of experts in chronic oil discharge standard setting is that the PPD relies solely on in-house expertise, while the SPCA also includes experts from outside of government. The confidentiality of the operator's report as well as the desire to maintain a good working relationship was mentioned as the main reasons for keeping the review within governmental agencies in the UK.

2.4 Impactee Actors

Potential sufferers of chronic oil pollution include the fishermen and possibly the consumers of fish. Also included are coastal residents, tourists, the tourism industry, and local governments who may suffer from oily or tarred beaches. A different type of impactee are ecologists, conservationists and environmental groups who may not be directly impacted upon, but their values (high evaluation of rare species, birds, etc.) are affected.

In the CUEP research on guideline standards these impactees had a possibility to be heard at a public seminar held by the CUEP, but they were not directly involved in the process of elaborating discharge standards. In the review process by the PPD the impactees are not involved, although some governmental experts could be interpreted as representing their personal or professional interests (e.g., biologists from the MAFF). In the Norwegian review process some impactees are involved; for example, fishery organizations receive discharge applications for comment.

2.5 Exogenous Actors

Exogenous actors involved in the basic work on standards by the CUEP were the SPCA and IMCO. Both were informed but not directly involved in the standard setting process. The EEC played a special role as an exogenous actor, since some member countries which share non-oil North Sea resources could potentially be affected by chronic oil pollution. The EEC has pushed for rather stringent across-the-board standards.

In terms of the routine review of discharge exemptions exogenous actors play a more limited role. The PPD and the SPCA have contact but do not inform each other about every discharge exemption case. There are contacts between the SPCA and the Nordic environmental convention, but it is not clear to what extent these contacts include actual discharge application reviews.

Although the above sections indicate all five actor groups were involved in the setting of standards and in the day-to-day review of discharge applications, the "core actors" are the regulator and the developer. Although the impactees have little direct involvement in the standard-setting process, the consideration of their interests by the regulator makes them an implicit

part of the process. In the further analysis of the objectives, alternatives and decision making processes this paper will therefore concentrate on these three groups.

3. GOALS AND OBJECTIVES OF REGULATORS, DEVELOPERS AND IMPACTEES

The area of value and objectives has a much less firm data base than do the alternatives noted in the next section. It is usually difficult to elicit from the literature or from more or less informal discussions a good picture of goals and objectives for actual decision making. Therefore, some of the following arguments will be rather hypothetical.

3.1 Regulatory Objectives

Environmental control agencies of the UK and Norway list at various places goals and means for meeting environmental objectives. Table 3 shows that the UK and Norway have relatively similar goals and means for meeting environmental objectives. Both the UK and Norway give credence to the best practicable and best available means for meeting their environmental goals respectively. The UK defines "best practicable" as the ability to prevent or control pollutants as far as is practicable regarding local conditions, financial implications and current technical knowledge. [16] Best practicable is seen as distinct from the best technological since it accounts for economic and other implementation problems. Norway defines "best available" as the use of the best available technology known internationally but constrained by the costs of such technology. [17] Thus both countries virtually end up with the same definition. [18]

Further regulatory objectives are related to the pressures and constraints put on the regulator from the legal system and from international and administrative demands. Qualitatively speaking any regulation should:

- be easy to manage (implementation and control);
- fit into international agreements and rules;
- fit into the national legal and policy framework.

In the UK case such objectives worked rather as constraints. There had been much concern about fitting discharge regulations into international rules and policies. For platform regulations the international community put pressure on the regulator in the form of international conventions that suggested the early adoption of rather stringent uniform oil discharge standards for the North Sea. The constraints set by the legal framework in the UK were largely defined by the Pollution Acts of 1971 and 1975.

In addition, regulatory constraints were imposed through national oil development policy which tended to prohibit regulations which would seriously interfere with the pace and scale of oil development defined by political bodies. In the UK the goal

Table 3 COMPARISON OF POLLUTION CONTROL GOALS AND MEANS FOR THE UK AND NORWAY

UK POLLUTION CONTROL (1)		NORWAY POLLUTION CONTROL (2)	
GOALS	MEANS	GOALS	MEANS
• protection of human life and health	• use of best practicable means	• protect capacity of nature to produce and renew itself	• use of best available means
• safeguarding plant and animal life useful to man	• avoidance of rigid quantitative standards	• ensure pollution does not damage human health or affect personal well-being	• discharge may not occur without permission
• restrict interference with man's normal use of environment	• delegation of actual enforcement to local levels	• consider pollution control in relation to other social goals, including costs of such control	• pollution control included in cost of goods and services
• minimize permanent adverse effects on environment	• extensive monitoring for pollutants, humans and plants and animal species	• ensure similar goals are set in other countries	• pollution to be controlled at source using standards, land use controls and impact assessment

(1) Taken from: A.J. Fairclough, The UK Approach to Environmental Matters, speech given to B.P. Environmental Forum, London, December 1, 1976.

(2) Taken from: Ministry of Environment, Parliamentary Report No. 44 on Pollution Control Measures, Oslo, 1975-76.

See also: UNEP, Environmental Conservation in the Petroleum Industry, UNEP/ISS.5/10 Industry Sector Seminar, Paris, June 10, 1977, pp.41-43.

of rapid oil development could probably be considered an integral part of the regulatory objectives since the regulator is part of the Department of Energy.

In Norway the SPCA objectives may be considered more concentrated on the environmental side. Neither international agreements about pollution nor national energy policy seem to have had a large impact. However, the manageability criterion may have played a larger role in Norway which does not have a large research or regulatory capacity to set standards and enforce them regularly. The regulation of offshore platform discharge standards in Norway is still a one-man operation in the SPCA.

3.2 Developer's Objectives

Two objectives may be of over-riding importance to the developer: minimization of investment and operational costs for pollution control equipment and minimization of possible sanctions or costs due to violations of regulations. These objectives are in direct conflict. Good equipment is expensive but insures against violations of regulation or possible compensations to impactees.

While the cost of pollution control is easy to quantify the cost for violation of regulation are not clear cut. However, it was clear from discussions with environmental control officers of the oil companies that the oil industry was highly concerned about possible violations of governmental regulations. The effects of such violations are, of course, not only monetary in terms of additional costs for equipment, penalties, shut-down costs, etc., but they also relate to a worsening of the working relationship with the regulatory agencies.

The environmental control officers which were contacted in this study also pointed out that it was in the oil companies' interest to minimize oil pollution from production platforms. It is not clear, however, how this objective actually enters into the offshore operators' decision making about pollution control equipment and operation. It is probably fair to say that, although the oil companies' concern about pollution is genuine, it enters into the actual decision making rather through considerations of compliance with regulation and general public sentiments. The immediate environmental concern is therefore discussed in detail only for the impactees.

3.3 Impactees' Objectives

The fishery side is concerned about minimizing a possible loss of fish catch due to chronic oil pollution and about minimizing the risks of chronic toxicity and tainting of fish. An additional objective may be to minimize dirtying of equipment. Tourists, tourism industry, local governments and beach residents have identical objectives: preventing oil and tar balls from reaching the shore waters and amenity beaches. The public at

large as consumers of fish and other marine organisms should have virtually identical interests as the fishing industry. Environmentalists and ecologists are impacted more in their perceptions and values and therefore have the additional objectives of minimizing ecological disturbances due to chronic oil pollution as well as minimizing mortality risks to rare marine species.

Figure 3 puts these objectives together under the explicit definition of the UK objectives set out by the Department of Environment. [19] The basic structure of the impactee objectives is similar in Norway, although the general values and sentiments of the "Norwegian way of life" may shift some of the priorities as compared to the UK case.

4. ALTERNATIVE REGULATIONS, TREATMENTS AND USES OF THE ENVIRONMENT

Each actor group has its specific set of alternatives: regulation alternatives, development alternatives, and environmental responses and alternatives (excluded here are the impactees whose perceptions are impacted by the development but who do not actively use the environment).

4.1 Regulatory Alternatives

Figure 4 presents in a logical decision tree some of the alternative means to regulate chronic oil discharges from offshore production platforms. It also shows the path that the UK and Norway have taken and where they ended. These alternatives span the widest range that could possibly be considered by the respective regulators, the PPD and the SPCA.

The actual alternatives considered were, of course, much more limited. In the research on chronic oil pollution control by the CUEP the main focus was on average and maximum emission levels, that is, on the required average performance of the oily water treatment equipment and the maximum which should not be exceeded a given percentage of the time. The question that the CUEP addressed in its research was mainly: which average and maximum level appears reasonable under environment, engineering, economic and political considerations? Extreme alternatives such as no regulation at all or of a total prohibition of discharges were never seriously considered.

The Norwegian SPCA considers standards on average performance in connection with total effluent volume as the main regulatory tool for oil pollution; however, in its case-by-case application of regulations to platforms it reverts, in practice, to an equipment specification and approval regulation. Maximum performance may be considered by the SPCA in the future.

Several other alternative regulatory means arise in such case-by-case regulation. These include:

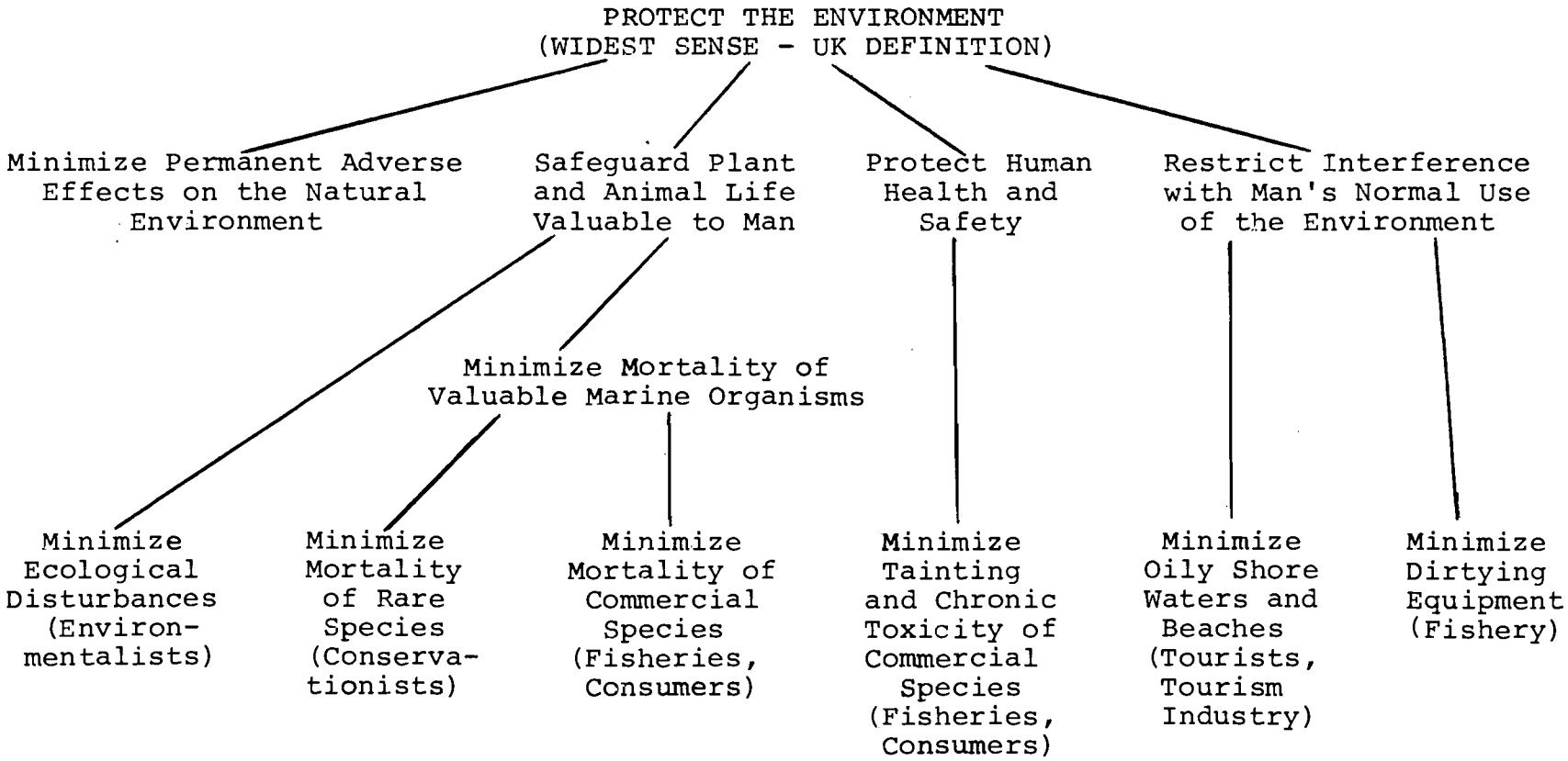

Figure 3 GOAL TREE FOR IMPACTEES CONCERNED ABOUT CHRONIC OIL POLLUTION

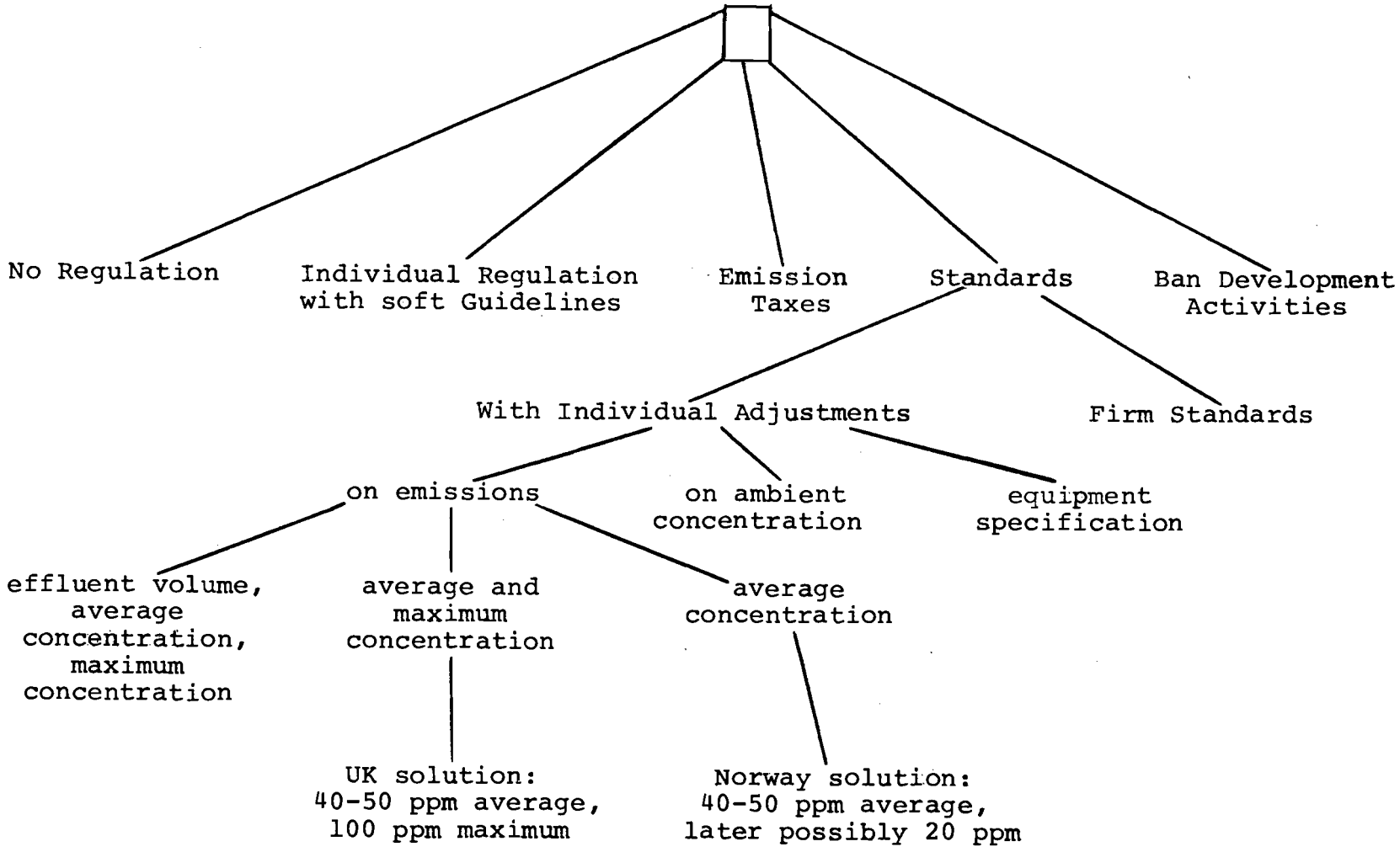

Figure 4 TREE OF REGULATION ALTERNATIVES

- the information requested by the oil company for the discharge application (e.g., cost, estimated performance figures, effluent volume, location of discharge, distribution of discharge, monitoring procedures, etc.);
- the circulation of applications for review (e.g., should non-governmental groups be involved or not);
- choices of the monitoring and inspection procedure to be imposed on the oil company;
- alternative sanctions for noncompliance.

4.2 Developer's Alternatives

Turning now to the substantive decision alternatives of the offshore operator, Figure 5 presents a logical decision tree including the kinds of treatment processes, equipment, and operating rules to run that equipment. In addition to the choices outlined in Figure 5, the operator has an additional choice not to discharge the oily water at the platform, but rather to pump it by pipeline to the shore where it can be treated or discharged. The primary treatment branch which is followed through in the figure is the most typical for offshore platforms. Sometimes it is coupled with secondary gas flotation or filtering equipment. For details of the equipment, the reader is referred to [20].

It is interesting to note that the oil companies virtually excluded the extreme alternatives from their considerations; that is, either no treatment at all or very severe treatment (biological or pumping oily water to the shore for treatment). Plate interceptors have become good operating practice all over the world and the offshore operators accept them as a practical way to treat oily water discharges.

Biological treatment is considered infeasible for offshore platforms, both by the operators and by the regulator. [21] The reason mentioned is the large size of biological treatment facilities (up to 4000 m^3 for a treatment volume of 10 000 tons per day). It is, however, not clear whether biological treatment is technically infeasible or whether it is feasible only at a very high cost. Concrete platforms with large storage volumes up to 100 000 tons should, in principle, be adaptable for biological treatment. Also it should be feasible from an engineering point of view to build a separate platform for a biological treatment plant, of course, at a substantial cost increase.

4.3 Impactees' Alternatives

The impactees alternative uses of the marine environment do not span a wide range. Fishermen can pursue either "business as usual" or divert fishing activities away from potentially polluted areas. The likely action is not to divert since it appears that fish are attracted by platforms. However, safety zones are established around platforms to avoid direct conflicts between these activities.

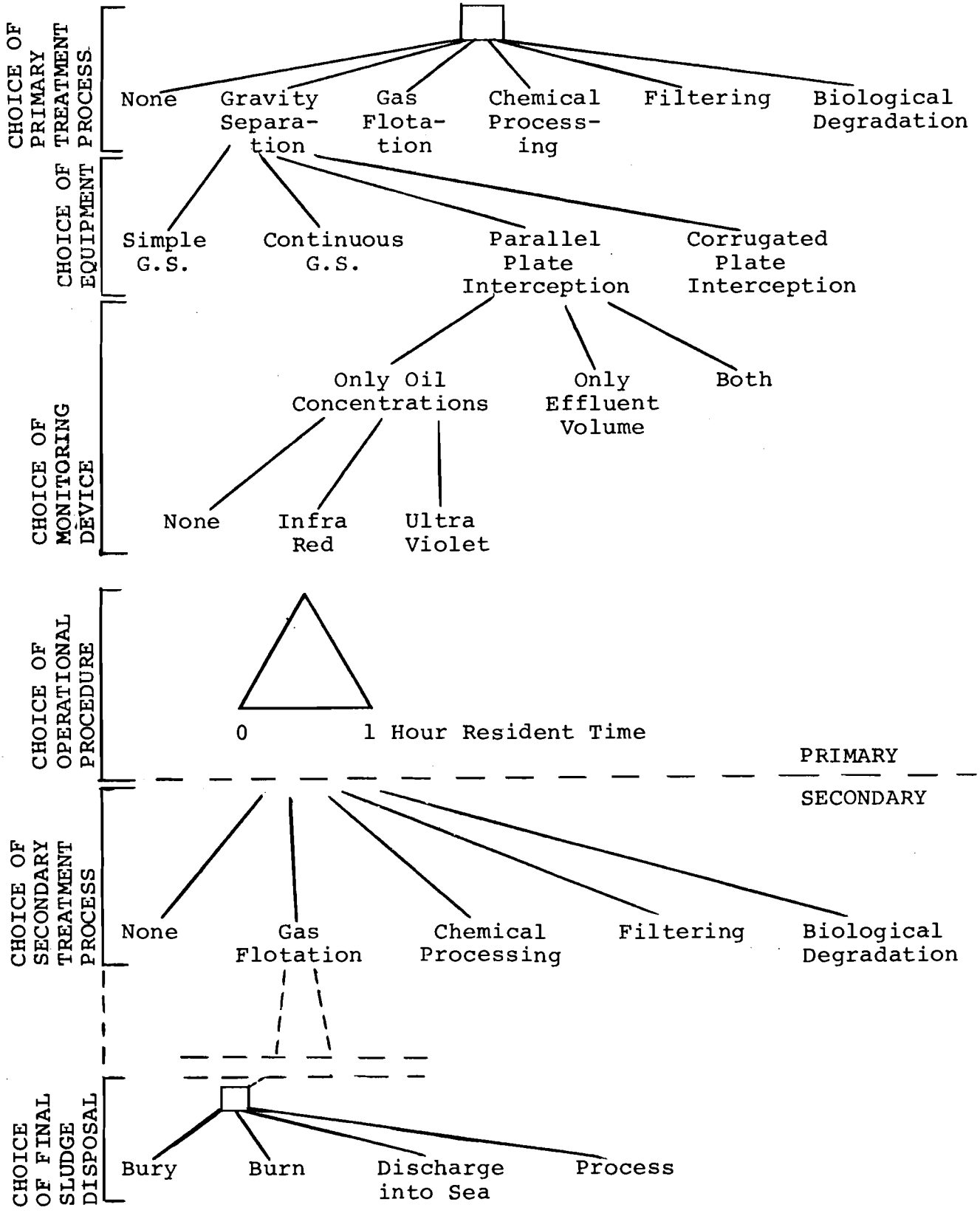

Figure 5 SOME BRANCHES OF A DEVELOPER'S TREE OF OILY WATER TREATMENT ALTERNATIVES

From present data and the scale of development it does not appear that shorelines are affected by chronic oil pollution from offshore platforms. Therefore, it is unlikely that tourists or beach residents would have to take recourse to such extreme alternatives as to move to non-polluted areas.

Although all groups have, in principle, the additional alternative of putting pressure on the regulator and the developer either through direct petition or through various forms of public and legal action, no such actions seem to have been considered yet by any of the impactees.

5. THE DECISION PROCESS IN STANDARD SETTING

While the previous sections described and discussed the elements of standard-setting for chronic oil discharges in terms of actors involved and their objectives and alternatives, the following section will describe the linkages in terms of information flows, procedures, and data base in the actual decision process for setting chronic oil discharge standards.

5.1 UK Standard Setting

Although the PPD issued discharge exemptions on a temporary basis as soon as the first production platforms began operations, the actual standard-setting process began only in 1975 with the research done by the CUEP. This research aimed at identifying guideline standards which would satisfy the environmental policy criterion of enforcing "best practicable" means of pollution control, in line with engineering, economic, environmental, and political objectives.

It soon became clear to the researchers involved that the uncertainty about biological effects made the setting of discharge standards on a purely biological basis virtually impossible. The fate, turnover, and effect of oily water emissions have been reviewed by several authors [22,23,24] but no firm conclusions can be drawn. In the North Sea it appears that effluents with a concentration of 50 ppm or less generate ambient oil concentration levels which are hard to detect against the background hydrocarbons in the sea water. Even at a highly polluting platform in the Ekofisk field, no noticeable oil concentrations were found away from the emission source.

Some marine biologists would agree that reasonable effluent volumes with 50 ppm oil concentration and with good dispersion characteristics will not lead to any direct harmful effects on marine organisms. Some oil company experts argue even stronger. From their experience in the Gulf of Mexico no short or long term effects could be shown even at higher effluent concentrations. Independent marine biologists are more cautious: they leave open the possibility of long term cumulative effects of low oil concentration in water or short term and medium term behavioural effects such as on spawning behaviour.

Because of this uncertainty about biological effects of oil in the sea water, the CUEP concentrated its effort mainly on estimates of total amounts of oil discharged in the North Sea and on technical feasibility, costs, and performance of oily water treatment equipment. By making rather stringent assumptions about treatment levels (25 ppm), production rates, transportation, and storage the CUEP calculated that approximately 585 tons of oil will be discharged from UK platforms in 1981. [25] In this study an independent estimate of 2,200 tons per year was made for the whole North Sea from all production platforms. The difference cannot be explained by the additional platforms in the Ekofisk and the Statfjord field alone. It appears that the UK estimate is based on far too optimistic assumptions. Even the estimate of this paper may be below actual performance figures. Platforms exist in the Norwegian sector which are estimated to discharge more than 800 tons of oil per year at peak production levels.

On the technical and economic side the CUEP studied in detail various oily water treatment equipment. A summarized version of the results is presented in Table 4. The performance figures could only be given in ranges since equipment manufacturers, oil companies, and independent researchers differ, often substantially, in their assessment of equipment performance. This uncertainty about actual performance played, in fact, a large role in standard-setting. Equipment manufacturers typically cite very good performance figures, while the oil companies doubt that these figures can be achieved in the field. In discussions with oil company representatives views were expressed that the figures used by the CUEP may be too optimistic. They feared that standards set on the basis of such optimistic figures could not be achieved in practice.

The study by the CUEP naturally did not mention any political objectives in setting standards. However, it should be clear that international pressures would have required standards set in the range of international acceptability (currently such standards vary from 10 ppm in Japan to 50 ppm in the US).

The CUEP study implies that standards of 30-40 ppm should be achievable with currently used technology at a reasonable cost. The conclusion of the CUEP study was, among others:

> "Data suggest that an average oil concentration of 30-40 ppm is achievable with present technology. A maximum effluent oil concentration of 100 ppm should not be exceeded more than 2% of the time. New developments of existing systems for use on platforms may be able to reduce the effluent oil concentration to an average of 20 ppm, but these systems have not yet been fully evaluated." [25, p.22]

The translation of these guideline standards into the case-by-case standard setting for individual platforms is done by the PPD. An application for an exemption to discharge is forwarded to the PPD from the oil company wanting to build the platform. Information is requested by the PPD from the company such as

Table 4 ASSESSMENT OF VALUE RELEVANT CONSEQUENCES FOR THE MAIN TREATMENT ALTERNATIVES

(from Pollution Paper No. 6, Department of Environment, UK)

TREATMENT ALTERNATIVE	COST RANGE (INSTALLMENT FOR 10 000 ton unit)	PERFORMANCE RANGE (ppm)		FEASIBLE ON OR OFFSHORE
		AVERAGE	98% OF TIME	
Simple Gravity Tank	?	40-50	155	BOTH
Corrugated Plate Interceptor	US$ 130,000-175,000	10-50	?	BOTH
Gas Flotation	US$ 175,000	27-34	100	BOTH
Filters	?	21-22	60	ON
Biological Treatment	?	1	?	ON ONLY

monitoring data from around the proposed platform site, the production aspects of the platform, volumes of oil to be treated, and location and depth of discharges. This information is then summarized and circulated to the organizations as described earlier, all of which are within the UK government. Comments received are then used as the basis for the PPD in setting oil discharge standards.

Contacts between the oil company and the regulator are informal. If the application is not acceptable as is the regulator can only suggest problem areas and cannot tell the company what it should do to correct the situation. This problem exists because the regulator may have to advise the Secretary should the company decide to appeal the regulator's ruling. Thus the PPD only recommends the limit of discharge (maximum average, maximum to be exceeded four percent of the time, maximum volume per day, etc.,) and the conditions necessary to obtain an exemption. Monitoring procedures are determined by the PPD. The granting of the exemption and the conditions under which it is granted are also circulated to the same organizations for comment. Again standards are set on a case-by-case basis. Information on such standards and discharges is available to the public ex post facto in the annual reports published by the Department of Energy.

The PPD in conjunction with the CUEP has evolved six basic operating principles:

1) provision of certain basic information on oil treatment alternatives on offshore platforms to oil companies,
2) emphasis on pollution control equipment since the effects of oil in the marine environment are not well known,
3) emphasis on good pollution control equipment being installed to meet the agreed standard of discharge,
4) maintenance of good informal working relations among government departments and between government and companies,
5) setting of good monitoring procedure as part of the conditions to obtain an exemption for oil discharges,
6) burden of proof for not installing treatment devices is shifted to companies since they must apply for exemption.

In January 1977 eight production platforms operated in the UK sector, six of which produce oily water discharges. The exemptions which have been granted so far were generally based on a standard of 40 ppm average oil concentration for production platforms with a large discharge volume (greater than 100 000 barrels of oily water a day) and a maximum of 100 ppm not to be exceeded 96% of the time. Platforms with smaller effluent volumes are required to treat oily water down to a level of 50 ppm average oil concentration. One platform has been granted an exemption although its oil concentration is on the average higher than 50 ppm.

These decisions indicate only slight deviations from the CUEP proposal. Most notable is the change from 98% to 96% for excess maximal performance. It is unclear by what process this change occurred.

Monitoring is used in the UK to provide a data base for standard-setting. Oil companies are given responsibility for such monitoring. Each platform is to be monitored twice a day by the company having operational responsibility. The PPD determines the method of monitoring and the method of analysis. Twice a month the platforms are inspected by the PPD, but since helicopter space must be reserved in advance no surprise inspections are possible. The results of such monitoring are subjected to analysis by a government laboratory. The expenses of such analyses are borne by the companies involved.

5.2 Norwegian Standard Setting

In the Norwegian case no research was carried out to determine guideline standards. However, several reports to the Storting, the Norwegian parliament, [26, 27] indicate the positions which the Norwegian government takes with respect to oil discharges and possible environmental effects. As mentioned before, the estimates for total oil discharges from North Sea oil development are more pessimistic than the ones generated by UK governmental researchers. Also the overall impression from these reports is that the potential environmental effects of oil are taken much more seriously than in the UK. In fact, environmental considerations had a strong influence on the Norwegian decision to halt development North of the 62nd parallel.

The SPCA sets and revises standards for offshore platforms against this background on a case-by-case basis, revising its position as the process goes along. The SPCA requests information from the oil company wanting to discharge oily water from offshore drilling and production platforms. The oil pollution control equipment used to reduce oil discharges is included as part of the application for the platform. The information requirements include:

- production process: amounts of oil to be produced, how the oil is to be handled, where oil pollution points exist, amounts of other wastes to be produced;
- monitoring process: how marine environment around platform is to be monitored;
- location of platform offshore (location is non-negotiable);
- function of platform: drilling for what kinds of petroleum, how petroleum is transported;
- storage of oil: where and how;
- effluent treatment: displacement water, production water, drainage water collection and treatment plus treatment costs.

The above information is then summarized, shown to the oil company first, and then sent to the organizations noted earlier for comment within eight weeks. Once comments are received they are used to guide the SPCA in its standard-setting process. Contacts between the oil company and the SPCA are informal, and they meet together to discuss the tentative standards before they are finally set. When the SPCA meets with the oil company both the Oil Directorate and the Marine Research Institute are invited.

Generally, discharges are allowed if the operator uses equipment that reduces the oil content in the effluent down to 50 ppm. However, the SPCA considers tightening up this standard in the future. Although no firm data are available about actual performance yet, it appears that the total volume of oil discharged may be substantially higher in Norway than in the UK due to large volumes of displacement water discharges. Also, some platforms in the Ekofisk field still use relatively poor treatment equipment.

The SPCA has adopted five basic operating assumptions:

1) a wide circulation of information of pending platform applications even though little hope exists that the impactee or exogenous actors will have information of use to the regulator,
2) an emphasis on pollution control equipment rather than on standards per se since the effects of oil in the marine environment are not well known,
3) an emphasis on working with the oil companies in the platform design stage to allow pollution control equipment to be integrated into the platform design itself,
4) if pollution can be technically controlled the SPCA is interested in reducing such pollution if at all possible and reasonable to do so,
5) given the lack of information on effects of oil in the marine environment the environment is given a strong bias to preserve future options.

One particular problem for the SPCA is its relative newness in regulating offshore oil activities. It has had little experience in dealing with multi-national companies. It also does not have the manpower and information resources available to it that such companies have. Therefore, its knowledge of alternatives is reduced and it attempts to depend on other bodies for information and for valuations of such information.

In addition, monitoring procedures are established. The oil companies are asked to do baseline monitoring in the vicinity of the platform location before construction occurs in cooperation with the Marine Research Institute. During the actual production phase monitoring continues at fixed points around the platform, again the company taking primary responsibility in cooperation with the Marine Research Institute. Only levels of

oil discharges are collected. These figures and samples are then sent to be evaluated by the Marine Research Institute and the Fishery Research Institute. The former institute also conducts an independent monitoring program on oil levels monthly. The complexity of hydrocarbon compounds and the relationship of oil with other pollutants makes evaluation of monitoring results (as well as setting standards) difficult. Also companies are reluctant to do continuous monitoring and then send such data to independent institutes for fear that their own figures would be used against them. The greatest problem in Norwegian monitoring appears to be a lack of a common monitoring framework using a wide variety of biological and ecological variables tied together into a systems approach.

5.3 Biological Information for Standard-Setting

While both countries have adopted monitoring programs as a part of their standard-setting process it is clear that a major gap exists in the availability of adequate information on the long-term effects of chronic oil discharges on marine organisms. One would like to answer questions for such a consequence assessment as: Given normal fishing operations and no oil development what is the amount and quality of fish catch that the fishing industry can expect? To what degree do different levels and amounts of chronic oil pollution reduce the amount and quality of the catch? To what degree does chronic oil pollution endanger the ecological balance in the marine environment? To what degree does chronic oil pollution contribute to dirty fishing equipment and to producing dirty shore waters and oil slicks on amenity beaches?

The basic answer to these questions from scientists, regulators and managers was: we do not know. There seems to be an enormous uncertainty with respect to biological effects of oil that is discharged at low but constant levels into the sea waters. Ambient oil concentrations are hard to detect against background hydrocarbons in the sea. Even at a highly polluting platform in the Ekofisk field (at least 10-30 tons of oil are being discharged there monthly) which is located near a very large herring spawning ground, marine biologists can not claim that there are effects of oil on fish.

The process from emission to the fish or marine organisms into the food chain is uncertain: the fate and turnover of oil once released is currently beyond measurement. But in the judgement of marine experts reasonable effluent volumes with 50 ppm discharged offshore with good dispersion will not lead to any direct harmful effects on fish and marine organisms. On the other hand, marine biologists do not reject the possibility of behavioural effects of small amounts of oil pollution (e.g., on spawning behaviour) and of long-term cumulative effects on fish and in the food chain. An additional source of uncertainty arises onshore, where synergetic effects of oil together with other pollutants from refineries and other industries may occur.

The high uncertainty about the effects of biological effects created another source of opinion conflict among the various decision making units involved in the regulation problem. Experts from the offshore operators side claim no effects whatsoever with present treatment levels. Some marine biologists and fishery representatives warn of the potential long-term effects.

In the light of such uncertainty and the importance of this issue one would expect both countries to have staged a comprehensive marine research program on effects of oil pollution. Although the problem of oil pollution in the North Seas was known several years ago, up to now the research responses to reduce this uncertainty have been slow and rather ad hoc.

The main result of the uncertainty about biological effects in the Norwegian regulation setting was a rather pessimistic view. The pessimism with respect to consequence estimates has, of course, several other supporting sources: the strong Norwegian sentiment favouring fishing and the general policy of slowed development of the oil fields. The first sources makes a pessimistic assessment of biological effects a political necessity, the second factor allows the pessimism to be translated into rather strict standards and regulations. Practically, this pessimism is related to the environmental policy to use best technical (applicable) means to prevent chronic oil pollution.

In the UK regulation the uncertainty about biological effects resulted in a shift from environmental considerations in regulations to equipment performance and cost considerations. Rather than starting - like the Norwegian regulators claim - with a worse environmental case attitude, UK regulators asked which efficient treatment equipment can be implemented without imposing too high a cost to the developer. This consequence of the uncertainty about biological effects is compatible with the prevailing UK objectives of rapid oil field development and the general environmental policy to use "best practical means" in reducing pollution.

6. COMPARISONS AND CONCLUSIONS

Comparing Norway with the UK it is clear that certain similarities and differences exist in their standard-setting processes for offshore oil discharges from platforms. Table 5 is an attempt to summarize the differences between Norway and the UK. Since it is generally self-explanatory little necessity exists for elaborating on the information in this table. The similarities between these two countries include the following points:

- emphasize treatment equipment;
- standards tied to equipment;
- standards (equipment) set on a case-by-case basis;
- standards set in vicinity of 40-50 ppm;
- attempt to work with company in design stage;

Table 5 COMPARISON OF REGULATORS OF OIL DISCHARGES CONNECTED WITH OFFSHORE PLATFORMS IN THE NORTH SEA

DIFFERENCES BETWEEN NORWAY AND UK	
NORWAY	UK
• regulator is pollution control authority with emphasis on environment	• regulator is petroleum production unit with emphasis on energy
• regulator had to create regulatory structure	• regulator had to redesign regulatory structure
• impactees asked for comments	• impactees not asked for comments
• regulator open with information	• regulator keeps information confidential
• problem viewed as environmental with emphasis on fish impacts	• problem viewed as political and technical
• no research on treatment alternatives	• published one paper on treatment alternatives
• pessimstic estimates of total amount of oil discharges	• optimistic estimates of total amount of oil discharges

- monitoring process tied to discharge permit;
- responsibility on company to monitor;
- energy unit inspects monitoring.

One key finding is that both countries must wholly rely on entrepreneurial endeavour for oil discharge treatment alternatives. Neither country is attempting to initiate a research program to develop technological treatment alternatives; nor are these countries testing such equipment for performance ranges.

In addition, the standards set depend directly on such treatment equipment as is shown below:

- availability: existence
- capability: performance
- practicability: size and price.

Given a lack of information on biological and chemical effects of oil on the marine environment both regulators have turned to practical solutions to their regulatory function. Key factors include the platform space available for containing such treatment equipment on the platform as well as the cost of such equipment, which has been reported as approaching ten percent of total platform cost. Given this high cost and the lack of data on negative effects of oil in the marine environment it is surprising that the oil companies appear so willing to install treatment equipment. It would be very difficult for the regulators to state their case on a strong research basis.

Another important finding is that the degree of severity of oil discharge standards offshore affects oil discharges nearshore or onshore as well. If the offshore standard is low, say 0-20 ppm, and if it is coupled with a rigorous offshore monitoring, inspection and sanction program then one could expect that discharges might occur elsewhere in the company's operations closer into or onshore. Therefore, given a cost constraint to the company a tightening of operations in one place can mean a loosening of operations in another place which may have greater environmental effects.

The last major finding is the lack of a role for the actual quality of the environment in the setting of discharge standards offshore. In no case discussed did the environmental quality appear to be a significant factor in the standard-setting process. There appeared to be no fundamental change in location, design, technology or operation of any offshore project based solely on environmental quality criteria. Rather in each case standards were tied directly to performance of treatment equipment available for installation on platforms. Data other than for treatment equipment comes from physical aspects of the North Sea such as winds, currents, etc., rather than from any biological or ecological data.

Each of these regulators have quite different perceptions of the other. For example, the SPCA sees the UK as linking its standards to the assimilative capacity of the site whereby treatment equipment is used only when the expected pollution levels will exceed the capacity of that site. On the other hand, the CUEP and PPD see Norway as being very unreasonable in forcing companies to adopt the latest equipment available regardless of cost. As seen from the earlier discussion neither perception is correct.

The analysis of the standard-setting process about chronic oil discharges in the UK and Norway leads to several recommendations as to how the regulators could possibly improve their standard-setting process. While actual performance cannot be evaluated yet, the regulators' decision making intentions and capabilities have been identified and discussed.

In reviewing and updating oil discharge standards it will be necessary to continually monitor ambient distributions and effects on marine organisms. Therefore a comprehensive research program should be organized to assess changes in ambient oil concentrations close and far away from platforms and terminals. In addition, a stronger effort should be made to study the biological effects of oil in the North Sea. As a starting point, marine biologists should be encouraged to state and quantify what they know and what they do not know about biological effects and assess at least the extreme upper and lower limits of detrimental effects from offshore marine pollution. The data from a comprehensive marine research program could then be used to update the information already expressed in present knowledge.

Secondly, it would be advisable to maintain an ongoing file of possible regulatory and treatment options as reference points. At the moment the regulators are forced to evaluate only the technical design proposal made by the developer. The regulator himself does not have sufficient in-house research capacity to come up with specific alternatives to change proposed treatment plans. Consequently, most regulatory decisons will remain patchwork. If the regulator cannot maintain a file of possible treatment alternatives for platforms, the developer should be requested to submit several proposals at different discharge levels for the regulator to select among them.

Thirdly, the regulator should make more explicit his own objectives in dealing with oil discharges, both in terms of internal regulation objectives and in terms of trade-offs between development and environment. Measures of these objectives could then continually be used to analyse present standards and regulations. They could also be used to communicate between central and local regulators and to solicit more useful responses from reviewers in the discharge application review process.

Fourth, there may be some benefit in quantifying some of the intangibles, at least by marking them against reference events or reference alternatives. For example, one may think of qualitatively comparing the assumed biological effects of several

amounts of oil spills with discharges from platforms, both against a "no development" alternative. The step from such a qualitative comparison to a judgemental scaling of effects is not very large. Such quantification could then be updated continually on the basis of new information and lead to faster responses in changing standards and regulations.

Fifth, public participation and advocacy in the standard setting and regulation process could be improved. By this is meant both a higher involvement (for example in the UK review process of discharge applications) and a more structured dialogue, (in eliciting preferences and opinions from environmentalists and fishery representatives). Public participation should be made part of the decision making process rather than operating mainly as an insurance against future complaints and criticism.

All of these suggestions amount to a more comprehensive and integrated system for environmental information collection, evaluation and decision making. While these proposals are costly, considering the highly uncertain future effects of chronic oil discharges, they may turn out to be less costly than future efforts and strains to avert a possible disaster.

The systems perspective of actors in a socio-economic-political process emphasizes comprehensive and integrated responses to environmental management. It is clear that such a response pattern would be quite easy to set aside since the results of a systems approach would not show in the immediate future, except for accident responses which are often soon forgotten by the public. However, the evidence in this study shows that the record is mixed. While core actors do dominate the decision-making system and do attempt to influence other parts of the system to their viewpoint it is clear that other actors are becoming more vocal. The actual persuasiveness of other actors is still open to consideration. Nevertheless, as core actors both the oil industry and the requisite government departments have recognized the necessity of expanding their information network, pressure points and feedback patterns.

The environmental management system in such a vast and unknown area as the North Sea is characterized by situations which call for a joint energy-environment systems response. The roles generated by the core actors of government and industry have worked well to implement the development goals of these actors, namely the maintenance of a steady development pace and increasing scale of development. However, this role has worked only partially well in the overall environmental area, despite efforts by interested parties in industry and government. The fact that impactees and outside experts have a low profile in decision making is shown through the mismatch of roles. Such issues as the above suggest that the decision making system itself may not only be lacking in such respects as including impactees from offshore oil development and non-government affiliated experts but that it is not responding comprehensively nor in any integrated way. A comprehensive technology assessment system would provide

for the inclusion of all actor groups affected by offshore petroleum development. [28] Only those interests will be considered in any assessment when all interested or affected parties are directly involved in the assessment process.

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