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IMCO/FAO/UNESCO/WMO/WHO/IAEA/UN/UNEP
JOINT GROUP OF EXPERTS ON THE SCIENTIFIC ASPECTS OF MARINE POLLUTION
- GESAMP -

REPORTS AND STUDIES

No. 17

The Evaluation of the Hazards of Harmful Substances Carried by Ships

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Reports and Studies No. 17

IMCO/FAO/UNESCO/WMO/WHO/IAEA/UN/UNEP Joint Group of Experts
on the Scientific Aspects of Marine Pollution (GESAMP)

THE EVALUATION OF THE HAZARDS OF HARMFUL SUBSTANCES CARRIED BY SHIPS

IMCO, 1982

NOTES

1. GESAMP is an advisory body consisting of specialized experts nominated by the Sponsoring Agencies (IMCO, FAO, UNESCO, WMO, WHO, IAEA, UN, UNEP). Its principal task is to provide scientific advice on marine pollution problems to the Sponsoring Agencies and to the Intergovernmental Oceanographic Commission (IOC).

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Definition of Marine Pollution by GESAMP

"POLLUTION MEANS THE INTRODUCTION BY MAN, DIRECTLY OR INDIRECTLY, OF SUBSTANCES OR ENERGY INTO THE MARINE ENVIRONMENT (INCLUDING ESTUARIES) RESULTING IN SUCH DELETERIOUS EFFECTS AS HARM TO LIVING RESOURCES, HAZARDS TO HUMAN HEALTH, HINDRANCE TO MARINE ACTIVITIES INCLUDING FISHING, IMPAIRMENT OF QUALITY FOR USE OF SEA WATER AND REDUCTION OF AMENITIES."

* * *

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NOTE

GESAMP wishes to draw attention to the fact that the hazard rationale was developed for the particular purpose of the development of the International Convention for the Prevention of Pollution from Ships, 1973 (MARPOL 73). As a consequence the hazard profiles are intended to be used solely for that purpose. Information should not be extracted from the text or from the tables and used out of context unless the limitations and restrictions imposed upon it by the hazard assessment rationale are fully appreciated.

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* International Convention for the Prevention of Pollution from Ships, 1973

THE EVALUATION OF THE HAZARDS OF HARMFUL SUBSTANCES CARRIED BY SHIPS

(Composite Report)

FOREWORD

This report is being published almost ten years after work started on the assessment of the environmental hazards of substances carried by ships. This work was undertaken initially as preparatory work for the development of the International Convention for the Prevention of Pollution from Ships, 1973 (MARPOL 73). A request was made by the Sub-Committee on Marine Pollution* of the Inter-Governmental Maritime Consultative Organization (IMCO) with regard to questions related to the consideration of hazards which might arise through the accidental spillage of substances carried either in bulk or in packaged form, or through the operational discharge of tank washings by chemical tankers, whenever such discharges might take place. Originally it was envisaged that this might include major inland water-ways, e.g. St. Lawrence Sea Way and Houston Ship Channel. The procedures were therefore initially developed to cover certain forms of fresh water pollution. Following signature of the Convention which deals only with marine pollution, this aspect has been given no further attention. Work has continued throughout the intervening period and reports have been prepared of individual meetings of the GESAMP Working Group on the Evaluation of the Hazards of Harmful Substances Carried by Ships.

Hitherto these reports have only been available to GESAMP members and to the relevant IMCO Committees and Sub-Committees. However, bearing in mind that the original working procedures** have been progressively clarified, GESAMP considered it desirable that the entire package of separate reports be drawn together and published as a single entity, together with all the hazard profiles evaluated to date; at its twelfth session (22-28 October 1981) GESAMP adopted the composite report for publication. It should however be emphasized

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* The Sub-Committee on Marine Pollution was the predecessor of the Marine Environment Protection Committee (MEPC), established by the IMCO Assembly in 1973 (resolution A.297(VIII)).

** The very early work was made available to particularly interested parties as GESAMP document IV/19/Supp.1 but was not published.

that the original working procedures have not been substantively altered. To do so would require changes of the International Convention for the Prevention of Pollution from Ships, 1973 (MARPOL 73) which at the time of preparing this report has not yet entered into force.

In making this report more widely available, GESAMP wishes to draw attention to the fact that the hazard profile rationale was developed for the particular purpose of the development of the International Convention for the Prevention of Pollution from Ships, 1973 (MARPOL 73). As a consequence the hazard profiles are intended to be used solely for that purpose. Information should not be extracted from the text nor from the tables and used out of context unless the limitations and restrictions imposed upon it by the hazard assessment rationale are fully appreciated.

The lists of hazard profiles included in this composite report are accurate as of late 1981 and will certainly remain valid until 1983. It should however be recognized that GESAMP has continually been faced with the problem of limited data availability. This has meant that in many cases extrapolations have had to be made. As more information becomes available, hazard profiles are reviewed and, if necessary, revised. It is recognized that the consequent change of a hazard profile may cause operational problems, but until Governments supply the data necessary for GESAMP to carry out a complete hazard profile assessment the problem will remain. Being aware that in many cases such data have been prepared for restricted distribution only, GESAMP pointed out that such information might, if necessary, be provided to GESAMP on an "In Confidence" basis.

1 INTRODUCTION

1.1 Historical background

In 1969 the Assembly of the Inter-Governmental Maritime Consultative Organization (IMCO) decided to convene an International Conference for the purpose of preparing a suitable international agreement for placing restraints on the contamination of the sea, land and air by ships and other equipment operating in the marine environment.

Late in 1971, in the course of preparing for the International Conference on Marine Pollution, which was held in 1973, the Sub-Committee on Marine Pollution of IMCO experienced considerable difficulty in categorizing pollution hazards of substances carried by ships in a way which could be utilized in the development of control measures. As a means of solving the problem the Sub-Committee on Marine Pollution prepared a detailed enquiry requesting GESAMP to examine a number of lists of chemicals and products and to consider the hazards which these substances might pose to the aquatic environment. A copy of the enquiry is attached to this report as Annex 1. At that time (late 1971) it was the intention that the International Convention, which was to be developed in 1973, should contain regulations for the prevention of pollution by oil, noxious liquid and solid dangerous chemicals carried in bulk, harmful substances carried in packages, portable tanks, freight containers or road or rail tank wagons, as well as sewage and garbage from ships.

Due to the urgency of the problems related to evaluating the hazards of all the substances carried by ships, the then Chairman of GESAMP, Dr. M. Waldichuk, agreed that an Ad Hoc Panel of IMCO and GESAMP experts should be established. A list of members of the Ad Hoc Panel is given in Annex 2. The panel met on three occasions prior to the International Conference on Marine Pollution and, following the second meeting of the Ad Hoc Panel, the proposed methods for assessing the hazards likely to be posed were approved by GESAMP at its fourth session (18-23 September 1972). The outcome of the Ad Hoc Panel was set out in document GESAMP IV/19/Supp.1 which was not published, although it has been made available to interested parties on request and has, as a consequence, been widely distributed. This report updates and replaces both the Rationale and Hazard Profile List included in that original report.

The International Conference on Marine Pollution in 1973 adopted the International Convention for the Prevention of Pollution from Ships, 1973 (MARPOL 73)*. The Convention in its Annex II contains detailed requirements for the discharge criteria and measures for control of pollution by noxious liquid substances carried in bulk. For this purpose noxious liquid substances are divided into four categories depending upon their hazard to marine resources, human health, amenities and other legitimate uses of the sea as evaluated by the Ad Hoc Panel. Some 250 substances had been categorized and were included in the list appended to Annex II to the Convention.

Following the conclusion of the Convention, GESAMP agreed to undertake the on-going task of evaluating the environmental hazards of additional substances carried by ships, and a Working Group was established. This met for the first time in 1974 and has since met on ten more occasions. Both the terms of reference and the membership of the Working Group have changed over the years, although an effort has always been made to maintain continuity in membership. A list of those experts who have been members of the Working Group is given at Annex 3. The two sets of terms of reference are shown at Annex 4. Under the earlier and wider terms of reference the Working Group was also asked by GESAMP to deal with questions which were not directly related to the main task of assessing, through the development of hazard profiles, the environmental hazards of substances carried by ships. Such questions were about the quantities of dangerous goods which might be carried in packaged form without the need to

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* MARPOL 73 covers all the technical aspects of pollution from ships, except disposal of land-generated waste into the sea by dumping and the discharge of substances directly arising out of the exploration and exploitation of sea-bed mineral resources. It consists of Articles, two Protocols dealing respectively with reports on incidents involving harmful substances and arbitration, and five Annexes which contain regulations for the prevention and control of marine pollution by:

(1) oil;

(2) noxious liquid substances carried in bulk;

(3) harmful substances carried in packages, portable tanks, freight containers, or road or rail tank wagons, etc.;

(4) sewage from ships; and

(5) garbage from ships.

The International Conference on Tanker Safety and Pollution Prevention, 1978, by adopting the 1978 MARPOL Protocol modified the provisions of the Convention, referred to hereafter as MARPOL 73/78.

consider pollution prevention measures. Others were related to the interpretation of the expression "rapidly rendered harmless at sea" as used in various international legal agreements on the prevention of marine pollution by dumping of wastes at sea. The results of the considerations of the Working Group were used by IMCO and non-IMCO bodies in subsequent deliberations.

1.2 Factors taken into account in developing the Hazard Evaluation Rationale

As mentioned above, the Ad Hoc Panel of IMCO and GESAMP Experts was requested to develop a means by which substances carried by ships could be classified according to the hazards they might pose if released to the environment. In order to assist the Panel in appreciating the scale and nature of the problem, a report was made available by the Government of Norway on pollution caused by the normal operational procedures of ships engaged in bulk transport. Further information was made available by representatives of the International Chamber of Shipping (ICS). A list of substances reported to be carried in bulk was also provided, as was a list of dangerous goods carried in packages.

In the light of this information the Ad Hoc Panel agreed to consider all shipborne substances with the exception of:

(1) oil, as then defined by the 1954 Pollution Convention*; and

(2) radioactive substances.

Radioactive substances were excluded on the grounds that:

(1) the requirements laid down by the International Maritime Dangerous Goods Code (Class 7) involve a high degree of containment to avoid exposure to individuals; this should be sufficient to minimize accidental spillage and should therefore be adequate to take account of environmental hazards;

(2) the matter would be reviewed by the IMCO Sub-Committee on the Carriage of Dangerous Goods (CDG) in co-operation with the International Atomic Energy Agency (IAEA)**; and

(3) the matter could only properly be assessed by a group of specially selected experts.

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* International Convention for the Prevention of Pollution of the Sea by Oil, 1954.

** IAEA Regulations for the Safe Transport of Radioactive Materials, 1973, Revised Edition - Safety Series No.6.

It was recognized that the definition of oil as laid down in the 1954 Oil Pollution Convention might well be extended to include some of the substances listed as being carried in bulk.

The Ad Hoc Panel concluded that there were a number of circumstances in which substances carried by ships might escape to the environment. For example, packaged goods could be swept overboard as a result of bad weather or be released as a direct result of a collision. As a result the contents of these packages may be released either where they are lost (for example, on the high seas or in the coastal zone) or during or subsequent to being swept on to a beach. Substances carried in bulk might escape to the environment as a result of collisions or of ships sinking. Such releases would occur in the vicinity of the accident.

Shipping experts advised the Ad Hoc Panel that it was rarely possible to unload the entire contents of a tank in a port, and that in most cases the vessel involved would be expected to carry different substances in its tanks on its next voyage. As a result the tanks had to be washed out and the normal practice at that time (1971/72) was to discharge the wash and rinse waters overboard, either in or close to the port of unloading or loading, or en route between ports. The amount of tank washings discharged would be dependent on the product involved and on the design of the tank.

The Ad Hoc Panel agreed it should not consider questions relating to the effects of substances on either the vessel or its crew. Such matters were considered to involve aspects of occupational safety which were covered by other Conventions* and were therefore outside the scope of the Panel. However, since people might come into contact with the substance, its solution or its reaction products after its release into the environment, the Panel believed it necessary to consider these wider aspects of possible hazard to human health.

It was noted that the scope of the proposed Marine Pollution Convention was not clear and that ships involved in sea passages might also travel considerable distances via inland waterways, and almost invariably enter river estuaries. Accordingly it was concluded that any of the substances might enter waters which might be abstracted and used as a source of potable water supplies. However, the Convention did not include inland waterways in its provisions and the consideration of freshwater problems has subsequently been dropped.

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* e.g. the International Convention for the Safety of Life at Sea, 1974 (SOLAS 74).

Using the definition of pollution adopted by GESAMP** the Ad Hoc Panel was asked to evaluate substances according to the hazards they might pose when released into the sea for the following four considerations:

(1) damage to living resources;

(2) hazards to human health;

(3) reduction of amenities; and

(4) interference with other uses of the sea.

Recognizing that the evaluation of hazards would eventually be required for all substances carried by ships, the Ad Hoc Panel made no attempt to select particularly dangerous substances; rather a conscious attempt was made to cover examples from the full range of substances which might be carried in the form of bulk liquid or dry cargoes or as packaged goods. The Ad Hoc Panel noted that guidance was required on the potential scales of problems which might be involved in terms of the bodies of waters which might be affected, e.g. a river, an estuary, coastal waters or deep sea.

Following a thorough analysis of the range of problems which could be encountered in a broadly defined hazard assessment, the Ad Hoc Panel adopted a procedure consisting of a seven-step process which became known as the Hazard Evaluation Procedure. By this procedure hazard profiles were established and were used in 1973 by the International Conference on Marine Pollution in the preparation of the Convention. It was therefore essential that the Hazard Profile Procedure remain in basically the same structure as conceived. Since the 1973 Conference the procedure has not been changed except to modify certain definitions in the light of difficulties encountered. Such modifications have been introduced by way of clarification and have not in any way changed the substance of the procedure except that in 1978 the question of carcinogenesis was introduced (see Section 2.3).

** The working definition of marine pollution adopted for the purposes of GESAMP is "Introduction by man, directly or indirectly, of substances or energy into the marine environment (including estuaries) resulting in such deleterious effects as harm to living resources, hazard to human health, hindrance to marine activities including fishing, impairing of quality for use of sea water and reduction of amenities".

2 THE HAZARD EVALUATION PROCEDURE

2.1 Outline

Figure 1 illustrates the originally developed procedure and its subsequent modifications. This version includes the additions and amendments introduced subsequently by the GESAMP Working Group (with dates). No further mention of the dates of change is made and all the Hazard Profiles set out in Annex 6 to this document have been assessed according to the Procedure as it now stands. It is important to recognize that in assigning a hazard profile to any particular substance it is essential that these steps are followed as summarized below.

The first step in the process of hazard evaluation is designed to ensure that the substance involved is carried by ships and that hazard profiles are not produced unnecessarily.

The second step is designed to eliminate oils from further consideration. These substances were already covered by the 1954 Oil Pollution Convention. A somewhat extended range of oils is listed in Appendix I to Annex I to MARPOL 73/78. Consequently, conditions for the carriage of noxious liquid substances other than oil, plus the procedures and arrangements for the discharge of their residues and tank washings, are covered by a different Annex and differ in several respects from those laid down for oil (e.g. rates of discharge and position of the outlet for the discharge).

The third step was introduced because it is very difficult to establish a safe limit of discharge for substances which are liable to bioaccumulation. Even small discharges may be hazardous since very low concentrations of such substances in the water may be concentrated by marine life and, as a result, pose a hazard, either to the organisms themselves or to their predators, including man. In the special context where the marine organism is commercially exploited its flesh may be rendered unpalatable. For these reasons it is felt that special measures are called for in order to restrict the input of such substances.

FIGURE 1

		Action taken	Details of consideration	Rating assigned in	Session Reports of Working Groups in which changes/clarifications reported
STEP 1					
Is the substance carried by ship?	NO →	Take no further action			
↓ YES					
STEP 2					
Is the substance an oil?	YES → as defined 1954 Convention	Take no further action			1st session 1973 Convention Definition adopted 10th session Substances containing mineral oil rated as as interim measure 1st session Physical properties and behaviour in water recorded
↓ NO					
STEP 3					
Is the substance, or its reaction/degradation product(s) liable to be bioaccumulated?	YES →	Assess duration and potential effect on:	1) Aquatic organisms directly 2) Predators including man 3) Tainting of fish or shellfish flesh	Column A	Definitions clarified 6th, 8th, 9th and 11th sessions
STEP 4					
How great is the risk posed to living aquatic organisms by a single large discharge or repeated small discharges?	→	Assess on basis of acute toxicity as:	1) Highly toxic 2) Moderately toxic 3) Slightly toxic 4) Practically non-toxic 5) Non-hazardous	Column B	Modifications to subsidiary assessments on BOD and blanketing of sea bed at 8th, 9th and 11th sessions
STEP 5					
How great a hazard is posed to human health?	1) →	Assess on basis of acute oral toxicity as:	1) Highly hazardous 2) Moderately hazardous 3) Slightly hazardous 4) Practically non-hazardous 5) Non-hazardous	Column C	
	2) →	Assess on basis of dermal and inhalation toxicity as:	1) Hazardous 2) Slightly hazardous 3) Non-hazardous	Column D	Modification of interpretation introduced at 8th session, defined as such at 11th session
	3) →	Assess potential for specific chronic health effects	Possibility of risk from carcinogenic properties or effects on e.g. nervous system	Columns D and E and Remarks Column	Introduced at 8th session, defined at 9th session and clarified at 10th session
STEP 6					
What impact would a spill have on recreational use of a beach, amenity interests and aesthetics?	→	Assess as:	1) Highly objectionable 2) Moderately objectionable 3) Slightly objectionable 4) No problem	Column E	
STEP 7					
What hazard potential does the substance pose to different bodies of water?	→	Assess in relation to:	1) River 2) Estuary 3) Coastal water 4) Deep sea		Dropped 1st session

The fourth step is followed in order to give a ranking of the potential danger of marine organisms being killed in the short term, either as a result of operational discharges or as a result of major spillages. These dangers are assessed by use of acute toxicity information. It was noted that certain substances may exert a very high oxygen demand as they degrade in the water and it was initially felt desirable to identify substances particularly likely to pose such problems. Similarly, certain substances, especially bulk solids, if spilt in large quantities, may blanket the sea-bed and render it unsuitable for marine fauna, and indication is given where such dangers are felt likely.

The fifth step provides for the ranking of potential short and longer term dangers to humans, other than ship or dock-side personnel, who might accidentally or unwittingly come into contact with the substance. These dangers are assessed by examination of published information on oral, skin and inhalation toxicity.

The sixth step is a somewhat subjective one. It was introduced in the light of several actual incidents and is designed to make provision for the protection of amenity interests such as beach use and water sports, e.g. sailing. Aesthetic considerations such as discolouration of the water, objectionable smells and creation of scums or floating material are also taken into account.

The seventh step was necessary in the pre-1973 Convention days to provide some measure of the potential of a substance to create a hazard in particular water bodies. In order to illustrate this, hypothetical bodies of water were postulated in which the quantity of substance being carried could be shown to be potentially dangerous. The assessment proved useful in combining the previous hazard evaluations and in drawing attention to the protective measures needed. The step has not been used since 1973.

2.2 Detailed explanation of the hazard evaluation steps

Prior to the 1973 Conference, no records of the basis of decisions were kept by the Ad Hoc Panel. Subsequently it was recognized that from time to time questions would be raised as to the information used in the derivation of the hazard profiles. It was therefore agreed, at the first meeting of the GESAMP Working Group (1974), that a data sheet should be completed for each substance for which a hazard profile was assigned. These sheets are stored at IMCO for future reference and updated as necessary. A copy of a blank data sheet is included in this report as Annex 7. Most of the substances originally assessed by the Ad Hoc Panel have subsequently been re-examined by the GESAMP Working Group. Where this is the case, data sheets have been prepared. The data sheets are the property of GESAMP and as such are intended as working records. They are not made available to outside persons, although details can be made available on request through the IMCO Secretariat of GESAMP in consultation with the Chairman of the Working Group.

Each substance is listed under a commonly accepted chemical name. Where substances are commonly known by several such names, those names are listed but the hazard profile is given under one name and the reader is referred to that name and entry at each of the additional entries. It is recognized that various formal nomenclature systems exist but, as these are not universally adopted the Working Group has used these names of substances listed in the Bulk Chemicals* and Dangerous Goods Codes** developed by IMCO. Trade-names are listed in the Hazard Profiles only in exceptional circumstances (see section 5).

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* Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk;

** International Maritime Dangerous Goods Code.

Based on the procedure shown in Figure 1 each substance is given a hazard profile, an example of which is shown below:

	Bioaccumulation	Damage to living resources	Hazard to human health		Reduction of Amenities	
			Oral intake	Skin contact and inhalation		
Substances	A	B	C	D	E	Remarks
Carbolic oil	T	3	2	I	XX	Rated as creosote (wood tar)

2.2.1 Column A - Bioaccumulation

Bioaccumulation occurs if an aquatic organism takes up a chemical to which it is exposed so that it contains a higher concentration of that substance than is present in the ambient water or its food. The process is usually reversible, although the rates of loss may be substantially slower than the rate of uptake. Where the rate of metabolism or elimination of the substance is high and the degree or period of exposure is small, bioaccumulation may be short-lived. Where the rates of metabolism or elimination are low or the degree or period of exposure great, bioaccumulation may be of long duration.

The hazard posed by a substance is increased if the substance is accumulated in aquatic organisms, since poisoning of the organisms may eventually ensue. The effect on the target organism in so far as the end result is concerned is the same whether the accumulation takes place directly from the water or via the consumption of food. Furthermore, once accumulated in an aquatic organism, predators, including man, may be adversely affected. In certain situations there may be no adverse health effect but the palatability of fish or shellfish may be adversely affected through tainting of their flesh.

Accumulation is not necessarily harmful and in some cases with naturally occurring substances may even be beneficial. Such accumulations are disregarded. Occasionally a substance may be altered in the environment and as a consequence become more readily bioaccumulatable and harmful, e.g. mercury may be changed to methyl mercury. Similarly some compounds are degraded or metabolised fairly readily but yield products which are either equally or more harmful, e.g. aldrin is metabolised to dieldrin. Substances such as these are considered in terms of their reaction products.

It was felt that the hazard evaluation procedure should distinguish between those substances which have a long residence time in the animal and are harmful and those which are harmful but have a shorter residence time in the animal. Similarly in view of the importance of commercial fishing it was felt important to identify substances which might affect the acceptability of the appearance or taste of fisheries products. This is important even if the effect is short-lived; consumer confidence is only slowly restored once affected by an off-flavoured meal.

Four symbols have been adopted. Brief definitions of these symbols are given in the summary legend to the hazard profiles in Annex 5 but the detailed definitions adopted, i.e. the ones to which the Working Group operate, are as follows:

"+" Refers to a substance which is known to be accumulated to a significant extent by marine organisms, which is not readily excreted or degraded into a less harmful metabolite by the organism and which as a consequence is known, or strongly suspected to be harmful to the animal, or to man if he eats the organism. Examples are mercury compounds and DDT.

Note 1: No precise definition of the words "significant extent" has been adopted but it is generally agreed that a material which is bioaccumulated to the extent of one hundredfold would be a candidate for this rating. Similarly where the log of the octanol:water partition coefficient (log P_{OW}) exceeds three the substance would be a candidate for inclusion. Final inclusion is dependent on the assessment of likely harm.

Note 2: Substances which are known to be converted to other substances which by themselves will fall within this definition are included in this group.

"T" Refers to a substance which is known to be accumulated by marine organisms with the result that sea food is tainted and rendered unpalatable. Examples are chlorophenols

Note 1: Where a substance causes taint but also merits a "+" rating, a "+" rating only is allocated.

Note 2: Where a substance causes taint it would be given a "T" rating even though it is known to have a relatively short half-life in the animal.

"Z" Refers to a substance which is known or strongly suspected to be accumulated by marine organisms but which is rapidly lost (half-life of about 1 week or less) by that organism when it moves or is moved from the zone of exposure. Substances are only given this rating when they are also known or strongly suspected to be harmful to the organisms or man. "Z" ratings are allocated to most of the short chain halogenated aliphatic hydrocarbons (C_2-C_8).

"0" Indicates a substance for which there is no evidence to support one of the above ratings (+, T or Z).

Note: The symbol is used in cases where the available evidence or scientific assessment indicates that a substance will not accumulate or that there is little possibility of the compound being harmful to the animal or man, even though the bioconcentration factor or partition octanol:water coefficient (P_{OW}) indicates that bioaccumulation does or may occur. Examples of such compounds are the higher alcohols and phthalates.

"-" Indicates a substance for which data are not available to the Working Group to enable them to make an assessment.

Wherever possible the Working Group will make a tentative assessment based either on comparison with other structurally similar substances or some such extrapolation. Where this is done the rating is shown in parenthesis, e.g. (+), indicating inadequate evidence to give a firm evaluation but enough to indicate this is the most likely correct assessment. The ( ) symbol has a similar meaning in Columns B and C. Because the assessment of potential impact on amenities (Column E) is necessarily a subjective one and in view of the multiplicity of toxicological effects which are taken into account in assigning a rating to Column D, the ( ) symbol is not used for Columns D or E. The "-" symbol may be used in any of the columns and always indicates insufficient data to make an assessment.

It was recognized that a number of compounds which are usually regarded as pollutants also occur naturally, examples being benzo-a-pyrene and the halomethanes, e.g. methyl iodide and chloromethane. It may therefore be wrong to regard small-scale inputs, e.g. from tank washings, as being detrimental to the environment. However, information on the naturally occurring concentrations of such substances is sparse and its accuracy is uncertain. The Working Group will keep this topic under review but until reliable information becomes available on the relative inputs (man-made and natural) of such substances it was considered prudent to rate them according to the standard hazard procedure.

2.2.2 Column B - Damage to living resources

2.2.2.1 Direct toxic effects

In order to rank the hazard posed to living resources the most practical solution available was considered to be the use of acute toxicity test data. Wherever possible 96hr TLm* data relating to marine species are used and wherever possible the Working Group use data relating to adult or juvenile stages of organisms representing the middle to upper levels of an aquatic food chain, e.g. crustacea or fish. Where data are not available for marine species but are available for freshwater species these may be used after due consideration of the possible effect on toxicity of the different water medium. Where data are available for several species, generally the figure which indicates the greater degree of hazard is used. Wherever possible data are checked as to the reliability of the test procedures used and if such checks indicate the data are unreliable they will be ignored, e.g. bad test conditions, use of a particularly sensitive or resistant species etc. Artemia (brine shrimp) data are not usually accepted by the Working Group.

Where it is known that a chemical is likely to be altered once it has entered the aquatic environment the original substance is rated taking into account the expected product. This rule is followed especially strictly when the substance is changed into a more toxic substance.

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* TLm: The concentration of a substance which will, within the specified time (generally 96 hrs) kill 50% of the exposed group of test organisms, often specified in mg/l (parts per million; ppm)- synonymous with LC_{50}.

The Working Group is fully aware that other stages in the life cycle of aquatic organisms are more sensitive than those which are usually the subject of toxicity testing. It is also well aware that chronic or sub-lethal effects may manifest themselves after prolonged exposure to much lower concentrations than those which are acutely toxic and that these may ultimately be more important in their effect on the marine ecosystem. Similarly it is recognized that behaviour and chemoreception capabilities may be affected at concentrations considerably lower than the 96hr TLm. These factors were taken into account when the use of acute toxicity test data was adopted as the means of hazard ranking. The hazard profile system required by IMCO simply calls for a means of ranking hazard and the only type of data sufficiently widely available to permit this to be done with reasonable accuracy is that relating to acute toxicity tests.

It must be emphasized that the concentration bands selected do not mean that under other circumstances a substance with a 96hr TLm above 1000 mg/l would not be harmful nor does it mean that in other situations subdivisions below 1 mg/l would not be appropriate. However, it was considered that if the 96hr TLm exceeded 1000 mg/l then it was unlikely, in the context under consideration, to pose a significant hazard to marine organisms. Similarly any substance with a 96hr TLm less than 1 mg/l was considered to be sufficiently toxic to merit the strictest precautions to prevent it entering the sea. Four subdivisions of the category were considered appropriate. These are shown in Annex 5.

As mentioned earlier, in most cases data relating to fish and/or crustacea are used wherever possible. A few substances have been considered which it was known were likely to have particularly serious effects on algal organisms including phytoplankton; in such instances these effects were taken into account in assessing the rating given.

2.2.2.2 Indirect toxic effects

It was originally considered that in certain areas (enclosed bays, lagoons and inland waterways), especially under tropical or sub-tropical conditions, certain substances would be so rapidly degraded biochemically

that the biochemical oxygen demand (BOD) exerted on the water column might lead to severe oxygen depletion which in turn might cause fish mortalities. For this reason it was felt desirable to indicate substances where this risk was considered most severe. The BOD rating, in combination with effects related to blanketing of the sea floor, was taken into account at the 1973 Conference and does feature in the Guidelines for the Categorization of Noxious Liquid Substances in Appendix I to Annex II to MARPOL 73/78 by which substances were divided into different pollution categories. (see Annex 8).

However, when attempts were made to quantify the assignment of a BOD rating difficulties were encountered. It was noted at this time that of the 54 substances originally allocated a BOD rating, 14 had not been considered worthy of any measure of control. The BOD ratings were accordingly removed from these 14 substances. Moreover, it was noted that no liquid substance could be identified which had a high BOD and caused blanketing of the sea-bed. Subsequent consideration of this problem led to the conclusion that under most circumstances it was unlikely that the discharge of chemicals to the sea from ships would lead to serious deoxygenation of the water. It was therefore decided that notification of BOD hazards is no longer necessary unless it is associated with blanketing effects.

A number of substances have been assessed which it was considered were liable, if spilt in substantial quantities, to blanket the sea-bed rendering it unsuitable for bottom living animals and plants. To date the only such substances have all been solids; no liquid has been considered sufficiently dense and insoluble that it was likely to blanket the sea-bed and cause a significant problem.

2.2.3 Columns C and D - Hazards to human health

It was considered that as a consequence of pollution of the sea or waterways a substance might pose a hazard to humans by one or more of three possible ways, namely:

(1) through ingestion of fish or shellfish which have accumulated toxic substances;

(2) from ingestion of water containing the substances;

(3) from the adverse action of the substance or its vapour or the substance in solution, on the skin, eyes, or respiratory tract, or through absorption via the skin to affect internal organs.

The first of these routes was considered amply covered by the bioaccumulation assessment under Column A but the other two routes were considered worthy of separate assessment; the latter being particularly relevant in the context of consideration of the potential impact on amenity interests.

2.2.3.1 Column C - Ingestion of water containing the chemical

It was recognized that ingestion of water contaminated by the substance being assessed may pose both an acute and long-term problem. However, it was considered that consumption of contaminated water was likely to be rare and to extend over a short time period, and it was therefore considered that the acute toxicity situation was that which needed to be guarded against. As with the assessment of the hazards to living resources, a factor which had to be taken into account was the availability of suitable data on which to base an assessment. These considerations led to the conclusion that the most appropriate data to use would be oral LD50 data*.

It is recognized that the degree of hazard posed to human life might be modified by factors such as dilution, degradation of the substances in water or by aquatic life and the extent, if any, of their removal by water treatment processes or evaporation. However, the main requirement in the context under consideration is a simple comparative ranking system. The hazard is therefore assessed in terms of oral LD50 values, as determined in suitable mammalian species, on the assumption that the hazard increases with toxicity. It was considered that if the LD50 exceeded 5000 mg/kg then the substance could, in the context under consideration, be regarded as non-hazardous. Similarly it

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* LD50: The dose of a substance which it is calculated will, within the specified conditions of the test, kill 50% of a group of test animals to which it has been administered. The dose is usually expressed in terms of mg of the substance administered for each kg of the animals body weight. Oral LD50 usually refers to a single dose expressed in the terms stated.

was decided that substances with an LD50 less than 5 mg/kg merited the strictest measures of control to prevent them entering the aquatic environment by discharges from ships or contaminating recreational areas as a result of accidental spillages or loss of packages.

The five ratings as adopted are shown in Annex 5. It must be emphasized that these descriptions of non-hazardous, slightly hazardous, hazardous, etc. do not indicate that water contaminated by the concentrations of the substance indicated would be safe for drinking. A completely different set of toxicological criteria is needed to define standards for drinking water. The ratings and the descriptive terms used are intended purely to reflect the degree of concern which should be shown if the chemical were released from a ship.

As stated above, in making the assessment of acute hazard to human health, oral LD50 data are normally used. However, in certain cases the toxic action of a substance (and hence its LD50) might be highly dependent on concentration. In such cases the use of the LD50 figure for a pure or concentrated substance might give a misleading impression of the degree of hazard involved in ingesting a dilute solution (e.g. acids or alkalies). Accordingly, for such substances the hazard rating also takes into account the properties of dilute solutions.

Data relating to human exposures are comparatively uncommon and usually the assessment is made on the basis of LD50 data for laboratory mammals. Where data are available for several species or test conditions, those indicating the greatest toxicity are usually used unless they are radically different and there is reason to believe that they are of doubtful relevance to human health hazard assessment. When human data are available they relate to accidental or suicidal exposure situations, where dosages may be difficult to estimate. Thus, although such human data are taken into account, they may only in part be the basis for human hazard evaluation.

2.2.3.2 Column D - Risk to human health via skin or inhalation

It was recognized that some substances, their vapours or aqueous solutions, may cause irritation or injury to the skin, mucous membranes or eyes. A few

substances may also cause allergic reactions in a proportion of an exposed population. Some chemicals are readily absorbed through the skin and may cause injury to internal organs. Because of their physical properties, certain substances carried by ships are liable, in the event of spillage, to contaminate beaches. These may pose a particular hazard to human health from direct contact or from inhalation of their vapours. It is considered that the narcotic action of vapours from volatile substances is unlikely, in other than the most confined conditions, to present a health risk. With rare exceptions, this risk is not considered in the context under consideration. The Working Group took into consideration the fact that certain delayed and/or persistent toxic effects could develop subsequent to exposures to high single doses or a few moderate doses of certain substances. Column D has also been used to call attention to these special cases, for example see section 2.4. Three categories are considered appropriate to classify the hazards posed by aqueous solutions or water borne films or scums of the substances being considered:

Hazardous	Contact leads to severe irritation (pain and burns) of the skin and mucous membranes and injury to the eyes on short contact. The vapour may cause similar injuries and damage to the lungs even at low concentrations. Substances may be strongly allergenic. Absorption of substance through the skin may lead to damage to internal organs. There is potential for delayed or persistent toxicity.
Slightly hazardous	Contact likely to lead to mild skin irritation (reddening with or without slight pain) of a temporary nature. Vapour likely to cause temporary mild irritation to eyes or mucous membranes to a degree that subjects find unpleasant. Injury to internal organs is unlikely.
Not hazardous	Substances which on short exposure are unlikely to lead to irritation, allergy or local injury. Substances which are not absorbed to any significant extent through the skin. Substances which evaporate rapidly, the substance and the vapour do not cause irritation to the skin, eyes or mucous membranes or lungs. Note: the effects of prolonged or repeated contacts have not been considered.

2.2.4 Column E - Reduction of amenities

It was agreed at the outset that amenities should be understood to embrace all aspects of recreational use of the aquatic environment including its appearance. Thus reduction of amenities may be a consequence of the presence of poisonous, irritant or foul-smelling or appearing substances that may be released by ships. Objectionable slicks, floating scums or other floating or suspended materials on the sea surface or on the beach may also result from such releases. Impairment of scenic values may also be brought about by discolouration of the water, or by conversion of some of the liquid substances into solids, by polymerisation on exposure to air and sunlight.

Where substances are both persistent and either poisonous, irritant, foul-smelling or otherwise obnoxious, the seriousness of the effect on amenities will be greatly increased. While transient interference with recreational use of coastal areas, lasting perhaps for up to 48 hours, may be regarded merely as a nuisance, longer term persistence of effects, particularly the presence of poisonous or irritant substances may create serious problems in areas of importance to the holiday and tourist industries. For this reason substances which are highly persistent and which are capable of producing long-term effects, are given a high hazard rating. They will also have been given a high rating under Column D.

A hazard to human health may occur if noxious liquid or solid substances, contained in drums or packages, are lost from a ship and are washed up on the shore. The Working Group was aware of many such incidents, some involving highly hazardous chemicals and others quite harmless ones. Particular note is taken if substances have the potential for chronic health effects (see e.g. section 2.4).

The local hazard arising from such packages or containers, if opened or damaged, will be similar to that considered and evaluated in the handling and carriage of dangerous goods. If the substances cannot be identified by suitable markings, then the containers and packages have to be regarded as hazardous to human health and/or the environment until proved otherwise; in such circumstances local closure of beaches may be desirable. The Working Group recognizes that the development and use on all packages, drums, containers, etc. of a marking system which will be capable of withstanding

immersion in the sea for a period of months will involve additional expense. Nevertheless, it is felt that the advantages of some simple identification system (not necessarily the full label) are such as to render desirable its introduction as a requirement of the International Maritime Dangerous Goods Code.

The risk to amenities and human health due to inflammable materials carried ashore, or from toxic gases which are carried in bulk is not considered by the Working Group in relation to amenities. It is understood that measures are taken within IMCO to minimize these risks in the context of other Conventions.

On the basis of the above considerations the four point rating procedure shown in Annex 5 was considered appropriate.

2.3 Other considerations and remarks

Consideration was given at the outset to the need to assign hazard ratings to the possible interference, by substances released from ships, with other uses of the sea, such as:

(1) with fishing or navigation through the presence of containers or bulky objects on the sea floor;

(2) with ship operations from persistent floating or suspended materials such as plastic, netting, bags and sheets;

(3) underwater corrosion of structures in docks or harbours; and

(4) impairment of water quality for industrial use.

However, this was felt to be inappropriate, mainly due to the wide variety of possible effects, some of which are not attributable to polluting effects as such.

The Remarks Column is used to include additional comments about the substance, e.g. an unusual hazard which has been taken into account in the assessment, or drawing attention to some particular property which has been assumed, e.g. gas, or when several closely related compounds are rated as a single substance.

2.4 Carcinogenic properties

A particular aspect which was introduced at the eighth session of the GESAMP Working Group was consideration of the carcinogenic properties of a substance. This was discussed to consider the reality of there being a carcinogenic risk as a result of marine pollution, as defined by GESAMP, arising from shipping operations. The Working Group also discussed how this hazard could be indicated in a way that IMCO could note but which would not automatically, by virtue of the hazard profile assigned, force the adoption of unduly stringent pollution prevention measures.

It was noted that the UN Group of Rapporteurs does take carcinogenic properties into account when considering the measures requires to protect personnel involved in transport and associated activities. However it was apparent that such measures are not designed to take account of marine pollution aspects on which matters IMCO looks to the GESAMP Working Group for advice.

After due consideration of the potential pollution situations the GESAMP Working Group is required to discuss, it was concluded that a carcinogenic hazard to the health of bathers or members of the public enjoying marine amenities was unlikely to rise as a result of tank washing operations. However, it was considered that such a hazard might arise in the event of a large spill or through broken or leaking containers which might contaminate commercial fish catches or be deposited on beaches. Accordingly, the Working Group concluded that such risks should be noted in the hazard profile. It should be noted that consideration is given only to human health risks, the possibility of carcinogenic effects on marine biota was not considered to have sufficiently serious implications to the well-being of the resource as a whole.

Recognizing that a substantial body of evidence is available demonstrating that a large number of chemicals have, under particular circumstances, been observed to have carcinogenic properties, it was agreed that a very selective process of identification should be used. It was also recognized that all the previously rated substances would have to be evaluated.

At the time this task was undertaken, the number of substances which had already been assigned hazard profiles was about 1000. A comparison of these substances with those listed by the US National Institute of Occupational Safety and Hygiene (NIOSH) as suspect carcinogens produced 114 candidate substances. Further examination of the lists indicated that many of these 114 substances were named in the NIOSH list for reasons other than established carcinogenic activity in mammals. This left a total of only 49 compounds. These were compared with the information contained in the reviews of the cumulative work of expert committees of the International Agency for Research

on Cancer (IARC)*. As a separate approach, the cumulative IARC list of carcinogens was compared with the list of 1000 or so substances assigned hazard profiles to ensure the NIOSH listing of suspects had not omitted any possible candidates.

The individual IARC monographs for each of the 49 candidate substances were then reviewed and a judgement was made as to whether carcinogenicity either in man or laboratory mammals, had been reasonably established. The Working Group agreed that compounds which had only been demonstrated to cause tumours at the site of subcutaneous injections in laboratory mammals should not be considered to pose a demonstrable hazard with respect to possible pollution incidents as a result of marine transport. In addition several compounds which had been demonstrated to be carcinogenic at high doses** in laboratory mammals were considered unlikely to persist on beaches for repeated exposure, even in the event of a large spill; these were therefore only identified as "carcinogens" in the remarks column - no other notation or change to the hazard profile was introduced for these substances. The same process of assessment is now followed for all substances considered by the Working Group. On completion of the assessment of the original 1000 compounds it was concluded that only 27 substances should be identified as posing a carcinogenic risk in the type of environment envisaged by the Working Group. In the course of the evaluation of additional substances the number of substances which have been identified as posing a carcinogenic risk has been increased to 42 of a total of approximately 1200 compounds.

Consideration was given to how the attention of IMCO could be drawn to the potential carcinogenic hazard. It was concluded that the introduction of a new symbol would be confusing and could as a result be counter-productive. Enhanced ratings in any of Columns A, B or C would have caused substantial alterations to pollution categorization requirements and was therefore rejected. However, the regulatory impact of enhanced ratings in Columns D or E would in itself be minimal, as Columns D and E have little automatic effect on the pollution category assigned by IMCO, unless moderately high hazard assessments are also assigned in Columns A, B or C.

Compounds which have clearly been established as causing cancer in man, or which have produced malignant tumours in animals through systemic action

* Tomatis, L. Ann. N.Y. Acad. Sci. 271, 398-409, 1976;
Tomatis, L et al. Cancer Research 38m 977-985, 1978.

** It is recognized that the term "high doses" is somewhat subjective and as such is dependent on expert judgement. Generally, however, the term is used in relation to tests in which an increased incidence of tumours was produced only after repeated, prolonged doses at or near the maximum dose tolerated by the test organism with respect to other non-carcinogenic toxic actions of the substance.

and which are of a chemical nature to suggest potential reactivity with cellular genetic material, are considered to have a serious potential for carcinogenic hazard to man. Such chemicals are rated II in Column D and XXX in Column E, notation is given in the remarks column as "human carcinogen" if this is appropriate or as "carcinogen" if the evidence relates only to animals. The hazard symbols used are felt to be consistent with the hazard posed (Column D) and the impact that would be felt by amenity interests and the response which would be taken by the authorities concerned (Column E) - i.e. closure of beaches.

Recognizing that the introduction of the carcinogenicity hazard was a development which had taken place after the conclusion of the 1973 MARPOL Conference, the Working Group gave some consideration as to what steps IMCO might take to incorporate the assessment in its categorization schemes. It was considered that, provided tank washings are not discharged close to land, the risk to human health would be small and the Group noted that through the notation of XX or XXX in Column E the lowest assignment possible would be pollution category D of Annex II of MARPOL 73/78 which means that tank washings are not allowed within 12 miles of land. However, the Working Group considered it was reasonable to expect that precautions should be taken to prevent accidental spillage of large volumes of such substances or the possibility of packages containing such substances being washed up on beaches. To this end it is suggested that consideration should be given by the appropriate IMCO Committee to the transport of such bulk liquids in middle tanks or, if in packages, stowage under deck or in some other position where the possibility of accidental loss overboard is minimal.

2.5 Amendment Procedures

It has always been recognized that for many substances only tentative hazard assessments will initially be possible. Subsequently it is hoped that additional information will become available which confirms the tentative rating, or at least allows a firm rating to be assigned. It is also recognized that test procedures are improving and that new data may become available which may necessitate a review of earlier assessments.

Furthermore, from time to time hazard assessments are challenged either by individual manufacturers, trade associations, or by government administrations or Sub-Committees of IMCO. The proper procedure by which new information should be brought to the attention of the Working Group is that it should be provided in full to the IMCO Technical Secretary for GESAMP at IMCO Headquarters in London, who will bring it to the attention of the Working Group at the next possible opportunity.

Any individual member of the Working Group may question any hazard assessment or individual hazard rating of any substance previously considered. To allow for such eventualities and in recognition that the hazard profiles are used by IMCO bodies as a basis for decision on ship type, tank washing arrangements, labelling, stowage, etc., a protocol has been devised to ensure that amendments to hazard profiles are only made with adequate reason and after serious consideration of the implications.

The Working Group prepared guidelines on amendment procedures which stipulate that:

(1) no change should be considered to an existing rating unless a clear proposal is made for such a change;

(2) no change should be made unless there is positive scientific evidence that the change is justified;

(3) in the event of a proposal to change an existing rating, the members of the Working Group are then required to decide between the following alternatives:

  (a) advocate no change;

  (b) agree to the proposed change; or

  (c) propose another change, which must be other than a "-" (dash) rating;

(4) There should be no change of any rating without unanimous agreement in the Working Group.

3 SOURCES OF AND REQUIREMENTS FOR DATA

The information used by the Working Group in assigning hazard profiles to substances comes from a wide variety of sources. In recent years the Governments of the United States of America, the United Kingdom of Great Britain and Northern Ireland, Sweden and the Netherlands have provided information on short lists of substances. This has saved considerable time and effort on the part of the Working Group, although it has not of course eliminated the need for careful cross-checking of available information or comparison with other data. IMCO has developed a questionnaire which governments are expected to complete when submitting new substances or proposals for shipping regulations.

For the most part, however, the Working Group has had to seek data from various literature sources and to make its own assessment of which information should be given the most credence. The source of data used is recorded on the data sheets for individual substances which are filed at IMCO Headquarters. As the data are taken from individual scientific papers as well as from major compilations of data, it is not practicable or even appropriate in a report of this nature to give all the references used. However, as a general guide to the most commonly used reference sources a selected list of references is given at Annex 9.

As a means of pooling resources, links have been established with the International Registry of Potentially Toxic Chemicals (IRPTC) of the United Nations Environment Programme (UNEP). It is hoped that when the Working Group encounters difficulties in obtaining data UNEP will be able to search this Registry. Conversely, if IRPTC need information on chemicals assessed by the Working Group this can be provided by extraction from the Data Sheet. It also has access to the updated lists of hazard profiles which can be exchanged and made available through IMCO shortly after each Working Group meeting.

As the work has progressed the Working Group has encountered increasing problems of deficiency of data. These have been particularly obvious in relation to the effect on living resources. Unless data are available for a similar substance a rating is not possible for such substances until data are provided; this may require the commissioning of toxicity tests by the interested party. Concern has been expressed that the resultant data might not meet the standards of current laboratory techniques. Accordingly the advice of the Working Group has occasionally been sought with respect to the type of aquatic toxicity test which should be conducted. After due consideration it has been concluded that it is not the task of the Working Group to establish standard test procedures. Such matters are under discussion in such fora as the International Organization for Standardization (ISO) and the Organisation for Economic Cooperation and Development (OECD) and some national organizations have made their own recommendations.

Nevertheless, by way of <u>general guidance</u> the Working Group has offered the following advice in relation to its requirements for aquatic toxicity testing:

> Tests should be conducted using a marine fish and a marine crustacean in sea water and should produce 96hr TLm values. If continuous flow conditions are not utilized the exposure medium should be changed at least every 24 hours. Full details of the test procedure used should be provided with the results. Results obtained using tests which do not meet these requirements would still be considered and it is emphasized that within sensible limits any aquatic toxicity data are better than no data at all.

4 CONSIDERATION OF CLASSES OF CHEMICALS

During recent years as the number of representatives of particular classes of compounds has increased considerably, it has been found useful to review the hazard profiles for entire classes of compounds. In this way the consistency of use of the various hazard ratings is ensured and, where necessary, data for individual substances can be reviewed and where appropriate, amendments can be made.

In the course of this process a number of generalizations have been made as described in the following paragraphs.

4.1 Alcohols

It was considered that BOD problems severe enough to be worthy of preventative measures are unlikely to occur with compounds above C_4 or with a tertiary carbon atom - e.g. tertiary butyl alcohol. Alcohols above C_7 are mobile waxy solids at most ambient temperatures and would, if released into the marine environment, cause some interference with the amenity use of beaches. As such they merit a single X in Column E. Alcohols above C_{18} would not be mobile and an X rating would not be justified. Alcohols show an increase in toxicity to marine organisms with increase in carbon number but in practice the extent of this increase is limited by their water solubility. Above C_{12} it was considered unlikely that toxic concentrations could be maintained in the natural environment and such alcohols are rated "0". Allyl alcohol is considered an exception in relation to its potential effect on amenities because of its unusually objectionable smell.

4.2 Halogenated compounds

In the course of reviewing the profiles of aliphatic halogenated substances it was noted that there was no direct evidence of short-term bioaccumulation for many of these compounds. However, it was noted that in connexion with work on EDC tars (residues from vinyl chloride production which contain a large proportion of ethylene dichloride (1,2 Dichloroethane)) and the definition of bioaccumulation for the purposes of the Oslo Convention*, a number of specific chlorinated compounds had been specifically identified as giving rise to short-term bioaccumulation (Jensen and Renberg, Oslo Commission Papers). These studies followed reports in the early 1970s of deaths of marine organisms in the wake of vessels dumping EDC tars. In addition the halocarbon profile obtained from marine organisms after exposure to EDC tars, indicated that most, if not all, of the 200 or so observed but not separately identified halocarbons (C_2-C_8) in EDC tar were accumulated. On the basis of this evidence, it was agreed that a "Z" rating would be appropriate for many of the halocarbons containing 2 - 8 carbon atoms. Further consideration of the technical information available on this type of compound, in particular the partition octanol:water (P_{OW}) coefficients, the lack of reported presence of any of the C_1 compounds in marine organisms and the information on half-lives in biota of some of the lower aliphatic compounds, led the Working Group at its twelfth session to conclude that a "Z" rating for every halogenated aliphatic compound would be ill-advised.

* Convention on the Prevention of Marine Pollution by Dumping from Ships and Aircraft, 1972.

The group of compounds was then examined as a complete series and such information was considered for each compound. It was concluded that for practical purposes a value of about 1.5 or greater for the log P_{OW} could be used as an indication of a candidate for a "Z" rating. Final assignment of this symbol being dependant on the evidence for harm and persistence in the animal. As a consequence, for example, brominated organic compounds are considered rather more rigorously than chlorinated organic compounds.

4.3 Phthalates

The phthalates have been reviewed as a group of compounds on a number of occasions. In the course of review it was noted that there has been a substantial number of reports on the presence of these compounds in marine organisms. The Working Group recognized that the accurate chemical analysis of these commonly used products is very difficult and that there must be some reservations over the compound identification and the actual quantities present. Nevertheless, the fact that they are detected indicates that bioaccumulation occurs in the marine environment. The consensus was that the lower phthalates, up to dipropyl, were unlikely to be significantly bioaccumulated (based on octanol:water partition coefficients). Above this there is sufficient evidence to indicate that most phthalates may be bioaccumulated by marine organisms. However, the evidence for and against this bioaccumulation proving harmful is conflicting.

At the twelfth session of the Working Group consideration was given to the most recent information from uptake and loss experiments and tests on reproduction with the most widely used phthalates. It was concluded that excretion of phthalates by most marine organisms is probably rapid. Therefore, at concentrations likely to be encountered as a consequence of discharges or spillages from ships, harm as a result of the short-term bioaccumulation is unlikely to arise. It was noted that tests are being undertaken in a number of countries to further clarify the effects, both long and short-term, of phthalates on man and other animals and that there are suggestions that certain phthalates may be carcinogenic. Accordingly, it was agreed that the entire set of hazard profiles for phthalates should be reviewed by the Working Group at a later stage.

5 CONSIDERATION OF MIXTURES UNDER TRADE OR GENERIC NAMES

Many of the substances carried by ships are known only by their trade-names. Some of these are pure substances but a substantial number are mixtures which are used as chemical raw materials. As such the same substance is likely to be known by several different trade-names depending on which company produces the substance. It is also likely that its precise composition will vary depending on the customer's requirements and on the feed

stocks available to the producer at the time of manufacture. In spite of these problems many of these trade-name substances are expected to be carried under MARPOL 73/78 requirements and as such require a hazard profile before they can be assigned a pollution category. The Working Group is of the opinion that substances should not be carried only under trade-names and feels that shipments should be made under clearly stated chemical descriptions.

The Working Group is prepared and will attempt in exceptional cases to assign a hazard profile to substances with only trade-names, provided adequate relevant information on the properties is supplied on the substances concerned. At the same time, an assurance is required of the manufacturer that the composition of the substance will remain constant within given limits. A description of the composition of the product is also required. If details are provided in confidence the content of the data sheet will not be made available to other parties. However, the hazard profile will be included in the composite list, or subsequent updatings thereof.

A number of substances are made available for shipment which are known simply by generic titles, e.g. acrylic ester, which may mean one of a number of acrylic esters of which there may be many compounds or isomers. The Working Group is in principle opposed to such practices and will require details of which compounds may be carried under the generic name. If the necessary information is provided the Working Group will assign a hazard profile, provided adequate data are available for it to do so. The hazard assessments will be carried out on the assumption that the substance is the most hazardous member of the generic group of substances.

6 CONSIDERATION OF SUBSTANCES CONTAINING MINERAL OIL

On a number of occasions the Working Group has been asked to assign a hazard profile for substances containing mineral oils. Full details of their composition have usually been provided, although in some cases the precise nature of the mineral oil was not known. Although the hazard assessment procedures required the exclusion of all substances which are classified as mineral oil under the terms of MARPOL 73/78, Annex I of this Convention does not give a comprehensive list of mineral oils, only a list of examples. Additionally, the question of how to deal with the transport of mixtures, especially substances containing mineral oils, has still to be resolved by the IMCO Sub-Committee on Bulk Chemicals (BCH).

Under these circumstances and fully recognizing that the requirements for carriage, tank washings, etc., differ from Annex I to Annex II of MARPOL 73/78, the Working Group has experienced difficulties in resolving this problem. As an interim measure, it has been agreed that hazard profiles will continue to be assigned to substances containing oil. This decision is of course, subject to the provision of full information on the composition and properties of the substances and the remarks column will include a note to the effect that the substance contains mineral oil, even though its name may make this clear. This procedure will be reviewed when a clear decision has been reached by the relevant IMCO Committees.

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ANNEX 1

INQUIRY TO GESAMP

The Inter-Governmental Maritime Consultative Organization (IMCO) has scheduled an International Conference on Marine Pollution for the fall of 1973. Presently under consideration is a draft convention which will address pollution of the marine environment by the marine transportation of bulk and packaged "noxious substances"; a "noxious substance" being a product or concentration of a product, other than oil, sewage or garbage or refuse, yet to be defined.

The following decisions are examples of those that have to be made by the Conference concerning the marine transportation of "noxious substances" to minimize any damage to the marine environment.

1. What degree of containment is required, that is, the structure of vessels carrying the products in bulk or the containers for packaged shipments?

2. What degree of sophistication is required for cargo (product) handling and control?

3. What limit, if any, should be placed upon cargo (product) shipment size?

4. What limit, if any, needs to be placed upon the intentional discharge of substances in the process of tank washing?

5. What degree of operational control must be placed upon vessels carrying "potential noxious substances"?

The decisions to be made concerning the carriage of "noxious substances" will directly affect mankind in general by not only protecting the environment but changing the cost or even the availability of certain products basic to his society. IMCO must make these decisions and solicits the assistance of GESAMP in reaching these decisions.

Therefore, IMCO requests GESAMP to review the attached list of products and consider their hazard to the environment if released accidentally or deliberately into the water.

Specifically GESAMP is requested:

(1) to evaluate substances under at least four degrees of hazard, according to each of the following effects when released into the sea:

(a) damage to living resources;

(b) hazards to human health;

(c) reduction of amenities;

(d) interference with other uses of the sea;

in doing so, take into account the release in the following four forms:

(i) through normal operation of ships other than the disposal of shore-generated waste;

(ii) through marine casualties to ships carrying cargoes in bulk;

(iii) through marine casualties to ships carrying cargoes in packages;

(iv) through accidental spillage (e.g. overflow),

(2) to indicate how their hazard ratings apply to areas such as rivers, estuaries, inshore waters, enclosed seas, and deep ocean, under the different climatic conditions,

(3) to specify as far as possible criteria and critical parameters used in determining hazard ratings of the substances.

IMCO is prepared to provide such information as it has and to assist GESAMP as much as possible in this extremely necessary and important task. The time constraints dictate an urgent response from GESAMP. It would therefore be desirable to receive their reply if possible by 31 May 1972.

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ANNEX 2

LIST OF MEMBERS OF THE ORIGINAL IMCO/GESAMP AD HOC PANEL
ON ENVIRONMENTAL HAZARDS OF NOXIOUS SUBSTANCES
OTHER THAN OIL TRANSPORTED BY SHIPS

Address 1972/1973

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ANNEX 3

LIST OF SESSIONS AND EXPERTS PARTICIPATING IN SESSIONS OF THE WORKING GROUP ON THE EVALUATION OF THE HAZARDS OF HARMFUL SUBSTANCES CARRIED BY SHIPS
(originally referred to Substances in the Marine Environment)

Session

1	London 14-15 October 1974	7	London 4-6 July 1977
2	London 4-6 June 1975	8	Bergen 22-26 May 1978
3	London 15-17 October 1975	9	Burnham 5-9 November 1979
4	London 12-14 July 1976	10	London 2-6 June 1980
5	London 22-24 October 1976	11	Houston 15-19 December 1980
6	Delft 9-13 May 1977	12	London 21-25 September 1981

Experts	Session numbers											
	1	2	3	4	5	6	7	8	9	10	11	12
Dr. P.G. Jeffery United Kingdom (Chairman 1974-78)	X	X	X	X	X	X	X	X				
Dr. J.E. Portmann United Kingdom (Chairman since 1978)	X	X	X	X	X	X	X	X	X	X	X	X
Dr. C.H. Thompson United States	X				X	X		X				
Dr. B-E. Bengtsson Sweden	X	X	X	X	X	X	X	X	X	X	X	X
Mr. L. Føyn Norway	X	X	X	X	X	X	X	X	X	X	X	
Prof. E. Vigliani Italy	X		X	X								
Ms. D.M. Adema Netherlands			X	X	X	X	X	X	X	X	X	X
Dr. V. Zitko Canada			X									
Dr. B. Ballantyne United States							X	X		X	X	X
Mr. T.A. Wastler United States							X					
Dr. K.W. Wilson United Kingdom							X					
Prof. S.D. Murphy United States								X	X	X	X	X
Dr. P. Lefcourt United States								X				
Mr. D. Ehreth United States											X	X
Secretaries												
Mr. S.L.D. Young (IMCO)	X	X	X	X	X							
Mr. B. Okamura (IMCO)						X	X					
Dr. M. Nauke (IMCO)								X	X	X	X	X

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ANNEX 4

TERMS OF REFERENCE

1 Terms of reference given by GESAMP at its sixth session (Geneva, 22-28 March 1974) to the Working Group on the Evaluation of the Hazards of Harmful Substances in the Marine Environment:

(1) to examine and evaluate available data and to provide such other advice as may be requested, particularly by IMCO, for evaluating the environmental hazards of harmful substances carried by ships, in accordance with the rationale approved by GESAMP for this purpose (GESAMP IV/19/Supp.1); and

(2) to examine annually the Review of Harmful Substances (GESAMP Reports and Studies No. 2, New York 1976) in accordance with Recommendation 88 of the United Nations Conference on the Human Environment (Stockholm, 5-16 June 1972) in order to amend the Review if and when appropriate.

2 Terms of reference amended by GESAMP at its eighth session (Rome, 21-27 April 1976):

The second part of the terms of reference concerning the updating of the Review of Harmful Substances was deleted and consequently the title of the Working Group was changed to "Working Group on the Evaluation of the Hazards of Harmful Substances Carried by Ships".

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ANNEX 5

ABBREVIATED LEGEND TO THE HAZARD PROFILES

Column A - Bioaccumulation

+ Bioaccumulated to significant extent and known to produce a hazard to aquatic life or human health

Z Bioaccumulated with attendant risk to aquatic organisms or human health, however with short retention of the order of one week or less

T Bioaccumulated, liable to produce tainting of seafood

0 No evidence to support one of the above ratings (+, Z, T)

Column B - Damage to living resources

Ratings		96 hr. TLm
4	Highly toxic	less than 1 mg/1
3	Moderately toxic	1-10 mg/1
2	Slightly toxic	10-100 mg/1
1	Practically non-toxic	100-1000 mg/1
0	Non-hazardous	greater than 1000 mg/1

D Substance likely to blanket the sea-bed

BOD Substance with oxygen demand.
See paragraph 2.2.2.2

Column C - Hazard to human health, oral intake

Ratings		LD50 (laboratory mammal)
4	Highly hazardous	less than 5 mg/kg
3	Moderately hazardous	5-50 mg/kg
2	Slightly hazardous	50-500 mg/kg
1	Practically non-hazardous	500-5000 mg/kg
0	Non-hazardous	greater than 5000 mg/kg

Column D - Hazard to human health, skin contact and inhalation

II	Hazardous
I	Slightly hazardous
0	Non-hazardous

Column E - Reduction of amenities

Ratings

XXX	Highly objectionable because of persistency, smell or poisonous or irritant characteristics; as a result beaches liable to be closed; also used when there is clear evidence that the substance is a human carcinogen
XX	Moderately objectionable because of the above characteristics, but short-term effects leading only to temporary interference with use of beaches; also used when there is credible scientific evidence that the substance is an animal carcinogen but where there is no clear evidence to indicate that the material has caused cancer in humans

X Slightly objectionable, non interference with use of beaches

0 No problem

Other Symbols

Ratings in brackets, ( ), indicate insufficient data available to the GESAMP experts on specific substances, hence extrapolation was required.

NA Not applicable (e.g. if gases)

- Indicates data was not available to the GESAMP Working Group.

Note: The descriptive terms such as highly toxic, non-hazardous etc., were used by the original panel for the purposes of the 1973 International Conference on Marine Pollution. They have no particular significance in terms of hazard posed outside the particular circumstances addressed by that Conference and IMCO Sub-Committees, i.e. marine pollution as a consequence of discharges or spillages from ships.

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ANNEX 6

HAZARD PROFILES

Substances	Bioaccumulation A	Damage to living resources B	Hazard to human health: Oral intake C	Hazard to human health: Skin contact and inhalation D	Reduction of Amenities E	Remarks	Considered/ Revised
Acetaldehyde	0	2	1	0	X		3/73 6/75
Acetic acid	0	2	1	0	0		3/73 5/77
Acetic anhydride	0	2	0	0	0		3/73 6/75
Acetone	0	0	0	0	0		7/76 9/81
Acetone cyanohydrin	0	4	3	II	XX		3/73 6/75
Acetonitrile	0	0	1	0	0		3/73 6/75
Acetophenone	0	(2)	1	0	0		10/75
Acetyl bromide	0	(2)	(2)	I	XX		11/76
Acetyl chloride	0	2	(2)	II	XX		6/75 11/76 6/80 12/80
Acetylene tetrabromide	Z	(3)	2	II	XX		11/79
Acetylene tetrachloride	See 1,1,2,2-Tetrachloroethane						
Acetyl iodide	0	(2)	(2)	I	XX		11/76
Acid butyl phosphate	0	-	-	II	XX		11/76 6/80
Acid mixtures (Hydrofluoric and Sulphuric)	0	3	2	II	0		11/76
Acid mixtures (nitrating acid)	0	2	1	II	0		11/76
Acrolein	T	4	3	I	XXX		3/73 6/75
Acrylamide	0	1	2	II	XX	Delayed neurotoxicity	7/76 6/80
Acrylate ester	0	1	2	I	XX		11/79

Substances	A	B	C	D	E	Remarks	
Acrylic acid	0	1	2	II	XX		3/73 11/74 10/75 6/80
Acrylic latex	0	(0)	0	0	XX		3/73 11/74 10/75 6/80
Acrylonitrile	0	3	3	II	XXX	Human carcinogen	3/73 6/80
Adiponitrile	0	1	3	I	X		11/74
Alcoholic beverages	0	0	0	0	0		10/75
Aldrin	+	4	2	I	XX	Carcinogen	3/73 11/79
Alkane sulphonic acids	0	-	2	I	X		11/76
Alkyl benzene (C_9-C_{17})	0	(0)	(0)	0	XX		11/79
Alkyl benzene sulphonate (straight chain)	0	2	1	0	0		3/73
Alkyl benzene sulphonate (branched chain)	0	3	1	0	0		3/73
Alkyl benzene sulphonic acid	0	2	1	I	0		6/80
Allyl alcohol	0	3	2	0	XX		2/73 11/76
Allyl bromide	See 3-Bromopropene						
Allyl chloride	Z	2	2	II	XX		3/73 5/78
Allyl chloroformate	0	-	-	I	XXX		11/76
Allyl iodide	0	(3)	(3)	II	XX		11/76 5/78
Allyl isothiocyanate	0	(2)	2	II	XX		11/74
Allyl trichlorosilane (stabilised)	0	(1)	(1)	II	XX		11/76 6/80
"Alphanol 79"	0	2	(1)	0	X		5/78 11/79
Alum (15% solution)	0	1	0	0	0		3/73
Alumina	0	D	0	0	0		3/73
Aluminium bromide	0	(2)	(1)	I	XX		11/76
Aluminium chloride	0	1	1	0	X		10/75
Aluminium phosphide	0	3	3	II	XX		11/79
1-Amino-3-aminomethyl-3, 3,5-trimethylcyclohexane	See Isophoronediamine						
Aminobenzene	See Aniline						
1-Aminobutane	See n-Butylamine						

Substances	A	B	C	D	E	Remarks
Aminocyclohexane	See Cyclohexylamine					
Amino-3,4-dimethylbenzene	See Xylidenes					
2-Aminoethanol	See Ethanolamine					
Aminoethylethanolamine	0	(1)	1	I	X	7/76 12/80
1-Amino-2-ethylhexane	See Mono-2-ethylhexylamine					
6-Aminohexanoic acid, lactam	See Caprolactam					
Aminomethane	See Monomethylamine					
Aminomethylbenzene	See Toluidenes					
2-Aminopropane	See iso-Prolylamine					
Aminotoluene	See Toluidenes					
Aminotrimethylcyclo-hexane	See Trimethylcyclohexylamine					
Ammonia (anhydrous and aqueous)	0	2	1	I	X	3/73 10/75 7/76 7/77 11/79
Ammonium arsenate	+	3	-	-	0	3/73
Ammonium fluoride	0	1	2	I	X	11/79
Ammonium hydrogen fluoride	0	2	(2)	0	X	11/76
Ammonium metavanadate	0	(2)	(2)	0	0	11/79
Ammonium nitrate	0	1/BOD	1	0	0	3/73
Ammonium phosphate	0	1/BOD	0	0	0	3/73
Ammonium polyvanadate	0	(2)	(3)	I	X	11/79
Ammonium silicofluoride	See Silicofluoride					
Ammonium sulphate	0	1	1	0	0	5/78 11/79
iso-Amyl acetate	0	2	0	0	X	3/73
n-Amyl acetate	0	2	0	0	X	3/73
iso-Amyl alcohol	0	2	1	0	0	10/75
n-Amyl alcohol	0	1/BOD	1	0	0	3/73
tert-Amyl alcohol	0	0	1	0	0	3/73 9/81
Amyl chloride	See 1-Chloropentane					
tert-Amylenes	(0)	(2)	(1)	0	0	9/81
Amyl mercaptan	T	2	2	0	XXX	3/73
Amyl trichlorosilane	0	(1)	1	II	XX	11/76 6/80

Substances	A	B	C	D	E	Remarks	
Aniline	0	2	2	II	XX		3/73
Aniline hydrochloride	0	2	2	II	0		3/73
ortho-Anisidine	0	2	1	II	XX		11/79 6/80 12/80
Anisoyl chloride	0	(1)	(1)	0	XX		11/76 9/81
Anthracite	0	D	0	0	0		3/73
Antimony compounds	+	2	3	II	XXX		3/73 5/78
Antimony lactate	+	2	2	0	0		3/73
Antimony pentachloride (liquid)	+	(2)	1	II	XX		11/79
Antimony pentachloride (solutions)	+	(2)	1	0	0		11/79
Antimony pentafluoride	+	(2)	(2)	II	XXX		5/78
Antimony potassium tartrate	+	2	2	0	0		3/73
Antimony trichloride (solid)	+	2	1	II	XX		11/79
Antimony trichloride (solutions)	+	2	1	I	0		11/79
Apatite	0	D	0	0	0		3/73
meta-Arsenic acid	+	(3)	3	0	0		3/73
ortho-Arsenic acid	+	(3)	3	0	0		3/73
Arsenical flue dust	+	3	2	0	0		3/73
Arsenic bromide	+	3	4	I	0		3/73
Arsenic compounds (liquid, N.O.S.)	+	3	4	II	XXX	Human carcinogen	7/76 11/79
Arsenic compounds (solid, N.O.S.)	+	3	4	II	XXX	Human carcinogen	7/76 11/79
Arsenic (metallic)	(+)	(3)	2	II	XXX	Human carcinogen	11/79
Arsenic pentoxide	+	(3)	3	0	0		3/73
Arsenic trichloride	+	3	4	I	0		3/73
Arsenic trioxide	+	3	2	II	XXX	Human carcinogen	3/73 11/79
Atrazine	0	3	1	0	XXX		3/73

Substances	A	B	C	D	E	Remarks	
1-Azacycloheptane	See Hexamethylene imine						
Azinphos methyl	0	4	4	II	XXX		6/80
Aziridine	See Ethyleneimine						
Ball clay	0	D	0	0	0		3/73
Barium azide	0	2	2	0	XX		3/73 11/76
Barium compounds (N.O.S.)	0	0*	0	0	0	* D if in bulk	11/76
Barium cyanide	0	4	3	I	0		3/73 11/76
Barium metal	0	0	0	0	X		11/76
Barium oxide	0	2	1	I	0		3/73 11/79
Barley	0	0/BOD	0	0	X		3/73
Battery fluid (acid)	0	2	1	I	0		11/76
Battery fluid (alkaline, corrosive)	See Sodium hydroxide						
Bauxite	0	D	0	0	0		3/73
Benzene	0	2	1	II	XXX	Human carcinogen	10/75 11/76 11/79
Benzene acetate	0	(1)	(1)	0	0		10/75 9/81
Benzene sulphonyl chloride	0	1	1	II	XX		11/79
1,2-Benzene dicarboxylic acid, butyl benzyl ester	See Butyl benzyl phthalate						
1,2-Benzene dicarboxylic acid, butyl ester	See Dibutyl phthalate						
1,2-Benzene dicarboxylic acid, decyl octyl ester	See Octyl decyl phthalate						
1,2-Benzene dicarboxylic acid, diethyl ester	See Diethyl phthalate						
1,2-Benzene dicarboxylic acid, di-2-ethyl hexyl ester	See Di-2-ethyl hexyl phthalate						
1,2-Benzene dicarboxylic acid, diheptyl ester	See Diheptyl phthalate						
1,2-Benzene dicarboxylic acid, diisobutyl ester	See Diisobutyl phthalate						
1,2-Benzene dicarboxylic acid, dimethyl ester	See Dimethyl phthalate						
1,2-Benzene dicarboxylic acid, dinonyl ester	See Dinonyl phthalate						

Substances	A	B	C	D	E	Remarks	
1,2-Benzene dicarboxylic acid, dioctyl ester	See Di-n-octyl phthalate						
1,2-Benzene dicarboxylic acid, dipropyl ester	See Dipropyl phthalate						
1,2-Benzene dicarboxylic acid, ditridecyl ester	See Ditridecyl phthalate						
1,2-Benzene dicarboxylic acid, diundecyl ester	See Diundecyl phthalate						
Benzidine	0	(3)	2	II	XXX	Human carcinogen	3/73 11/79
Benzoic acid	0	1	1	0	0		11/76 9/81
Benzoic acid, 4 methoxy chloride	See Anisoyl chloride						
Benzonitrile	0	2	1	I	X		11/79
Benzotrichloride	0	-	-	II	XX		11/79
Benzoyl chloride	0	1	1	0	XX		11/76 9/81
Benzyl acetate	0	(1)	1	-	-		12/75 12/80
Benzyl alcohol	0	2/BOD	1	0	0		3/73 5/77
Benzyl bromide	0	-	1	I	X		11/76
Benzyl chloride	0	3	1	II	XX		11/76 12/80
Benzyl chloroformate	0	-	-	0	XXX		11/76
Benzyl cyanide (liquid)	0	(2)	2	I	X		11/79
Benzyl ether	See Dibenzyl ether						
Benzylidene chloride	0	(3)	1	II	XX		7/76
Beryllium chloride	0	2	2	II	XXX	Carcinogen	3/73 11/74 7/76 11/79
Beryllium compounds (N.O.S.)	-	2	2	II	XXX	Carcinogen	3/73 7/76 11/79
Beryllium powder	0	2	2	II	XXX	Carcinogen	3/73 11/74 11/79
Blue gas	See Water gas						
Boracic acid	See Boric acid						
Borax	0	1	2	0	0		3/73 5/78
Bordeaux arsenites	+	2	3	0	XX		3/73
Boric acid	0	1	2	0	0		5/78

Substances	A	B	C	D	E	Remarks
Boron trifluoride, acetic acid complex	0	-	-	-	XX	11/76
Boron trifluoride, propionic acid complex	0	-	-	-	XX	11/76
Bran pellets	0	0/BOD	0	0	0	3/73
Brazil nuts	0	0	0	0	0	3/73
Bricks	0	0	0	0	0	3/73
Bromine	0	3	2	II	XX	3/73
Bromine pentafluoride	0	(3)	(2)	II	XXX	11/76
Bromine trifluoride	0	(3)	(2)	II	XXX	11/76
Bromoacetic acid (solid)	0	(2)	2	0	X	11/76
Bromoacetic acid (solution)	0	(2)	2	0	X	11/76
Bromoacetone	0	2	(2)	I	XX	3/73 9/81
Bromoacetyl bromide	0	(2)	(2)	II	XX	11/79
Bromobenzyl cyanide	Z	2	(3)	II	XX	3/73 9/81
1-Bromo-2,3-epoxy propane	-	-	-	-	-	11/79
Bromoethane	0	-	-	I	X	5/78 9/81
Bromoethene	See Monobromoethylene					
Bromoform	Z	(3)	(2)	II	XX	11/79
Bromomethane	0	2	-	II	XX	5/78 9/81
3-Bromopropene	Z	(3)	3	II	XX	5/78
Brucine	0	2	3	I	0	7/76 5/78
1,3-Butadiene (inhibited)	---------gas---------					3/73
Butanal	See n-Butyraldehyde					
Butane	---------gas---------					3/73
Butanedioic acid	See Succinic acid					
trans-Butanedioyl chloride	See Fumaryl chloride					
Butanoic acid	See Butyric acid					
Butanoic acid, butyl ester	See n-Butyl butyrate					
1-Butanol	See n-Butanol					
2-Butanol	See sec-Butanol					
iso-Butanol	0	1	1	0	0	11/76 9/81
n-Butanol	0	1	1	0	0	11/76 9/81
sec-Butanol	0	(1)	1	0	0	11/76 5/77
tert-Butanol	0	1	1	0	0	7/76 11/76
2-Butanone	0	0	1	0	0	3/73

Substances	A	B	C	D	E	Remarks
Butene	---------gas---------					6/80
cis-Butenedioic acid	See Maleic acid					
2-Butoxyethanol	See Ethyleneglycol, monobutyl ether					
iso-Butyl acetate	0	2	1	I	0	6/80
n-Butyl acetate	0	2	1	I	0	6/80
sec-Butyl acetate	0	1	0	0	X	3/73
iso-Butyl acrylate	0	1	0	0	X	6/80
n-Butyl acrylate	0	1	1	I	X	6/80
n-Butylamine	0	2	2	II	XX	7/76 6/80
sec-Butylamine	0	(2)	2	II	XX	6/80
tert-Butylamine	0	(2)	2	II	XX	6/80
Butyl benzyl phthalate	(+)	3	1	0	X	11/79 12/80
n-Butyl butyrate	(T)	(2)	0	0	X	3/73 12/80
Butyl carbitol	See Diethylene glycol, monobutyl ether					
n-Butyl chloride	Z	-	1	-	-	5/78
Butylene	---------gas---------					10/75
Butylene glycol(s)	0	1/BOD	0	0	0	3/73
1,2-Butylene oxide	0	-	-	I	X	7/76
Butyl ether	See Dibutyl ether					
iso-Butyl formate	0	(2)	1	-	0	9/81
iso-Butyl formate and iso-butanol (mixture)	0	(2)	1	I	X	6/80 9/81
Butyl glycol acetate	0	(2)	(2)	0	0	6/80
Butyl lactate	0	-	2	II	X	10/75 12/80
iso-Butyl methacrylate	0	1	0	0	X	3/73 6/80
n-Butyl methacrylate	0	1	0	I	X	3/73 6/80 9/81
1-tert-Butyl-4-methyl benzene	See para-tert-Butyl toluene					
Butyl phenols (liquid)	T	(3)	(1)	I	X	11/79
Butyl phenols (solid)	T	3	1	I	X	11/79
Butyl phosphoric acid	See Acid butyl phosphate					
Butyl stearate	-	-	(1)	-	-	10/75 6/80 9/81
para-tert-Butyl toluene	T	3	1	I	X	10/75 11/76
Butyl trichlorosilane	0	1	(1)	II	XX	11/76 6/80

Substances	A	B	C	D	E	Remarks	
iso-Butyraldehyde	0	2	1	I	X		3/73
n-Butyraldehyde	0	3	0	0	X		3/73
iso-Butyric acid	(T)	(1)	2	II	XX		5/77 6/80
n-Butyric acid	T	1	1	II	XX		5/77 6/80
Butyrolactone	0	0	1	II	XXX	Carcinogen	3/73 11/79
Cacodylic acid	+	3	2	0	XX		3/73
Cadmium alkyl salicylate	-	-	(2)	0	0		6/80
Cadmium chloride	+	4	2	II	XXX	Carcinogen	11/79
Cadmium compounds	+	4	2	II	XXX	Carcinogen	11/79
Calcium alkyl salicylate	-	-	(2)	0	0		6/80
Calcium alkyl salicylate (basic)	0	0	0	I	XXX		6/80
Calcium arsenate	+	2	3	0	XX		3/73
Calcium arsenate and arsenite (solid mixtures)	+	2	3	0	XX		3/73
Calcium chloride (solutions)	0	0	0	0	0		3/73
Calcium hydrogen sulphite (solution)	0	(2)	-	0	X		11/76
Calcium hydroxide	0	1	0	0	0		3/73
Calcium hypochlorite	0	3	1	I	X		3/73
Calcium naphthenate	T	3	3	0	X		5/78 12/80 9/81
Calcium phosphate	0	D	0	0	0		3/73
Camphor oil	T	0	2	0	XX		3/73 5/77
Caprolactam	0	1	1	0	0		10/75 5/78 9/81
Caproic acid	See Hexanoic acid						
Carbaryl (Sevin)	+	4	1	0	XX		3/73
Carbolic oil	T	3	2	I	XX	rated as cresols (wood tar)	7/76
Carbon anode pellets	0	D	0	0	0		3/73
Carbon disulphide	(T)	2	3	I	XXX		3/73 11/74 10/75 6/80 12/80

Substances	A	B	C	D	E	Remarks	
Carbonic acid, diethyl ester	See Diethyl carbonate						
Carbon monoxide	---------gas---------						5/78
Carbon tetrabromide	Z	(3)	1	I	0		10/75 5/78 9/81
Carbon tetrachloride	See Tetrachloromethane						
Carbophenothion	-	4	3	II	XXX		6/80
"Cardura E10"	0	3	1	II	XX		6/80
Cashew nut shell oil	0	0	0	I	XX		6/80
Castor oil	0	0	0	0	XX		3/73 5/77 9/81
Caustic alkali liquids (N.O.S.)	See Sodium hydroxide						
Caustic potash	0	2	1	I	0		3/73
Caustic soda	See Sodium hydroxide						
Celluflex	See Tricresylphosphate						
Cement	0	D	0	0	0		3/73
China clay	0	D	0	0	X		3/73
Chloral	See Trichloroacetaldehyde						
Chloral hydrate	See Trichloroacetaldehyde						
Chlorine	0	4	N/A	II	XX	gas	3/73
Chlorine trifluoride	0	(3)	(2)	II	XX		5/78
Chloroacetaldehyde	0	3	3	II	XX		11/79 6/80
Chloroacetic acid	0	2	2	0	0		3/73
Chloroacetone	0	2	3	II	XXX		3/73 9/81
Chloroacetyl chloride	0	2	2	0	X		11/76
2-Chloroaniline	See ortho-Chloroaniline						
3-Chloroaniline	See meta-Chloroaniline						
4-Chloroaniline	See para-Chloroaniline						
meta-Chloroaniline	Z	3	2	I	XX		7/76 9/81
ortho-Chloroaniline	Z	3	2	I	XX		7/76 9/81
para-Chloroaniline	Z	3	2	I	XX		7/76 9/81
Chlorobenzene	Z	3	1	0	X		3/73
para-Chlorobenzyl chloride	Z	(3)	(1)	I	XX		11/79
2-Chloro-1,3-butadiene	Z	(2)	1	II	XXX	Human carcinogen	3/73 11/74 10/75 6/80 12/80 9/81

Substances	A	B	C	D	E	Remarks
1-Chlorobutane	Z	-	1	-	-	5/78
alpha-Chloro-4 chlorotoluene	See para-Chlorobenzyl chloride					
Chlorodifluoromethane	---------gas---------					10/75
Chlorodinitrobenzene	Z	3	1	II	XXX	5/78 9/81
2-Chloro-1-ethanal	See Chloroacetaldehyde					
1-Chloroethane	0	0	N/A	0	0	3/73 5/78 9/81
2-Chloroethanol	See Ethylene chlorohydrin					
Chloroethene	See Vinyl chloride					
Chloroethylene	See Vinyl chloride					
Chlorofenvinphos	-	-	3	II	XXX	6/80
Chloroform	See Trichloromethane					
1-Chloroheptane	-	-	-	-	-	5/78
1-Chlorohexane	-	-	-	-	-	5/78
Chlorohydrins	0	(1)	2	I	XX	3/73 11/74 12/80
Chloromethane	0	1	(1)	0	0	5/78 9/81
3-Chloro-4-methyl phenyl isocyanate	-	-	-	II	XX	11/79
Chloronitroanilines	Z	(4)	2	I	XX	11/79 9/81
Chloronitrobenzene	Z	4	2	0	X	5/77
Chloro-ortho-nitrotoluene	Z	2	1	I	XX	11/79 6/80 12/80 9/81
4-Chloro-2-nitrotoluene	See Chloro-ortho-toluene					
1-Chlorooctane	See n-Octyl chloride					
Chloro-ortho-toluene	T	3	-	I	X	9/81
1-Chloropentane	-	-	-	-	-	5/78
Chlorophenates	See Sodium pentachlorophenate					
Chlorophenyl trichloro-silane	(+)	-	(1)	II	XX	11/76 6/80
Chloropicrin	(Z)	(3)	3	II	XXX	3/73
Chloroprene	See 2-Chloro-1,3-butadiene					
1-Chloropropane	See n-Propyl chloride					
2-Chloropropane	Z	-	-	-	-	5/78
1-Chloro-2-propanol	See Propylene chlorohydrin					

Substances	A	B	C	D	E	Remarks	
Chloro-2-propanone	See Chloroacetone						
1-Chloropropene	See 1-Chloropropylene						
2-Chloropropene	See 2-Chloropropylene						
3-Chloropropene	See 3-Chloropropylene						
2-Chloropropionic acid	0	2	1	II	XX		6/80
1-Chloropropylene	Z	-	1	-	-		5/78
2-Chloropropylene	Z	-	-	-	-		5/78
3-Chloropropylene	Z	2	2	II	XX		5/78
Chlorosulphonic acid	0	2	1	I	0		3/73
4-Chlorotoluene	See para-Chlorotoluene						
ortho-Chlorotoluene	T	3	-	-	-		12/80
para-Chlorotoluene	Z	(3)	1	I	X		3/73 11/74 12/80
4-Chloro-ortho-toluidine hydrochloride	0	-	2	I	XX	Carcinogen	7/76 11/79
Chlorotoluidines	0	-	2	I	XX	Carcinogen	11/79
Chrome concentrates	0	0	0	II	XXX	Human carcinogen	3/73 11/79
Chrome ore	0	D	0	0	0		3/73
Chromic acid	3	2	2	I	X		3/73 5/78
Chromic fluoride (solid and solution)	-	-	2	-	XX		11/76
Chromium oxychloride	0	4	(1)	I	XX		5/77
Chromium trioxide (anhydrous)	Z	2	2	I	X		5/78
Chromosulphuric acid	0	(2)	(1)	II	XXX		11/79
Citric acid	0	1/BOD	0	0	0		3/73 5/77
Citric juices	0	0	0	0	0		6/80 9/81
Clay	0	D	0	0	0		3/73
Coal (dust)	0	D	0	0	X		3/73
Coal gas	---------gas---------						5/78
Coal (large)	0	0	0	0	0		3/73
Coal tar creosote	See Creosote, coal tar						
Cocculus (solid)	0	4	4	0	XX		3/73
Coconuts	0	0	0	0	0		3/73
Coconut oil	0	0	0	0	X		3/73 9/81

Substances	A	B	C	D	E	Remarks
Codfish (fresh, salted)	0	0	0	0	X	3/73
Cod liver oil	0	0	0	0	XX	3/73 9/81
Coke	0	0	0	0	0	3/73
Coke breeze	0	D	0	0	X	3/73
Colemanite	0	1	2	0	0	3/73
Copper acetoarsenite	+	2	3	0	XX	3/73
Copper arsenite	+	3	3	0	XX	3/73
Copper concentrates (sulphides)	0	2	1	0	0	3/73 9/81
Copper cyanide	+	3	3	I	XX	3/73
Copper ore	See Copper concentrates					
Copra	0	0/BOD	0	0	X	3/73
Cotton seed cake	0	0/BOD	0	0	X	3/73
Cotton seed oil	0	0	(1)	I	XX	6/80
Creosote (coal tar)	0	2	1	I	XX	3/73 6/80
Creosote (wood)	T	3	2	I	XX	7/76
Cresol (mixed isomers)	T	3	2	II	XX	3/73 6/80
Cresylic acid	See Cresol					
Crotonaldehyde	0	3	2	I	XX	3/73
Cumene	0	2	1	0	X	11/76
Cupriethylene diamine	+	(3)	(2)	I	X	3/73
Cyanides (including solutions)	See Potassium cyanide					
2-Cyanoethanol	See Ethylene cyanohydrin					
Cyanomethane	See Acetonitrile					
Cyanogen bromide	0	4	3	II	XX	3/73
Cyanogen chloride	0	4	3	II	XX	3/73
2-Cyanopropan-2-ol	See Acetone cyanohydrin					
Cyanuric chloride	0	3	2	II	XX	11/79
Cyclododecatriene	0	3	1	II	XX	11/79
Cycloheptane	0	1	(1)	II	X	10/75 12/80
Cyclohexane	0	2	1	II	X	3/73 6/80
Cyclohexanol	0	2	1	II	X	3/73 6/80
Cyclohexane/cyclohexanol (mixture)	0	2	1	II	X	3/73 6/80
Cyclohexanone	0	1	1	0	0	3/73

Substances	A	B	C	D	E	Remarks
Cyclohexenyl trichloro-silane	0	(1)	1	II	XX	5/77 6/80
Cyclohexylamine	0	2	2	II	XX	3/73 11/79 12/80
Cyclohexyl isocyanate	0	-	-	II	XX	11/79
Cyclohexyl trichlorosilane	0	(1)	(1)	II	XX	5/77 6/80
Cyclotrimethylene trinitramine	0	-	2	0	XX	5/78
Cygon	0	4	2	I	XXX	3/73
para-Cymene	0	2	1	I	X	3/73 12/80
2,4-D	See Dichlorophenoxyacetic acid					
DDT	+	4	2	0	XXX	3/73
Decaborane	0	-	3	II	XX	5/78
Decahydronaphthalene	0	(1)	1	0	X	3/73 12/80
iso-Decaldehyde	0	-	1	I	0	10/75 12/80
n-Decaldehyde	0	-	1	I	0	10/75 12/80
Decanal	See n-Decaldehyde					
Decane	0	(1)	(1)	0	0	12/80
Decanedioic acid, dibutyl ester	See Dibutyl sebacate					
Decanedioic acid, dimethyl ester	See Dimethyl sebacate					
Decanoic acid	0	(0)	(1)	I	X	5/77
1-Decanol	0	3	1	0	X	3/73 11/76 11/79
iso-Decanol	0	3	0	0	X	3/73 11/76 11/79 12/80
Decene	0	(2)	(1)	0	0	3/73 10/75 12/80
Decyl acrylate	0	-	1	I	X	6/80
iso-Decyl acrylate	-	-	0	0	X	6/80
Decyl adipate	-	-	-	-	-	7/76
Decyl octyl alcohol	See 1-Octadecanol					
Demeton-S-methyl	-	-	2	II	XXX	6/80
Dextrose solution	0	0	0	0	0	10/75 9/81
Diacetin	See Glycol diacetate					
Diacetone alcohol	0	1	1	0	0	3/73 5/77

Substances	A	B	C	D	E	Remarks	
Diaminobenzenes	See Phenylenediamines						
4,4'-Diaminobiphenyl	See Benzidine						
1,6-Diaminohexane	See Hexamethylene diamine						
Diamino methyl benzene	See 2,4-Tolylenediamine						
3,3-Diamino propylamine	See Dipropylene triamine						
Diamino-3,3,5-trimethylhexane	See 3,3,5-Trimethylhexamethylenediamine						
Diammonium phosphate	0	1/BOD	0	0	0		3/73
Diazinon	-	4	2	I	XXX		6/80
Dibenzyl dichlorosilane	-	(1)	(1)	II	XX		6/80
Dibenzyl ether	0	(2)	1	I	X		3/73 11/74 12/80
Diborane	0	1	2	II	XX		5/78
1,1-Dibromoethane	Z	(2)	(2)	I	X		5/78
1,2-Dibromoethane	See Ethylene dibromide						
1,2-Dibromoethylene	Z	2	2	II	XXX	Carcinogen	5/78 11/79
Dibromethane	(Z)	(2)	(1)	I	X		5/78
Di-iso-butene	0	2	(1)	0	0		3/73 5/78 11/79 6/80 12/80
Di-iso-Butylamine	0	(2)	2	I	0		6/80
Di-n-butylamine	See n-Dibutylamine						
n-Dibutylamine	0	2	1	I	0		10/75 7/76
Dibutyl ether	0	2	0	0	0		3/73 10/75 12/80
Di-iso-butyl ketone	0	1	0	0	0		3/73
Dibutyl phthalate	0	3	1	I	X		10/75 7/76 11/79 12/80 9/81
Di-iso-butyl phthalate	0	3	0	0	X		10/75 11/79 9/81
Dibutyl sebacate	-	-	0	0	0		10/75 6/80
Dichloroacetic acid	0	(2)	1	I	X		5/77
Dichloroacetyl chloride	0	(2)	1	I	XX		5/77
Dichloroanilines	Z	4	2	I	XX		3/73 9/81
1,2-Dichlorobenzene	See ortho-Dichlorobenzene						

Substances	A	B	C	D	E	Remarks	
ortho-Dichlorobenzene	Z	4	1	I	X		3/73 6/80
Dichlorodiethyl ether	0	2	2	I	X		3/73 9/81
Dichlorodifluoromethane	---------gas---------						3/73 5/78
sym-Dichlorodimethyl ether	0	(3)	2	II	XXX	Human carcinogen	11/79
1,1-Dichloroethane	Z	(1)	1	0	0		5/78
1,2-Dichloroethane	Z	1	2	II	XX	Carcinogen	10/75 5/78 6/80
Dichloroethanoic acid	See Dichloroacetic acid						
Dichloroethanoic acid, chloride	See Dichloroacetyl chloride						
1,1-Dichloroethene	See Vinylidine chloride						
1,2-Dichloroethene	See Dichloroethylene						
1,1-Dichloroethylene	See Vinylidene chloride						
1,2-Dichloroethylene	0	(1)	1	I	X		10/75 12/80 9/81
Dichlorohexane	Z	1	1	0	0		10/75 7/76 12/80 9/81
Dichloromethane	0	1	1	I	0		10/75 7/76 5/78 9/81
2,4-Dichlorophenol	T	3	1	II	XX		9/81
2,4-Dichlorophenoxyacetic acid	(T)	3	2	0	XX		3/73
Dichlorophenyl isocyanates	-	-	-	II	XX		11/79
Dichlorophenyl trichlorosilane	(+)	-	(1)	II	XX		5/77 6/80
1,1-Dichloropropane	Z	2	0	I	X		10/75 5/78 12/80
1,2-Dichloropropane	See Propylene dichloride						
1,3-Dichloropropane	Z	2	(1)	I	X		10/75 5/78 12/80
Dichloropropane and dichloropropene (mixture)	Z	2	2	I	XX		3/73 6/80
1,1-Dichloropropene	See 1,1-Dichloropropylene						
1,2-Dichloropropene	See 1,2-Dichloropropylene						
1,3-Dichloropropene	See 1,3-Dichloropropylene						

Substances	A	B	C	D	E	Remarks
2,3-Dichloropropene	See 2,3-Dichloropropylene					
3,3-Dichloropropene	See 3,3-Dichloropropylene					
1,1-Dichloropropylene	Z	-	-	-	-	5/78
1,2-Dichloropropylene	Z	-	-	-	-	5/78
1,3-Dichloropropylene	Z	2	2	I	X	5/78
2,3-Dichloropropylene	Z	(2)	2	I	X	5/78
3,3-Dichloropropylene	Z	-	-	-	-	5/78
Dichloro-iso-propyl ether	0	(3)	2	I	XX	11/79
Dichlorvos	-	4	2	II	XX	6/80
Dicyclohexylamine	0	-	2	II	XX	11/79
Dicyclopentadiene	0	0	2	0	0	10/75
Di-iso-decyl phthalate	0	0	0	0	XX	11/79 12/80 9/81
Diethanol amine	0	0	1	0	0	3/73
Diethyl amine	0	2	2	I	X	3/73
Diethyl amino ethanol	0	2	1	II	XX	10/75 11/79
N,N-Diethyl aniline	-	3	1	I	X	11/79 12/80
Diethyl benzene (mixed isomers)	0	2	1	0	X	3/73 11/76
Di-2-ethyl butyl phthalate	See Dihexyl phthalate					
Diethyl carbonate	0	(1)	1	I	XX	6/75 7/76
Diethyl dichlorosilane	0	1	1	II	XX	5/77 6/80
Diethylene glycol	0	0	0	0	0	3/73 9/81
Diethylene glycol, diethyl ether	0	0	1	I	0	3/73 10/75 7/76
Diethylene glycol, monobutyl ether	0	0	1	I	0	10/75 7/76 5/77
Diethylene glycol, monobutyl ether acetate	0	(1)	1	I	0	10/75 7/76 12/80
Diethylene glycol monoethyl ether	0	0	1	I	0	6/75 7/76 5/77

Substances	A	B	C	D	E	Remarks	
Diethylene glycol monoethyl ether acetate	0	(1)	1	I	0		6/75 10/75 7/76 12/80
Diethylene glycol monomethyl ether	0	2	1	I	0		10/75 7/76
Diethylene glycol monomethyl ether acetate	0	(1)	1	I	0		10/75 7/76
Diethylene triamine	0	1	1	I	X		3/73 10/75 7/76
Diethyl ether	0	0	1	0	0		3/73 5/77
Di-(2-ethyl hexyl) adipate	0	-	-	-	XX		6/75
Di-2-ethyl hexyl phthalate	0	0	0	0	X		11/79 9/81
Diethyl ketone	0	1	1	0	0		3/73 5/77
Diethyl malonate	0	(1)	0	I	X		10/75 12/80
Diethyl oxalate	0	(2)	2	I	X		6/75 7/76
Diethyl phthalate	0	4	1	I	X		6/75 11/79 9/81
Diethyl sulphate	0	(2)	1	I	XXX	Carcinogen	6/75 7/76 11/79 6/80
Diethyl sulphide	0	-	-	-	X		6/75
Diethyl tartrate	0	(1)	-	-	0		6/75
Difluorophosphoric acid (anhydrous)	0	(1)	-	I	0		5/77
Diglycol chlorohydrin	0	(1)	(2)	II	XX		6/75 11/79
Diheptyl phthalate	0	(2)	(0)	0	X		11/79 9/81
Dihexyl phthalate	0	(2)	0	0	X		10/75 11/79 12/80 9/81
2,3-Dihydroxybutanedioic acid	See Tartaric acid						
2,3-Dihydroxybutanedioic acid, diethyl ester	See Diethyl tartrate						
2,3-Dihydroxypropane, methyl ether	See Tripropylene glycol, monomethyl ether						
"Dilinevol phthalate 79"	0	(1)	(0)	0	X		11/79 9/81
Dimethoate	0	4	3	I	XXX		3/73 6/80
Dimethyl acetamide	0	(3)	-	II	XX		6/75
N,N-Dimethyl amine (anhydrous)	0	2	1	I	XX		6/75

Substances	A	B	C	D	E	Remarks	
Dimethylamine (40% aq.)	0	2	1	I	0		3/73
Dimethylaminoethyl methacrylate	-	-	(2)	II	XX		11/79
N,N-Dimethyl aniline	-	-	2	I	X		11/79
3,4-Dimethyl aniline	See Xylidines						
Dimethyl benzene	See Xylenes						
Dimethyl benzene bromide	See Xylyl bromide						
Dimethyl dichlorosilane	0	1	1	II	XX		5/78 6/80 9/81
Dimethyl ethanolamine	0	(0)	1	II	XX		3/73 6/80
Dimethyl ether	0	(1)	(1)	0	0		6/75
Dimethyl formamide	0	0	0	0	0		3/73 5/78
2,6-Dimethyl-2,5-heptadiene-4-one	0	-	-	-	0		6/75
Dimethyl ketone	See Acetone						
Dimethyl phenols	See Xylenols						
3,5-Dimethyl phenol	T	2	1	I	XX		9/81
Dimethyl phthalate	0	2	1	0	X		6/75 10/75 7/76 11/79
Dimethyl sebacate	-	-	-	-	-		10/75
Dimethyl sulphate	0	2	2	I	XX	Carcinogen	11/74 7/76 11/79
Dimethyl thiophosphoryl chloride	0	-	1	I	XX		11/79
Dinitroanilines	0	2	2	I	XX		3/73 5/78
Dinitrobenzenes	0	3	3	II	XXX		7/76 5/78
4,6-Dinitro-ortho-cresol	T	4	3	II	XXX		3/73 5/78
Dinitrophenates	See Dinitrophenols						
Dinitrophenols	T	4	3	II	XXX		3/73 5/78
Dinitrotoluene	0	2	2	II	XXX	Carcinogen	3/73 5/78 6/80
Dinonyl phthalate	0	0	1	0	XX		12/80 9/81
Di-iso-nonyl phthalate	0	0	0	0	XX		11/79 6/80 12/80 9/81
Di-iso-octyl acid phosphate	0	-	-	II	XX		5/77 6/80

Substances	A	B	C	D	E	Remarks	
Di-n-octyl phthalate	0	(0)	0	I	X		10/75 11/79 12/80 9/81
Di-iso-octyl phthalate	0	1	0	I	X		10/75 11/79 12/80 9/81
1,4-Dioxane	0	0	0	II	XXX	Carcinogen	3/73 5/77 11/79
Dipentene	0	2	1	I	X		6/80 12/80
Diphenyl amine chloro-arsine	+	(4)	4	II	XXX		3/73
Diphenyl bromomethane	See Diphenyl methyl bromide						
Diphenyl chloroarsine	+	(4)	4	II	XXX		3/73
Diphenyl dichlorosilane	0	(1)	(1)	II	XX		5/77 6/80
Diphenyl/diphenyl oxide (mixtures)	+	3	1	I	X		3/73 12/80 9/81
Diphenyl ether	0	3	1	I	X		10/75
Diphenyl methane-4,4'-diisocyanate	0	(3)	(1)	II	XXX		6/75
Diphenyl methyl bromide	-	-	-	-	-		5/77
Di-iso-propanolamine	0	2	1	0	X		3/73
Di-n-propylamine	0	(2)	1	II	XX		9/81
Di-iso-Propylamine	0	2	1	0	X		3/73
Dipropylene glycol	0	0	0	0	0		3/73 9/81
Dipropylene glycol monomethyl ether	0	(1)	1	I	0		10/75 7/76 12/80
Dipropylene triamine	0	(1)	1	I	XX		11/79
Di-iso-propyl ether	0	1	0	0	0		3/73 10/75 7/76
Dipropyl phthalate	0	(3)	(1)	0	X		11/79 9/81
Disulfoton	-	4	4	II	XXX		6/80
Ditridecyl phthalate	0	(0)	0	0	XX		10/75 11/79 12/80 9/81
Diundecyl phthalate	0	(0)	(1)	0	XX		6/80 9/81
Diuron	0	3	1	0	XX		3/73
Divinyl acetylene	0	(1)	(0)	0	0		10/75 7/76 12/80

Substances	A	B	C	D	E	Remarks	
"Dobane JN"	0	0	(1)	0	0		11/79
"Dobanol 91"	0	3	1	0	0		5/78 11/79
Dodecane	0	(1)	(1)	0	0		10/75 12/80
Dodecanol	0	3	0	0	X		10/75 11/76 11/79 12/80
Dodecanoic acid	See Lauric acid						
1-Dodecene	0	(2)	(1)	I	0		6/75 6/80
Dodecyl benzene	0	2	0	0	0		3/73 5/76
Dodecyl diphenyl oxide disulphonate (solns)	-	-	-	-	-		6/80 9/81
Dodecyl phenol	(T)	(1)	1	II	XX		6/75 12/80
Dodecyl trichlorosilane	0	(1)	(1)	II	XX		5/77 6/80
Dytol R-52	See 1-Tetradecanol						
Eicosanic acid	0	(0)	(0)	0	0		5/77
Eicosanoic acid	See Eicosanic acid						
Emery stone	0	D	0	0	0		3/73
Endosulphan	+	4	2	0	XX		3/73
Endrin	+	4	3	I	XXX		3/73
Epibromohydrin	See 1-Bromo-2,3-epoxypropane						
Epichlorohydrin	0	2	2	II	XXX	Carcinogen	3/73 5/77 11/79 6/80
1,2-Epoxybutane	See 1,2-Butylene oxide						
Ethanal	See Acetaldehyde						
Ethane	---------gas---------						7/76
Ethanedioic acid	See Oxalic acid						
Ethanedioic acid, diethyl ester	See Ethyl oxalate						
1,2-Ethanediol	See Ethylene glycol						
Ethanoic acid	See Acetic acid						
Ethanoic acid, anhydride	See Acetic anhydride						
Ethanoic acid, bromide	See Acetyl bromide						
Ethanoic acid, 2-butoxy ethyl ester	See Ethylene glycol monobutyl ether acetate						
Ethanoic acid, butyl ester	See n-Butyl acetate						
Ethanoic acid, chloride	See Acetyl chloride						
Ethanoic acid, 2-ethyl butyl ester	See 2-Ethyl butyl acetate						

Substances	A	B	C	D	E	Remarks
Ethanoic acid, hexyl ester	See Hexyl acetate					
Ethanoic acid, 2-hydroxy-3-methoxy propyl ester	See Tripopylene glycol, monomethyl ether acetate					
Ethanoic acid, iodide	See Acetyl iodide					
Ethanoic acid, 3-methoxy butyl ester	See 3-Methoxy butyl acetate					
Ethanoic acid, 2-methoxy ethyl ester	See Ethylene glycol, monomethyl ether acetate					
Ethanoic acid, 2-methyl propyl ester	See iso-Butyl acetate					
Ethanoic acid, octyl ester	See n-Octyl acetate					
Ethanoic acid, 2-phenyl ethyl ester	See 2-Phenyl ethyl acetate					
Ethanoic acid, propyl ester	See n-Propyl acetate					
Ethanoic acid, 2-propyl ester	See iso-Propyl acetate					
Ethanol	0	0	0	0	0	11/76 9/81
Ethanolamine	0	1	1	0	0	3/73
Ethene	---------gas---------					6/80
Ethenyl benzene	See Styrene monomer					
Ethenyl benzene, ethyl methyl	See Styrene ethyl methyl					
Ethenyl trichloride	See 1,1,2-Trichloroethylene					
4-Ethoxy aniline	See Para-Phenetidine					
2-Ethoxy ethanol	See Ethylene glycol, mono ethyl ether					
Ethoxy ethyl acetate	See Ethylene glycol, monoethyl ether acetate					
beta-Ethoxy ethyl methacrylate	-	-	-	-	-	10/75
Ethyl acetate	0	1	0	0	0	3/73 11/79
Ethyl acetoacetate	0	(1)	1	I	0	6/75
Ethyl acrylate	0	1	2	I	X	3/73 11/79 6/80
Ethyl amyl ketone	0	2	1	I	X	3/73 12/80
N-Ethylaniline	-	-	2	I	X	11/79
2-Ethylaniline	-	2	1	I	XX	11/79 12/80

Substances	A	B	C	D	E	Remarks	
Ethyl benzene	0	2	1	0	X		3/73 11/76
N-Ethyl-N-benzylaniline	-	-	-	I	X		11/79
Ethyl bromoacetate	0	1	3	I	XXX		3/73
2-Ethyl-1-butanol	0	1	1	I	X		6/75 7/76 11/76 6/80
2-Ethyl butyl acetate	0	(1)	-	-	0		6/75
2-Ethyl butyl alcohol	See 2-Ethyl-1-butanol						
n-Ethyl butylamine	0	(2)	2	II	XX		6/80
Ethyl butyl carbonate	0	-	-	-	0		6/75
Ethyl butyl ketone	0	(0)	1	I	0		6/75
Ethyl chloroformate	0	-	(3)	II	XXX		5/78
Ethyl cyclohexane	0	1	1	0	0		3/73
n-Ethyl cyclohexylamine	-	-	1	II	X		6/80
Ethyl dichloroarsine	+	4	(4)	I	XXX		3/73
Ethyl dichlorosilane	0	1	(1)	II	XX		6/80
Ethylene carbonate	0	-	0	I	X		9/81
Ethylene chloride	See Vinyl chloride						
Ethylene chlorohydrin	0	(1)	2	II	XX		3/73 11/74 12/80
Ethylene cyanohydrin	0	(1)	1	I	X		3/73 10/75 12/80 9/81
Ethylene diamine	0	2	1	I	X		3/73
Ethylene dibromide	Z	2	2	II	XXX	Carcinogen	11/79 6/80
Ethylene dichloride	See 1,2-Dichloroethane						
Ethylene glycol	0	0	1	0	0		3/73 10/75 9/81
Ethylene glycol (mono) acetate	0	(1)	1	0	0		5/78
Ethylene glycol methyl butyl ester	0	-	-	-	0		9/81
Ethylene glycol, monobutyl ether	0	1	1	I	0		10/75 7/76
Ethylene glycol, monobutyl ether acetate	0	1	1	I	0		7/76
Ethylene glycol, monoethyl ether	0	0	1	I	0		7/76 5/77

Substances	A	B	C	D	E	Remarks	
Ethylene glycol, monoethyl ether acetate	0	(1)	1	I	0		3/73 12/80
Ethylene glycol, monomethyl ether	0	0	1	I	0		10/75 7/76 5/77
Ethylene glycol, monomethyl ether acetate	0	1	1	I	0		10/75 7/76 11/79
Ethylene glycol monophenyl ether	0	1	1	I	X		9/81
Ethylene glycol, mono-iso-propyl ether	0	1	1	I	0		6/80
Ethyleneimine	0	(2)	3	II	XXX	Carcinogen	5/78 6/80
2-Ethyl hexane acid	0	-	1	-	-		6/80
2-Ethyl hexanoic acid	0	1	1	I	0		6/80
2-Ethylhexan-1-ol	0	2	1	0	X		11/76
2-Ethyl 2-hexenal	See 2-Ethyl-3-propyl acrolein						
2-Ethyl hexyl acrylate	0	1	0	I	X		11/79 12/80
2-Ethyl hexyl alcohol	0	2	0	0	X		3/73
2-Ethyl hexylamine	0	3	2	II	XX		11/79 12/80
2-Ethyl-2-(hydroxy methyl)-1,3-propanediol	See Trimethylol propane						
Ethyl lactate	0	(1)/ BOD	1	0	0		3/73 12/80
Ethyl methacrylate	0	(1)	1	0	X		6/75 6/80
Ethyl oxalate	0	(1)	2	I	X		11/79
Ethyl phenyl dichlorosilane	-	(1)	(1)	II	XX		6/80
Ethyl parathion	0	4	4	II	XXX		3/73
2-Ethyl-3-propyl acrolein	(T)	(1)	1	II	XX		3/73 12/80
Ethyl sulphide	See Diethylsulphide						
Ethyl trichlorosilane	0	1	1	II	XX		5/78 6/80
Fatty alcohols C_{12}-C_{20}	0	0	(0)	0	X		11/76 12/80
Fenitrothion	0	-	2	I	XXX		6/80
Fentin acetate (dry)	0	2	2	0	XXX		3/73
Ferric arsenate	+	2	3	0	XX		3/73

Substances	A	B	C	D	E	Remarks	
Ferric arsenite	+	3	4	0	XX		3/73
Ferric chloride	0	2	1	0	X		3/73
Ferrosilicon (30%-90% silicon)	-	-	*	-	-	* Hazard from immediate release of highly toxic arsine and phosphine	5/78
Ferrous arsenate	+	2	3	0	XX		3/73
Fertilizer NPK	0	0	1	0	0		3/73
Fishmeal	0	0/BOD	0	0	XX		3/73
Fluoboric acid	0	-	-	-	-		5/77
Fluorophosphoric acids	0	(1)	-	I	0		5/77
Fluorosulphonic acids	0	3	(3)	II	XX		5/77 11/79
Fluorspar	0	D	0	0	0		3/73
Fluosilic acid	0	2	2	II	0		3/73 11/74 7/76
Formaldehyde (37%-50% solution)	0	2	2	I	0		3/73
Formamide	0	0	1	I	0		10/75 12/80 9/81
Formic acid	0	1	1	I	X		3/73 5/77
Formic acid, methyl ether	0	-	1	I	0		6/80
Fumaryl chloride	0	2	-	II	XX		5/77 6/80 12/80
Furfural	0	2	2	0	X		3/73
Furfuryl alcohol	0	2	2	0	0		3/73
Gallotanic acid	See Tannic acid						
Glycerine	0	0	0	0	0		3/73 9/81
Glyceryl 1,3-diacetate	See Glycol diacetate						
Glyceryl triacetate	0	(0)	1	0	0		10/75 12/80
Glycol diacetate	0	(0)	1	0	0		10/75 12/80
Glycol monoacetate	0	(0)	1	0	0		10/75 12/80

Substances	A	B	C	D	E	Remarks
Ground nuts (shelled)	0	0	0	0	0	3/73
Guano	0	0/BOD	1	0	X	3/73
Guthion	0	4	4	II	XXX	6/80
Gypsum	0	0	0	0	0	3/73
Gypsum fines	0	D	0	0	0	3/73
Haematite	0	0	0	0	X	3/73
alpha-HCH	See Lindane					
Heminellitene	See 1,2,3-Trimethylbenzene					
Heptachlor	+	4	2	0	XXX	3/73
Heptadecane	0	(0)	(0)	0	0	10/75 12/80
Heptadecanoic acid	0	(0)	(0)	0	0	10/75 5/77
2,5-Heptadiene-4-one, 2,6-dimethyl	0	-	(1)	-	0	12/80 9/81
n-Heptane	0	0	0	0	0	3/73
Heptanoic acid	0	(1)	0	I	X	3/73 5/77 12/80
1-Heptanol	0	2	1	I	0	7/76 11/76 11/79
2-Heptanol	0	(2)	1	I	0	10/75 7/76 12/80
3-Heptanol	0	(2)	1	I	0	10/75 7/76 12/80
2-Heptanone	See Methyl amyl ketone					
3-Heptanone	See Ethyl butyl ketone					
Heptene	0	2	(1)	0	0	3/73 10/75 6/80 12/80
Hexachlorobutadiene	+	4	2	I	X	11/79 6/80
alpha-Hexachlorocyclohexane	See Lindane					
Hexadecanoic acid	0	(0)	(0)	0	0	5/77
Hexadecanoic acid, propyl ester	See Propyl palmitate					
Hexadecyl trichlorosilane	0	(1)	(1)	II	XX	5/77 6/80
Hexaethyl tetraphosphate	0	4	4	II	XXX	3/73
Hexafluoroacetone hydrate	0	-	2	II	XX	11/79
Hexafluorophosphoric acid	0	-	-	II	XX	5/77
Hexaglycerol	See Trimethylolpropane					

Substances	A	B	C	D	E	Remarks	
Hexahydrocymol	0	(2)	(0)	0	0		10/75 12/80
Hexamethylene diamine	0	(2)	(1)	II	X		3/73 12/80
Hexamethyleneimine	0	-	3	II	X		5/78 12/80
Hexamethylene tetramine	0	0	0	0	0		10/75 7/76
n-Hexane	0	0	0	0	0	Delayed neurotoxicity	3/73 6/80
Hexanedioic acid, didecyl ester	See Decyl adipate						
Hexanedioic acid, di-(2-ethyl hexyl) ester	See Di-(2-ethyl hexyl) adipate						
Hexanedioic acid, dinitrile	See Adiponitrile						
1,2,6-Hexanetriol	0	0	0	0	0		10/75 7/76 12/80
Hexanitrodiphenylamine	0	-	2	-	XX		5/78
Hexanoic acid	0	-	1	I	X		5/77
Hexanoic acid, 6-amino, lactam	See Caprolactam						
1-Hexanol	0	1	1	II	XX		10/75 7/76 11/76 12/80
1-Hexene	0	2	(1)	0	0		10/75 6/80 12/80
Hexyl acetate	0	(1)	0	0	0		10/75 12/80
Hexylene glycol	0	0	1	0	0		10/75 7/76
Hexyl trichlorosilane	0	(1)	(1)	II	XX		5/77 6/80
Hydrazine	0	3	2	II	XXX	Carcinogen	3/73 11/79 9/81
Hydriodic acid	-	-	-	II	XX		5/77 11/79
Hydrobromic acid	0	-	-	II	X		5/77
Hydrochloric acid	0	1	1	0	0		3/73
Hydrocyanic acid	0	4	3	II	0		3/73
Hydrofluoric acid (solution)	0	2	(2)	II	X		3/73 6/80
Hydrogen bromide (anhydrous)	See Hydrobromic acid						
Hydrogen chloride (anhydrous)	See Hydrochloric acid						

Substances	A	B	C	D	E	Remarks	
Hydrogen cyanide	0	4	3	II	0		3/73
Hydrogen fluoride (anhydrous)	See Hydrofluoric acid						
Hydrogen peroxide	0	2	0	0	0		3/73
Hydrogen sulphide	0	3	2	II	XX		5/78
2-Hydroxybenzoic acid, methyl ester	See Methyl salicylate						
2-Hydroxybutanedioic acid	See Malic acid						
2-Hydroxyethyl acrylate	0	-	1	I	X		7/76 6/80
Hydroxyl 42	See Propoxylated polyglycol						
4-Hydroxy-4-methyl-2-pentanone	See Diacetone alcohol						
2-Hydroxy-2-methyl propionitrile	See Acetone cyanohydrin						
2-Hydroxy-1,2,3-propanetricarboxylic acid	See Citric acid						
2-Hydroxypropanoic acid	See Lactic acid						
2-Hydroxypropanoic acid, butyl ester	See Butyl lactate						
2-Hydroxypropanoic acid ethyl ester	See Ethyl lactate						
3-Hydroxypropanoic acid, beta-lactone	See beta-Propiolactone						
2-Hydroxypropyl acrylate	0	-	1	II	XX		6/80
Hypochlorite, solutions, more than 5% available chlorine	See Sodium hypochlorite						
Ilmenite	0	0	0	0	0		3/73
Iodine monochloride	-	-	2	II	XX		5/77 11/79
Iron concentrates	See Haematite						
Iron ore	See Haematite						
Iron pentacarbonyl	0	-	3	II	XX		5/78
Iron pyrites	0	0	0	0	0		3/73
Isocyanic acid, methyl ester	See Methyl isocyanate						
Isodurene	See 1,2,3,5-Tetramethyl benzene						

Substances	A	B	C	D	E	Remarks	
Isophorone	0	1	1	I	X		3/73
Isophoronediamine	0	-	1	II	XX		11/79 12/80
Isophorone diisocyanate	-	-	1	II	XXX		6/80
Isoprene	0	2	0	I	0		3/73 6/80 12/80
Isothiocyanic acid, allyl ester	See Allyl isothiocyanate						
Karmex	See Diuron						
Kieserite	0	1	1	0	0		3/73
Kronitex PX917	See Tricresyl phosphate						
Kyanite	0	0	0	0	0		3/73
Lactic acid	0	1/BOD	1	0	0		3/73 5/77
Lanette wax KS	See 1-Tetradecanol						
Latex (ammonia inhibited)	0	1	0	0	XX		3/73 11/74 7/76
Latex (mercury salts inhibited)	-	-	0	0	XX		7/76
Lauric acid	0	(0)	0	0	0		10/75 12/80
Lauryl methacrylate	0	(1)	(0)	0	X		10/75 6/80 12/80
L.A.W.S.	See White spirit, low aromatic						
Lead acetate	+	(2)	0	0	XX	Carcinogen	11/79
Lead arsenates	+	3	2	0	XX		3/73
Lead arsenites	+	3	3	0	XX		3/73
Lead compounds (soluble, N.O.S.)	+	(3)	(3)	I	XX	Carcinogen	11/79
Lead concentrates (sulphides)	0	0	0	0	0		3/73
Lead cyanide	+	3	3	I	XX		3/73
Lead nitrate	+	1	1	0	0		5/78
Lead ore	See Lead concentrates						
Lead perchlorate	+	1	(1)	I	0		5/78
Lead sulphate, (more than 3% free sulphuric acid)	See Sulphuric acid						
Lead tetraethyl	See Tetraethyl lead						
Lead tetramethyl	See Tetramethyl lead						

Substances	A	B	C	D	E	Remarks	
Ligroin	0	0	1	0	0		3/73
Limestone	0	0	0	0	0		3/73
Lindane	+	4	2	0	XX		3/73
Linoleic acid	0	(0)	0	0	XX		5/77
Linolenic acid	0	(0)	0	0	XX		5/77
Linseed oil	0	0	0	I	XX		6/80
Liquid sulphur	0	0	0	0	0		3/73
London purple	+	3	2	0	XXX		3/73
Loxanol W	See 1-Tetradecanol						
Magnesia	0	0	0	0	0		3/73
Magnesite	0	0	0	0	0		3/73
Magnesium arsenate	+	2	3	0	XX		3/73
Magnesium chloride	0	0	1	0	0		6/80
Magnesium phosphide	0	3	*	II	XXX	*Hazard from immediate release of highly toxic phosphine	5/77
Magnesium silicofluoride	See Silicofluorides						
Magnesium sulphate	0	0	0	0	0		10/75
Maize (not seed grain)	0	0/BOD	0	0	X		3/73
Malathion	0	4	1	0	XXX		3/73 6/80
Maleic acid	0	1	1	0	0		7/76 5/77
Maleic anhydride	0	1	2	II	XX		11/79
Malic acid	0	-	(1)	0	0		5/77
Malonic acid	0	-	1	0	0		5/77
Margaric acid	See Heptadecanoic acid						
Maneb	0	3	1	0	XX		3/73
Manganese concentrates	0	D	0	0	0		3/73
Manganese ore	0	D	0	0	0		3/73
MCPA	See 2-Methyl-4-chlorophenoxyacetic acid						
Menazon	-	-	2	I	XX		6/80
Mercaptoacetic acid	See Thioglycolic acid						
Mercuric acetate	+	4	3	0	0		3/73
Mercuric arsenate	+	4	3	0	XX		3/73
Mercuric chloride	+	4	3	0	0		3/73

Substances	A	B	C	D	E	Remarks
Mercuric cyanide	+	4	3	I	0	3/73
Mercuric nitrate	+	4	3	0	0	3/73
Mercuric potassium cyanide	+	4	3	I	0	3/73
Mercuric sulphate	+	4	3	0	0	3/73
Mercurous nitrate	+	4	3	0	0	3/73
Mercurous sulphate	+	4	3	0	0	3/73
Mercury alkyl	+	4	4	II	XXX	3/73
Mercury ammonium chloride	+	4	3	0	0	3/73
Mercury benzoate	+	4	3	0	0	3/73
Mercury bisulphate	+	4	3	0	XX	3/73
Mercury bromides	+	4	3	0	0	3/73
Mercury compounds (organic)	See Mercury alkyl					
Mercury gluconate	+	4	3	0	0	3/73
Mercury iodide	+	3	3	0	XX	3/73
Mercury nucleate	See Mercury alkyl					
Mercury oleate	+	4	(3)	I	XX	11/79
Mercury oxide	+	4	3	I	XX	11/79
Mercury oxycyanide	+	4	3	I	0	3/73
Mercury potassium iodide	+	4	3	0	0	3/73
Mercury salicylate	+	4	3	I	XX	11/79
Mercury thiocyanate	+	4	(3)	I	X	11/79
Mesitylene	See 1,3,5-Trimethylbenzene					
Mesityl oxide	0	1	1	I	0	3/73 12/80
Methacrylate mixtures (butyl/decyl/cetyl/ eicosyl)	0	(1)	-	-	X	9/81
Methacrylic acid inhibited)	0	(1)	(2)	II	XX	11/79 6/80 12/80
Methanal	See Formaldehyde					
Methanoic acid	See Formic acid					
Methanoic acid, amide	See Formamide					
Methanoic acid, propyl ester	See n-Propyl formate					
Methanol	0	0	1	0	0	3/73 11/76 5/77

Substances	A	B	C	D	E	Remarks
2-Methoxy aniline	See ortho-Anisidine					
3-Methoxy butanol	0	-	1	I	0	6/80
3-Methoxy butyl acetate	0	-	1	I	0	6/80
1-Methoxy-2,3-dihydroxy-propane	See Tripropylene glycol, monomethyl ether					
2-Methoxy ethanol	See Ethylene glycol, monomethyl ether					
Methoxy ethylene	See Vinyl methyl ether					
Methoxytriglycol	0	(1)	0	0	0	10/75 12/80
Methyl acetate	0	0	0	0	0	3/73 11/79
Methyl acetylene propadiene	---------gas---------					7/76
Methyl acrylate	0	2	2	II	XX	3/73 11/79 6/80
Methyl amyl acetate	0	0	0	0	0	3/73
Methyl amyl alcohol	0	1	1	0	0	3/73
Methyl amyl ketone	0	(2)	1	0	0	10/75 12/80
Methyl iso-amyl ketone	0	(2)	1	0	0	10/75 12/80
N-Methyl aniline	-	-	2	I	X	11/79
Methyl benzene	See Toluene					
Methyl bromide	---------gas---------					10/75
Methyl bromide and ethylene dibromide (liquid mix)	See Ethylene dibromide					
2-Methyl-1,3-butadiene	See Isoprene					
2-Methyl butanal	See Methyl butyraldehyde					
2-Methyl-1-butanol	0	(1)	1	0	0	11/76
2-Methyl-2-butanol	0	1	1	0	0	11/76
3-Methyl-1-butanol	0	1	1	0	0	10/75 11/76
3-Methyl-2-butanol	0	(1)	(1)	0	0	11/76
2-Methyl-3-butanone	See Methyl isopropyl ketone					
2-Methyl butene	0	(2)	(1)	0	0	10/75 6/80
Methyl iso-butyl carbinol	0	1	1	I	0	5/78
Methyl tert-butyl ether	0	1	1	0	0	9/81
Methyl iso-butyl ketone	0	0	1	0	0	3/73
2-Methyl butyraldehyde	0	(2)	1	I	X	10/75 12/80
3-Methyl butyraldehyde	See iso-Valeraldehyde					

Substances	A	B	C	D	E	Remarks
Methyl chloride	---------gas---------					3/73
Methyl chloroform	See 1,1,1-Trichloroethane					
Methyl chloroformate	0	-	(3)	II	XXX	5/78
2-Methyl-4-chlorophenoxy-acetic acid	0	2	1	0	XX	3/73
Methyl cyanide	See Acetonitrile					
Methyl cyclopentadiene	0	(0)	(2)	0	0	10/75 12/80
Methyl cyclopentadienyl manganese tricarbonyl	-	-	2	I	-	7/76
Methyl dichloroacetate	0	(2)	(1)	I	X	11/79
Methyl dichlorosilane	0	1	(1)	II	XX	5/78 6/80
Methylene dichloride	See Dichloromethane					
Methyl-1,2-ethanediol	See Ethylene glycol, monomethyl ether					
Methyl ethanol amine	0	2	1	0	X	3/73
Methyl ethyl ketone	See 2-Butanone					
2-Methyl-5-ethyl pyridine	(T)	(1)	1	II	XX	3/73 12/80
Methyl glycol acetate	See Ethylene glycol, monomethyl ether acetate					
6-Methyl-1-heptanal	See iso-Octaldehyde					
Methyl hydrazine	0	-	3	II	X	5/78
Methyl isocyanate (and solutions)	0	-	2	II	XX	5/78
Methyl methacrylate	0	1	1	0	X	3/73 6/80
7-Methyl-3-methylene-1, 6-octadiene	See Myrcene					
alpha-Methyl naphthalene	T	3	1	0	X	10/75 12/80
1-Methyl-2-nitrobenzene	See ortho-Nitrotoluene					
1-Methyl-3-nitrobenzene	See meta-Nitrotoluene					
1-Methyl-4-nitrobenzene	See para-Nitrotoluene					
Methyl parathion	0	4	3	II	XXX	6/80
2-Methyl pentane	0	(0)	(0)	0	0	12/80
2-Methyl-1-pentanol	0	1	1	0	0	11/76
4-Methyl-2-pentanol	See Methyl isobutyl carbinol					
2-Methyl pentene	0	(2)	(1)	0	0	3/73 6/80
4-Methyl-3-penten-2-one	See Mesityl oxide					
Methyl phenyl dichlorosilane	-	1	(2)	II	XX	6/80 9/81

Substances	A	B	C	D	E	Remarks	
Methyl phenyl ketone	See Acetophenone						
2-Methyl propanoic acid	See iso Butyric acid						
2-Methyl-1-propanol	See iso-Butanol						
2-Methyl-2-propanol	See tert-Butanol						
2-Methyl propenoic acid	See Methacrylic acid						
2-Methyl propenoic acid, butyl ester	See n-Butyl methacrylate						
2-Methyl propenoic acid, iso butyl ester	See iso-Butyl methacrylate						
2-Methyl propenoic acid, dodecyl ester	See Lauryl methacrylate						
2-Methyl propenoic acid, ethyl ester	See Ethyl methacrylate						
2-Methyl propenoic acid, methyl ester	See Methyl methacrylate						
2-Methyl propenoic acid, nonyl ester	See Nonyl methacrylate						
Methyl propionate	0	(1)	1	0	0		6/75
1-Methyl-4-(2-propyl) benzene	See iso-Propyl toluene						
Methyl n-propyl ether	0	(1)	-	0	0		6/75
Methyl n-propyl ketone	0	(1)	1	0	0		6/75
Methyl iso-propyl ketone	0	(1)	(1)	0	0		6/75
2-Methyl pyridine	(T)	(1)	1	I	XX		9/81
Methyl pyrrolidone	Z	1	0	0	0		5/78 11/79
Methyl salicylate	(T)	-	2	0	0		6/75
alpha-Methyl styrene	T	(2)	1	0	X		3/73 11/76 6/80 12/80
Methyl trichlorosilane	0	1	1	II	XX		5/78 6/80
Methyl trinitrobenzene	See Trinitrotoluene						
Mevinphos	-	4	4	II	XXX	Very high dermal toxicity	6/80
Milk	0	0	0	0	0		3/73 9/81
Molasses	0	0	0	0	X		3/73 9/81
Molybdenum pentachloride	0	(2)	(2)	II	XX		11/79
Monoacetin	See Glycol monoacetate						

Substances	A	B	C	D	E	Remarks	
Monobromoethane	Z	-	-	I	X		5/78
Monobromoethylene	0	-	2	I	X		5/78 9/81
Monobromomethane	(Z)	2	-	II	XX		5/78
Monochlorodifluoro-methane	---------gas---------						
Monochloroethene	See Vinyl chloride						
Monochloroethylene	See Vinyl chloride						
Monoethanolamine	See Ethanolamine						
Monoethylamine	0	(2)	2	II	XX		9/81
Monethylene glycol	See Ethylene glycol						
Mono-2-ethyl hexylamine	0	3	2	I	0		6/80
Monomethylamine	0	(2)	2	II	XX		6/80
Mononitrobenzene	0	2	2	I	XXX		5/78 6/80
Monopropylene glycol	0	0	0	0	0		3/73
Morpholine	0	1	1	I	0		3/73 7/76
Myrcene	0	-	-	0	0		6/85
Myristic acid	See Tetradecanoic acid						
Myristyl alcohol	See 1-Tetradecanol						
Naphthalene	T	3	2	I	X		3/73 6/75 11/79 6/80
Naphthenic acids	(T)	3	1	0	X		3/73 6/80 12/80
alpha-Naphthyl amine	0	3	1	0	XX		3/73
beta-Naphthyl amine	0	3	1	II	XXX	Human carcinogen	3/73 11/79
Naphthyl thiourea	0	(3)	4	I	XX		3/73
Naphthyl urea	-	-	-	-	-		7/76
Neodol (C_{12}-C_{15} alcohol)	0	0	1	0	X		11/79
Nickel concentrates sulphides)	0	0	0	II	XXX	Human carcinogen	3/73 11/79
Nickel cyanide	+	4	3	I	X		7/76
Nickel ore	0	0	0	0	0		3/73
Nickel tetracarbonyl	+	4	(3)	II	XXX	Human carcinogen	5/78 6/80
Nicotine	0	3	3	II	XX		7/76
Nicotine, compounds and preparations N.O.S.	See Nicotine						

Substances	A	B	C	D	E	Remarks
Nitric acid (90% or less)	0	2	1	II	0	3/73
Nitroanilines	0	2	2	I	XX	7/76 5/78
Nitrobenzene	See Mononitrobenzene					
Nitrobenzene sulphonic acids	0	(2)	(1)	II	XX	11/79
Nitrobenzotrifluorides	Z	(4)	(3)	I	XX	11/79 9/81
Nitrobutanes	0	-	1	I	X	5/78
3-Nitro-4-chlorobenzo trifluoride	Z	(4)	(3)	I	XX	11/79
Nitrocresols	T	(3)	1	I	XX	11/79
Nitroethane	0	(1)	1	I	X	6/75 5/78
Nitroglycerine	0	-	2	0	XX	5/78
Nitrohydrochloric acid	0	2	1	II	0	11/76
Nitromethane	0	(1)	1	I	X	5/78
Nitrophenols	0	3	2	I	XX	7/76 5/78
1-Nitropropane	0	(1)	2	II	XX	6/75 5/78 12/80
2-Nitropropane	0	1	2	II	XX	3/73 5/78 6/80
Nitrosyl chloride	0	2	-	II	XX	5/78
Nitrosyl sulphuric acid	0	(2)	-	II	XX	11/79
2-Nitrotoluene	See ortho-Nitrotoluene					
3-Nitrotoluene	See meta-Nitrotoluene					
4-Nitrotoluene	See para-Nitrotoluene					
ortho-Nitrotoluene	0	2	1	I	X	3/73 5/78
meta-Nitrotoluene	0	-	1	I	X	5/78
para-Nitrotoluene	0	-	1	I	X	5/78
Nitroxylenes	0	4	-	II	XX	7/76 5/78
Nonadecanoic acid	0	(0)	(0)	0	0	5/77
Nonane	0	(1)	(0)	0	0	12/80
Nonanoic acid	0	(1)	1	II	XX	7/76 5/77
1-Nonanol	0	2	1	0	X	3/73 11/76 11/79
Nonene	0	(2)	(1)	0	0	6/75 6/80
Nonoic acid	See Nonanoic acid					
iso-Nonoic acid	0	(1)	(1)	II	XX	7/76

Substances	A	B	C	D	E	Remarks
Nonyl methacrylate (monomer)	-	-	-	-	-	6/80
Nonyl phenol	0	2	1	I	X	3/73
Nonyl phenyl sulphide	-	-	-	-	-	7/76
Nonyl trichlorosilane	0	(1)	(1)	II	XX	5/77 6/80
9,12-Octadecadienoic acid	See Linoleic acid					
Octadecanoic acid	0	(0)	(0)	0	0	5/77
Octadecanoic acid, butyl ester	See Butyl stearate					
1-Octadecanol	0	0	(0)	0	X	3/73 10/75 11/76 12/80
cis-9-Octadecenoic acid	See Oleic acid					
9,12,15-Octadecatrienoic acid	See Linolenic acid					
Octadecyl trichlorosilane	0	(1)	(1)	II	XX	5/77 6/80
Octadiol	See Trimethyl pentanediol					
n-Octaldehyde	0	-	(1)	I	0	6/75 6/80
iso-Octaldehyde	-	-	-	-	-	6/80 9/81
Octanal	See n-Octaldehyde					
n-Octane	0	(1)	(1)	0	0	3/73 10/75
iso-Octane	0	(1)	(1)	0	0	3/73
Octanoic acid	0	-	1	I	X	5/77
Octanol	See 2-Ethyl hexan-1-ol					
1-Octanol	0	2	1	0	X	3/73 11/76 11/79
iso-Octanol	0	2	1	0	X	3/73 11/76
3-Octanone	See Ethyl amyl ketone					
1-Octene	0	2	(1)	0	0	10/75 6/80
n-Octyl acetate	0	(1)	1	0	0	6/75
iso-Octyl aldehyde	-	-	-	-	-	10/75
n-Octyl chloride	-	-	-	-	-	6/75 9/81
Octyl decyl adipate	-	-	-	-	-	10/75 6/80 9/81
Octyl/Decyl alcohol (mixture)	0	3	1	0	X	6/80
Octyl decyl phthalate	0	(0)	0	0	XX	10/75 11/79 9/81

Substances	A	B	C	D	E	Remarks
Octyl trichlorosilane	0	(1)	(1)	II	XX	5/77 5/80
Oil gas	---------gas---------					5/78
Olefins (C_6-C_8)	0	2	(1)	0	0	11/79
Olefins (C_{13}-C_{14})	0	0	-	0	0	11/79
alpha-Olefins (C_{16}-C_{18})	0	(2)	(1)	0	0	11/79
Oleic acid	0	(0)	0	0	XX	3/73 5/77
Olive oil	0	0	0	0	XX	3/73 5/77 5/78
Osmium tetroxide	0	4	3	II	XXX	11/79 6/80
Oxalates (water soluble)	0	0	2	0	0	11/79
Oxalic acid (10-25%)	0	1	1	0	0	5/77
3-Oxobutanoic acid, ethyl ester	See Ethyl acetoacetate					
Palmitic acid	See Hexadecanoic acid					
Palm nut oil	0	0	0	0	XX	6/80
Palm oil	0	0	0	0	XX	6/80
Palm oil, methyl ester	0	0	0	0	XX	6/80
Paraldehyde	0	2	1	I	X	10/75 9/81
Paraquat	0	3	2	I	XXX	3/73
Parathion	0	4	4	II	XXX	3/73 6/80
Pentachloroethane	Z	3	2	0	X	3/73 11/74 7/76
Pentadecanoic acid	0	2	(0)	0	0	5/77 6/80
1,3-Pentadiene	-	-	-	-	-	6/80
1-Pentanal	See n-Valeraldehyde					
n-Pentane	0	2	0	0	0	3/73
iso-Pentane	0	1	0	0	0	3/73
1-Pentanethiol	See Amyl mercaptan					
Pentanoic acid	0	2	1	II	XX	3/73 6/80 12/80
Pentanoic acid, chloride	See Valeric chloride					
1-Pentanol	0	1	2	II	X	11/76 9/81
2-Pentanol	0	(1)	1	0	0	11/76
3-Pentanol	0	(1)	1	0	0	11/76
2-Pentanone	See Methyl-n-propyl ketone					
3-Pentanone	See Diethyl ketone					

Substances	A	B	C	D	E	Remarks
n-Pentene	See 1- or 2- Pentene					
1-Pentene	0	(2)	(1)	0	0	6/75 6/80
2-Pentene	0	(2)	(1)	0	0	6/75 6/80
Peracetic acid	0	-	(3)	I	0	5/78
Perchlorethylene	See 1,1,2,2-Tetrachloroethylene					
Perchloric acid (not exceeding 50%)	0	-	-	II	0	5/77
Perchloromethylmercaptan	0	(4)	2	II	XX	7/76
Perlite	0	0	0	0	0	3/73
Petalite	0	0	0	0	0	3/73
"Petrinex 4R"	+	3	(2)	II	XX	11/79
Petrol (2 star)	Z	3	2	II	XX	6/80
Petrol (4 star)	Z	3	2	II	XX	6/80
Petroleum coke	0	0	0	0	0	3/73
para-Phenitidine	0	(2)	(2)	II	XX	6/75
Phenol	T	2	2	II	XX	3/73 6/80
Phenol sulphonic acid	-	-	-	II	X	5/77
Phenylacetonitrile	See Benzylcyanide liquid					
Phenylamine	See Aniline					
Phenyl carbylamine chloride	0	-	-	II	XXX	7/76
Phenyl cyanide	See Benzonitrile					
1-Phenyl dodecane	See Dodecyl benzene					
Phenylene diamine	0	3	2	II	X	7/76
Phenyl ethane	See Ethyl benzene					
2-Phenyl ethanol	See Phenyl ethyl alcohol					
2-Phenyl ethyl acetate	0	-	(0)	0	0	6/75
Phenyl ethyl alcohol	0	(1)	1	0	0	6/75
Phenyl ethylene	See Styrene monomer					
Phenyl hydrazine	0	-	2	II	XX	6/75
Phenyl isocyanate	-	-	1	II	XX	11/79
Phenyl mercuric compounds (N.O.S.)	See Mercuric compounds, organic					7/77
Phenyl mercuric hydroxide	+	(4)	3	II	XXX	5/77
Phenyl mercuric nitrate (basic)	+	(4)	3	II	XXX	5/77
Phenyl methane	See Toluene					

Substances	A	B	C	D	E	Remarks	
Phenyl methyl ketone	See Acetophenone						
1-Phenyl propane	See n-Propyl benzene						
2-Phenyl propene	See alpha-Methyl styrene						
Phenyl trichlorosilane	0	1	1	II	XX		5/77 6/80 9/81
1-Phenyl tridecane	See Tridecyl benzene						
Phorate	-	4	4	II	XXX	Very high dermal toxicity	6/80
Phorone diamine	-	-	-	-	-		5/77
Phosgene	0	-	-	II	XX		5/78
Phosphamidon	-	3	3	II	XX		6/80
Phosphoric acid	0	1	1	I	0		3/73 5/77
Phosphorus (elemental yellow powder)	+	4	4	II	XXX		3/73
Phosphorus oxybromide	0	-	(2)	II	XX		5/77 11/79
Phosphorus oxychloride	0	(1)	2	II	XX		5/77 11/79
Phorphorus pentachloride	0	(1)	1	II	XX		5/77 11/79
Phosphorus pentoxide	0	1	1	II	XX		5/77 11/79
Phosphorus sulfochloride	See Thiophosphoryl chloride						
Phosphorus thiochloride	See Thiophosphoryl chloride						
Phosphorus tribromide	0	-	1	II	XX		5/77 11/79
Phosphorus trichloride	0	(1)	1	II	XX		6/75 5/77 11/79
Phosphoryl chloride	See Phosphorus oxychloride						
Phthalic anhydride (molten)	0	2	1	II	XX		3/73 11/79
Picric acid	See Trinitrophenol						
Pig iron	0	0	0	0	0		3/73
alpha-Pinene	(T)	3	(1)	I	X		6/75 12/80 9/81
beta-Pinene	(T)	3	1	I	X		6/75 12/80 9/81
Pirimphos-ethyl	-	-	2	I	XX		6/80
Pitch coke	0	0	0	0	0		3/73
Pivaloyl chloride	0	1	1	I	XX		11/79

Substances	A	B	C	D	E	Remarks	
Polychlorinated biphenyls (chlorinated dibenzo-furans less than 1 ppm)	+	4	1	0	XX	Carcinogen	3/73 11/79
Polyethylene amines	0	(2)	1	0	0		6/80
Polymethylene polyphenyl isocyanate	-	-	-	-	-		7/76
Polypropylene glycol	0	1	0	0	0		3/73 5/77 9/81
Polyvinyl benzyl trimethyl ammonium chloride	-	-	-	-	-		6/80
Potash (potassium minerals)	0	0	0	0	0		3/73
Potassium arsenate	+	3	2	0	0		5/77
Potassium arsenite	+	3	3	0	0		5/77
Potassium bifluoride	0	(3)	2	II	0		5/77
Potassium chlorate	0	1	2	0	0		3/73
Potassium cuprocyanide	-	-	-	-	-		5/77
Potassium cyanide	0	4	3	I	0		3/73
Potassium fluoride	0	1	2	0	0		5/77
Potassium hydroxide	0	2	2	I	0		10/75
Potassium metavanadate	0	2	2	0	0		11/79
Potassium oxide	0	2	2	I	0		5/77
Potassium permanganate	0	3	1	0	XX		3/73
Potassium phosphide	0	3	*	II	XXX	*Hazard from immediate release of highly toxic Phosphine	5/78
Potassium silicate (solution)	0	(1)	(0)	0	0		10/75
Potassium sulphate	0	0	1	0	0		10/75 7/76
Potassium sulphide	0	2	2	II	XX		11/79
Potatoes	0	0/BOD	0	0	X		3/73
Propane	---------gas---------						3/73 9/81
Propanedioic acid	See Malonic acid						
Propanedioic acid, diethyl ester	See Diethyl malonate						

Substances	A	B	C	D	E	Remarks	
Propanoic acid, methyl ester	See Methyl propionate						
1-Propanol	See n-Propanol						
2-Propanol	See iso-Propanol						
n-Propanol	0	1/BOD	1	0	0		3/73 11/76 5/77
iso-Propanol	0	0	1	0	0		11/76 9/81
2-Propanone	See Acetone						
Propanoyl chloride	See Propionyl chloride						
iso-Propanolamine	0	2	1	0	X		3/73
Propenal	See Acrolein						
Propene	---------gas---------						6/80
Propene oxide	See Propylene oxide						
Propenoic acid	See Acrylic acid						
Propenoic acid, amide	See Acrylamide						
Propenoic acid, butyl ester	See n-Butyl acrylate						
Propenoic acid, decyl ester	See Decyl acrylate						
Propenoic acid, ethyl ester	See Ethyl acrylate						
Propenoic acid, 2-ethyl hexyl ester	See 2-Ethyl hexyl acrylate						
Propenoic acid, 2-hydroxy ethyl ester	See 2-Hydroxy ethyl acrylate						
Propenoic acid, 2-hydroxy propyl ester	See 2-Hydroxy propyl acrylate						
Propenoic acid, methyl ester	See Methyl acrylate						
Propenoic acid, 2-methyl nonyl ester	See iso-Decyl acrylate						
Propenoic acid, 2-methyl propyl ester	See iso-Butyl acrylate						
Propenoic acid, nitrile	See Acrylonitrile						
2-Propen-1-ol	See Allyl alcohol						
beta-Propiolactone	0	1	2	II	XXX	Carcinogen	3/73 11/79 12/80

Substances	A	B	C	D	E	Remarks
Propionaldehyde	0	1	1	0	X	3/73
Propionic acid	0	1	1	0	0	3/73 5/77
Propionic anhydride	0	1	1	0	0	3/73
Propionyl chloride	0	1	1	II	XX	11/79
Propoxylated polyglycol	0	1	0	0	XX	6/80
n-Propyl acetate	0	1	0	0	0	7/76
iso-Propyl acetate	0	0	1	0	0	3/73 10/75 7/76
iso-Propyl acid phosphate	0	-	-	I	-	5/77
n-Propyl amine	0	2	1	I	X	3/73
iso-Propyl amine	0	2	1	I	X	3/73
n-Propyl benzene	0	(2)	(0)	(0)	0	6/75
iso-Propyl benzene	0	2	1	0	X	7/76
n-Propyl chloride	Z	(1)	(0)	0	0	12/80 9/81
iso-Propyl cyclohexane	0	1	0	0	0	3/73
Propylene chlorohydrin	0	(1)	2	I	0	6/75
Propylene dichloride	Z	2	1	II	XX	3/73 5/78
Propylene glycol mono ethyl ether	0	(1)	(1)	I	0	7/76
Propylene glycol mono methyl ether	0	(1)	0	0	0	9/81
Propylene oxide	0	1	1	II	X	3/73 10/75 11/79 12/80
Propylene tetramer	0	0	1	0	0	3/73
Propylene trimer	0	0	1	0	0	3/73
iso-Propyl ether	See Di-iso-propyl ether					
n-Propyl formate	0	(0)	1	0	0	6/75
1-iso-Propyl-4-methyl benzene	See para-Cymene					
Propyl palmitate	0	(0)	(0)	0	X	10/75 12/80
iso-Propyl toluene	0	(2)	1	0	X	11/76
Propyl trichlorosilane	0	1	(1)	II	XX	5/77 6/80
Pseudo cumene	See 1,2,4-Trimethyl benzene					
Pumice	0	0	0	0	0	3/73
Pyridine	T	1/BOD	1	0	XX	3/73
Pyrite residue	0	0	0	0	0	3/73 11/74 7/76

Substances	A	B	C	D	E	Remarks
Pyrosulphuryl chloride	0	2	1	II	XX	5/77 11/79
Quicklime	0	1	0	0	0	3/73
Rape seed oil	0	0	0	0	XX	6/80
Rosin	-	3	-	-	-	6/80
Rutile	0	0	0	0	0	3/73
Saltpetre	0	0	0	0	0	3/73
Sand	0	0	0	0	0	3/73
Selenic acid	+	3	3	II	XX	5/77
Shell sand	0	0	0	0	0	3/73
Silicofluorides (solid, N.O.S.)	0	2	2	0	0	11/79
Silicon tetrachloride	0	1	1	0	0	3/73
Silicon tetrafluoride	0	3	(2)	II	XX	5/78
Silver arsenite	+	(4)	(3)	0	0	5/77
Silver cyanide	+	4	2	0	0	5/77
Simazine	0	3	0	0	XX	3/73 11/74
Soda lime	0	2	1	I	X	5/77
Sodium aluminate (solution)	0	2	1	I	0	5/77
Sodium ammonium vanadate	0	2	3	0	0	11/79
Sodium arsanilate	+	(3)	(3)	I	X	11/79
Sodium arsenate	+	3	2	0	0	3/73
Sodium arsenite	+	3	3	0	0	5/77
Sodium azide	0	3	3	0	XX	5/77
Sodium bichromate (solution)	0	2	1	0	0	3/73
Sodium bisulphate	See Sodium hydrogen sulphate					
Sodium bisulphide	See Sodium hydrosulphide					
Sodium bisulphite	See Sodium hydrogen sulphite					
Sodium borate	See Borax					
Sodium cacodylate	+	-	(2)	0	0	5/77
Sodium carbonate	0	1	0	0	0	3/73
Sodium chloride	0	0	0	0	0	3/73
Sodium chlorite	See Sodium hypochlorite					
Sodium cuprocyanide (solid)	+	(4)	(3)	II	XX	11/79
Sodium cyanide	0	4	3	I	0	5/77 11/79
Sodium dinitro-ortho-cresolate	See 4,6-Dinitro-ortho-cresol					

Substances	A	B	C	D	E	Remarks	
Sodium fluoride	0	1	2	0	0		7/76
Sodium hydrogen sulphate	0	1	1	I	0		5/77
Sodium hydrogen sulphite (solutions)	0	1	1	0	0		5/77
Sodium hydrosulphide (solutions)	0	3	2	II	XX		7/76
Sodium hydroxide	0	2	1	I	0		3/73
Sodium hypochlorite (solutions)	0	2	3	I	0		10/75 7/76
Sodium monoxide	0	2	1	I	0		5/77
Sodium nitrite	0	3	2	0	0		5/78 11/79
Sodium pentachlorophenate	T	4	2	0	XX		3/73
Sodium phenate	See Sodium phenolate						
Sodium phenolate (solid)	T	2	2	I	XX		11/79
Sodium phosphide	0	3	*	II	XXX	*Hazard from immediate release of highly toxic Phosphine	5/78
Sodium silicate (solution)	0	1	(0)	0	0		10/75
Sodium sulphide	0	3	2	II	XX		5/78 11/79
Sodium sulphite	0	1	1	0	0		5/78 11/79
Sorbitol	0	0	0	0	0		3/73 9/81
Soya bean meal	0	0/BOD	0	0	X		3/73
Soya bean oil	0	0	0	0	XX		6/80
Stannic chloride	0	2	1	I	XX		11/79
Stannic chloride pentahydrate	0	2	(2)	II	XX		11/79
Stearic acid	See Octadecanoic acid						
Stearyl alcohol	See 1-Octadecanol						
Stone	0	0	0	0	0		3/73
Strontium arsenite	+	3	3	0	0		5/77

Substances	A	B	C	D	E	Remarks	
Strontium phosphide	0	3	*	II	XXX	*Hazard from immediate release of highly toxic Phosphine	5/78
Strychnine (and salts)	0	4	4	II	XX		5/77
Styrene (monomer)	T	2	2	I	XX		10/75 7/76 6/80
Succinic acid	0	-	0	0	0		5/77
Sugar (brown, raw)	0	0/BOD	0	0	0		3/73
Sulpholane	0	(0)	1	0	0		10/75 12/80
Sulphonyl chloride	See Sulphuryl chloride						
Sulphur	0	0	0	0	X		3/73
Sulphur chlorides	0	-	-	II	XX		5/77
Sulphur dioxide (solution)	See Sulphurous acid						
Sulphuric acid	0	2	1	I	0		3/73
Sulphurous acid	0	1	1	I	0		5/77 11/79
Sulphurous oxychloride	See Thionyl chloride						
Sulphur trioxide	0	2	1	II	X		5/77
Sulphuryl chloride	0	(2)	(1)	II	XX		5/77 11/79
Sunflower oil	0	0	0	0	XX		6/80
Superphosphates	0	0	0	0	0		3/73
2,4,5-T	See 2,4,5-Trichlorophenoxyethanoic acid						
Talc rock	0	0	0	0	0		3/73
Tallow	0	0/BOD	0	0	XX		3/73
Tannic acid	0	2	1	0	0		10/75 5/77 12/80
Tannin	See Tannic acid						
Tartaric acid	0	-	0	0	0		5/77
TBP	See Tributyl phosphate						
TCP	See Tricresol phosphate						
"Tergitol 15 S9"	0	-	1	I	XX		11/79 6/80
1,1,2,2-Tetrabromoethane	See Acetylene tetrabromide						
Tetrabromomethane	See Carbon tetrabromide						
1,1,2,2-Tetrachloroethane	Z	3	2	II	X		5/77
1,1,2,2-Tetrachloro-ethylene	Z	3	0	0	X		5/78

Substances	A	B	C	D	E	Remarks	
Tetrachloromethane	Z	2	1	0	XX	Carcinogen	5/78 11/79 6/80
Tetradecanoic acid	0	(0)	(0)	0	0		5/77
1-Tetradecanol	0	(0)	0	0	X		11/76 11/79 12/80
Tetraethyl dichloro-pyrophosphate	-	-	-	-	-		6/80
Tetraethyl dithiopyro-phosphate	0	(4)	4	II	XX		5/77 6/80
Tetraethylene glycol	0	(0)	0	0	0		10/75 12/80
Tetraethylene pentamine	0	1	1	I	X		7/76 12/80
Tetraethyl lead	Z	3	3	II	XXX		3/73
Tetraethyl pyrophosphate	0	4	4	II	XXX		5/77 6/80
Tetrahydrofuran	0	1	1	0	0		3/73
Tetrahydronaphthalene	0	2	1	0	X		3/73
Tetrahydrothiophene-1,1-dioxide	See Sulpholane						
Tetramethyl ammonium hydroxide	0	2	-	II	XX		5/77 12/80 9/81
1,2,3,5-Tetramethyl benzene	0	(2)	(1)	0	0		11/76 12/80
Tetramethyl lead	Z	3	3	II	XXX		3/73
Thallium compounds	+	2	3	0	0		5/77
Thiocarbonyl chloride	See Thiophosgene						
Thioglycolic acid	0	-	2	II	XX		5/77
Thionyl chloride	0	1	-	II	XX		5/77
Thiophosgene	-	-	1	II	XX		11/79
Thiophosphoryl chloride	0	-	-	II	XX		5/77 6/80
Titanium slag	0	0	0	0	0		3/73
Titanium tetrachloride	0	1	1	0	0		3/73
TMA	See Trimethylamine						
TNT	See Trinitrotoluene						
Toluene	0	2	1	I	X		3/73 11/76
Toluene-2,4-diamine	See 2,4-Tolylenediamine						
Toluene diisocyanate	0	2	0	II	XXX	Potent sensitizer	7/76 11/79 12/80

Substances	A	B	C	D	E	Remarks	
Toluidenes	0	2	2	II	XX		5/77
2,4-Tolylenediamine	0	-	1	I	X		5/77
Toxaphene	+	4	2	I	XXX		3/73 9/81
Triacetin	See Glycerol triacetate						
1-Triacontanol	See Myristyl alcohol						
Tribromoethane	(Z)	(3)	(1)	I	X		5/78
Tribromomethane	See Bromoform						
Tributylamine	0	2	2	II	XX		11/79
Tributyl phosphate	0	3	1	II	XX		10/75 11/79 6/80
Trichloroacetaldehyde	0	1	2	0	0		3/73 7/76
Trichloroacetic acid	0	2	1	I	XX		11/79
Trichloroacetic acid, chloride	See Trichloroacetyl chloride						
Trichloroacetyl chloride	0	2	1	II	XX		11/79
1,2,4-Trichlorobenzene	Z	(4)	1	0	X		10/75
Trichlorobutene	Z	(2)	(2)	0	0		11/79
Trichloroethanal	See Trichloroacetaldehyde						
1,1,1-Trichloroethane	Z	2	1	0	0		3/73 10/75 5/78
1,1,2-Trichloroethane	Z	2	1	0	0		3/73 10/75 5/78
1,1,2-Trichloroethene	See 1,1,2-Trichloroethylene						
1,1,2-Trichloroethylene	Z	2	1	II	XX	Carcinogen	11/79 6/80
Trichlorofluoromethane	---------gas---------						3/73 5/78
Trichloromethane	Z	2	2	I	XX	Carcinogen	3/73 5/78 6/80 12/80 9/81
2,4,5-Trichlorophenoxy-ethanoic acid	0	3	1	0	XXX		3/73
2,4,6-Trichloro-1,3,5-triazine	See Cyanuric chloride						
Tricresyl phosphate (less than 1% ortho-isomers)	0	3	1	II	XX	Delayed neurotixicity	6/80 9/81

Substances	A	B	C	D	E	Remarks	
Tricresyl phosphate (more than 1% ortho-isomers)	0	4	1	II	XXX	Delayed neurotoxicity	9/81
Tridecanoic acid	0	(0)	(1)	0	0		5/77
1-Tridecanol	0	0	0	0	X		3/73 11/76 12/80 9/81
Tridecene and Tetradecene (mixture)	-	-	-	-	-		6/80
Tridecyl benzene	0	(2)	0	0	0		5/76
Triethanolamine	0	1	0	0	0		3/73
Triethylamine	0	2	1	I	X		3/73
Triethyl benzene	0	(2)	0	0	0		10/75 11/76 12/80
Triethylene glycol	0	0	0	0	0		3/73 9/81
Triethyleneimine phosphoric acid	See Tris(1-aziridinyl) phosphine oxide						
Triethylene tetramine	0	2	1	I	X		10/75
Triethyl pentanediol	0	-	(1)	0	0		10/75 6/80
Triethyl phosphate	0	1	1	II	XX		10/75 7/76 11/79 6/80
Trimethyl acetic acid	0	1	1	-	-		9/81
Trimethylamine	0	2	2	I	X		5/78
1,2,3-Trimethyl benzene	0	(3)	0	0	0		7/76 12/80 9/81
1,2,4-Trimethyl benzene	0	3	1	I	X		7/76 6/80 9/81
1,3,5-Trimethyl benzene	0	(3)	(1)	0	0		7/76 9/81
Trimethyl chlorosilane	0	1	(1)	II	XX		5/78 6/80
Trimethyl cyclohexylamine	0	(2)	(2)	I	XX		11/79
3,3,5-Trimethyl hexamethylene diamine	0	(1)	(1)	I	XX		11/79
Trimethyl hexamethylene diisocyanate	0	-	-	I	X		11/79 12/80
Trimethyl pentanediol	0	-	(1)	0	0		10/75 12/80
Trimethylol propane	0	0	0	0	0		7/76 12/80

Substances	A	B	C	D	E	Remarks	
2,2,4-Trimethyl-1,3-pentanediol monoisobutyrate	0	-	1	0	0		5/78 11/79
2,4,4-Trimethylpent-2-ene	See Diisobutene						
1,3,5-Trinitrobenzene	0	-	2	-	X		5/78
Trinitrophenol	0	3	(2)	II	XX		5/78
Trinitrotoluene	0	3	1	II	XX		5/78
Trioxane-2,4,6-trimethyl	See Paraldehyde						
"Trioxitol"	0	0	0	0	0		5/78
Triisopropanolamine	0	(2)	1	I	X		7/76 6/80
Tripropylene glycol	0	0	0	0	0		3/73 9/81
Tripropylene glycol monomethyl ether	0	(1)	1	I	0		10/75 7/76
Tripropylene glycol monomethyl ether acetate	0	(1)	1	I	0		7/76
Tris(1-aziridinyl) phosphine oxide (solution)	0	-	3	0	XX	Carcinogen	11/79
Tritolyl phosphate	See Tricresyl phosphate						
Trixylenyl phosphate	(0)	3	(1)	II	XXX		10/75 7/76 12/80 9/81
Turpentine (wood)	T	2	1	0	X		3/73
Undecane	0	(1)	(1)	0	0		10/75
Undecanoic acid	0	(0)	(1)	I	X		5/77
1-Undecanol	0	3	0	0	X		11/79
1-Undecene	0	(2)	(1)	0	0		6/80
Urea	0	0/BOD	0	0	0		3/73
Urea, ammonium nitrate solutions	0	1	1	0	0		9/81
Urea, ammonium phosphate solutions	0	1	0	0	0		9/81
USAF CB-35	See Thioglycolic acid						
n-Valeraldehyde	0	1	1	I	X		10/75 6/80 12/80
iso-Valeraldehyde	0	2	(1)	I	X		9/81
Valeric acid	See Pentanoic acid						

Substances	A	B	C	D	E	Remarks	
Valeryl chloride	0	-	(1)	I	XX		11/79
Vanadic anhydride	0	2	4	II	XX		11/79
Vanadium oxytrichloride	0	(2)	2	II	XX		11/79
Vanadium pentoxide	0	2	4	II	XX		11/79
Vanadium tetrachloride	0	(2)	2	II	XX		11/79
Vanadium trichloride	0	(2)	2	II	XX		11/79
Vanadium trioxide	0	(2)	2	I	X		11/79
VCM	See Vinyl chloride						
"Veova 10"	See Vinyl ester of C_{10} trialkyl acetic acid						
Vermiculite (natural)	0	0	0	0	0		6/80
"Versatic 10"	0	2	1	I	X		6/80
Vinyl acetate	0	2	1	0	X		6/80
Vinyl benzene	See Styrene monomer						
Vinyl benzene, ethyl methyl	See Styrene, ethyl methyl						
Vinyl chloride (inhibited)	0	N/A	N/A	II	XXX	gas, Human carcinogen	10/75 6/80 12/80 9/81
Vinyl ester of C_{10} trialkyl acetic acid	0	3	0	I	X		6/80
Vinyl ethyl ether	0	2	0	0	XX	Explosive	10/75 6/80
Vinylidene chloride	Z	1	2	II	XX	Carcinogen	11/74 10/75 6/80 9/81
Vinyl methyl ether	-	-	-	-	-		10/75 6/80
Vinyl neodecanate	-	-	-	-	-		6/80
Vinyl trichloride	See 1,1,2-Trichloroethylene						
Vinyl trichlorosilane	0	(1)	1	II	XX		5/78 6/80
Warfarin	0	2	2	0	XX		3/73 11/74 7/76
Water gas	---------gas---------						5/78
White spirit, low (15-20%) aromatic	Z	3	1	I	X		6/80
Wine	0	0	0	0	0		3/73 9/81
Woodbark	0	0/D/ BOD	0	0	0		3/73
Wood creosote	See Creosote, wood						
Wood pulp	0	0/D/ BOD	0	0	X		3/73

Substances	A	B	C	D	E	Remarks
Xylene (mixed isomers)	0	2	1	0	X	3/73 12/76 5/77
Xylenols (mixtures)	T	(3)	1	I	XX	10/75 12/80
Xylidines	0	2	1	II	XX	5/77
Xylyl bromide	0	-	-	-	-	5/77
Zinc arsenate and arsenite (solid mixtures)	+	3	3	-	-	5/77
Zinc chloride	+	3	2	0	0	5/77
Zinc concentrates (sulphides)	0	0	0	0	0	3/73
Zinc cyanide	+	4	3	I	0	5/77
Zinc dialkyl dithio-phosphate	-	-	-	-	-	7/76 6/80
Zinc ore (sulphides)	0	0	0	0	0	3/73
Zinc phosphide	+	3	3	II	XX	5/77 11/79
Zinc silicofluoride	See Silicofluorides					
Zircon	0	0	0	0	0	3/73
Zirconium tetrachloride	0	1	1	I	XX	11/79

HAZARD PROFILES FOR CLASSES OF COMPOUNDS

Substances	A	B	C	D	E	Remarks
1 Alcohols						
Methanol	0	0	1	0	0	
Ethanol	0	0	0	0	0	
n-Propanol	0	1/BOD	1	0	0	
iso-Propanol	0	0	1	0	0	
Allyl alcohol	0	3	2	0	XX	
n-Butanol	0	1	1	0	0	
iso-Butanol	0	1	1	0	0	
sec-Butanol	0	(1)	1	0	0	
tert-Butanol	0	1	1	0	0	
2-Methyl-1-butanol	0	(1)	1	0	0	
2-Methyl-2-butanol	0	1	1	0	0	
3-Methyl-1-butanol	0	1	1	0	0	
3-Methyl-2-butanol	0	(1)	(1)	0	0	
1-Pentanol	0	1	2	II	X	
2-Pentanol	0	(1)	1	0	0	
3-Pentanol	0	(1)	1	0	0	
2-Methyl-1-pentanol	0	1	1	0	0	
2-Ethyl-1-butanol	0	1	1	I	X	
n-Amyl alcohol	0	1/BOD	1	0	0	
iso-Amyl alcohol	0	2	1	0	0	
tert-Amyl alcohol	0	0	1	0	0	
Methyl amyl alcohol	0	1	1	0	0	
1-Hexanol	0	1	1	II	XX	
1-Heptanol	0	2	1	I	0	
2-Heptanol	0	(2)	1	I	0	
3-Heptanol	0	(2)	1	I	0	
1-Octanol	0	2	1	0	X	
iso-Octanol	0	2	1	0	X	
2 Ethyl hexyl alcohol	0	2	0	0	X	
1-Nonanol	0	2	1	0	X	
Octyl/Decyl alcohol (mixture)	0	3	1	0	X	

Substances	A	B	C	D	E	Remarks
1-Decanol	0	3	1	0	X	
iso-Decanol	0	3	0	0	X	
Dodecanol	0	3	0	0	X	
1-Tridecanol	0	0	0	0	X	
1-Tetradecanol	0	(0)	0	0	X	
1-Octadecanol	0	0	(0)	0	X	
Trimethyl pentanediol	0	-	(1)	0	0	
Triethyl pentanediol	0	-	(1)	0	0	
1,2,6-Hexanetriol	0	0	0	0	0	
Benzyl alcohol	0	2/BOD	1	0	0	
Phenyl ethyl alcohol	0	(1)	1	0	0	
Cyclohexanol	0	2	1	II	X	
2 Alkanes						
Ethane			gas			
Propane			gas			
Butane			gas			
n-Pentane	0	2	0	0	0	
iso-Pentane	0	1	0	0	0	
n-Hexane	0	0	0	0	0	Delayed neurotoxicity
n-Heptane	0	0	0	0	0	
n-Octane	0	(1)	(1)	0	0	
iso-Octane	0	(1)	(1)	0	0	
Nonane	0	(1)	(0)	0	0	
Decane	0	(1)	(1)	0	0	
Undecane	0	(1)	(1)	0	0	
Dodecane	0	(1)	(1)	0	0	
Tridecane			not considered			
Heptadecane	0	(0)	(0)	0	0	
2-Methyl pentane	0	(0)	(0)	0	0	
Cycloheptane	0	1	(1)	II	X	
Cyclohexane	0	2	1	II	X	
Ethyl cyclohexane	0	1	1	0	0	
iso-Propyl cyclohexane	0	1	0	0	0	

Substances	A	B	C	D	E	Remarks
3 Alkenes						
Ethene			gas			
Propene			gas			
Butene			gas			
di-iso-Butene	0	2	(1)	0	0	
2-Pentene	0	(2)	(1)	0	0	
2-Pentene	0	(2)	(1)	0	0	
Dipentene	0	2	1	I	X	
1-Hexene	0	2	(1)	0	0	
Heptene	0	2	(1)	0	0	
1-Octene	0	2	(1)	0	0	
Nonene	0	(2)	(1)	0	0	
Decene	0	(2)	(1)	0	0	
1-Undecene	0	(2)	(1)	0	0	
1-Dodecene	0	(2)	(1)	I	0	
Tridecene and Tetradecene (mixture)	-	-	-	-	-	
2-Methyl pentene	0	(2)	(1)	0	0	
1,3-Pentadiene	-	-	-	-	-	
Divinyl acetylene	0	(1)	0	0	0	
alpha-Pinene	(T)	3	(1)	I	X	
beta-Pinene	(T)	3	1	I	X	
Isoprene	0	2	0	I	0	
4 Benzene and Alkyl Benzenes						
Benzene	0	2	1	II	XXX	Human carcinogen
Toluene	0	2	1	I	X	
Ethyl benzene	0	2	1	0	X	
Diethyl benzene (mixed isomers)	0	2	1	0	X	
Styrene (monomer)	T	2	2	I	XX	
alpha-Methyl styrene (vinyl toluene)	T	(2)	1	0	X	
Xylene (para-)	0	2	1	0	X	
Xylene (ortho-)	0	2	1	0	X	
Xylene (meta-)	0	2	1	0	X	
Xylene, mixed isomers	0	2	1	0	X	

Substances	A	B	C	D	E	Remarks
1,2,3 - Trimethyl benzene (hemimellitene)	0	(3)	0	0	0	
1,2,4 - Trimethyl benzene (pseudocumene)	0	3	1	I	X	
1,3,5 - Trimethyl benzene (mesitylene)	0	(3)	(1)	0	0	
Cumene (isopropylbenzene)	0	2	1	0	X	
iso-Propyl toluene	0	(2)	1	0	X	
Triethyl benzene	0	(2)	0	0	0	
Dodecyl benzene	0	2	0	0	0	
Tridecyl benzene	0	(2)	0	0	0	
p-tert-Butyl toluene	T	3	1	I	X	
1,2,3,5 - Tetramethyl benzene	0	(2)	(1)	0	0	
5 Chlorosilanes						
Methyl dichlorosilane	0	1	(1)	II	XX	
Ethyl dichlorosilane	0	1	(1)	II	XX	
Dimethyl dichloro-silane	0	1	1	II	XX	
Diethyl dichloro-silane	0	1	1	II	XX	
Trimethyl chlorosilane	0	1	(1)	II	XX	
Methyl phenyl dichlorosilane	-	1	(2)	II	XX	
Ethyl phenyl dichlorosilane	-	(1)	(1)	II	XX	
Diphenyl dichloro-silane	0	(1)	(1)	II	XX	
Dibenzyl dichloro-silane	-	(1)	(1)	II	XX	
Methyl trichloro-silane	0	1	1	II	XX	

Substances	A	B	C	D	E	Remarks
Ethyl trichlorosilane	0	1	1	II	XX	
Propyl trichlorosilane	0	1	(1)	II	XX	
Butyl trichlorosilane	0	1	(1)	II	XX	
Amyl trichlorosilane	0	(1)	1	II	XX	
Hexyl trichlorosilane	0	(1)	1	II	XX	
Octyl trichlorosilane	0	(1)	(1)	II	XX	
Nonyl trichlorosilane	0	(1)	(1)	II	XX	
Dodecyl trichlorosilane	0	(1)	(1)	II	XX	
Hexadecyl trichlorosilane	0	(1)	(1)	II	XX	
Octadecyl trichlorosilane	0	(1)	(1)	II	XX	
Vinyl trichlorosilane	0	(1)	1	II	XX	
Allyl trichlorosilane (stabilized)	0	(1)	(1)	II	XX	
Phenyl trichlorosilane	0	1	1	II	XX	
Chlorophenyl trichlorosilane	(+)	-	(1)	II	XX	
Dichlorophenyl trichlorosilane	(+)	-	(1)	II	XX	
Cyclohexyl trichlorosilane	0	(1)	(1)	II	XX	
Cyclohexenyl trichlorosilane	0	(1)	1	II	XX	
6 Fatty Acids						
Formic acid	0	1	1	I	X	
Acetic acid	0	2	1	0	0	
Propionic acid	0	1	1	0	0	
n-Butyric acid	T	1	1	II	XX	
iso-Butyric acid	(T)	(1)	2	II	XX	
Pentanoic acid	0	2	1	II	XX	
Hexanoic acid	0	-	1	I	X	
Heptanoic acid	0	(1)	0	I	X	
2-Ethyl hexanoic acid	0	1	1	I	0	

Substances	A	B	C	D	E	Remarks
Octanoic acid	0	-	1	I	X	
Nonanoic acid	0	(1)	1	II	XX	
iso-Nonoic acid	0	(1)	(1)	II	XX	
Decanoic acid	0	(0)	(1)	I	X	
Undecanoic acid	0	(0)	(1)	I	X	
Lauric acid	0	(0)	0	0	0	
Tridecanoic acid	0	(0)	(1)	0	0	
Tetradecanoic acid	0	(0)	(0)	0	0	
Pentadecanoic acid	0	2	(0)	0	0	
Hexadecanoic acid	0	(0)	(0)	0	0	
Heptadecanoic acid	0	(0)	(0)	0	0	
Octadecanoic acid	0	(0)	(0)	0	0	
Nonadecanoic acid	0	(0)	(0)	0	0	
Eicosanic acid	0	(0)	(0)	0	0	
Linoleic acid	0	(0)	(0)	0	XX	
Linolenic acid	0	(0)	(0)	0	XX	
Oxalic acid (10-25%)	0	1	1	0	0	
Lactic acid	0	1/BOD	1	0	0	
Malonic acid	0	-	1	0	0	
Malic acid	0	-	(1)	0	0	
Succinic acid	0	-	0	0	0	
Tartaric acid	0	-	0	0	0	
Maleic acid	0	1	1	0	0	
Citric acid	0	1/BOD	0	0	0	
Tannic acid	0	2	1	0	0	
Oleic acid	0	(0)	0	0	XX	
7 Glycols and Derivatives						
Ethylene glycol	0	0	1	0	0	
Ethylene glycol, monomethyl ether	0	0	1	I	0	
Ethylene glycol, monoethyl ether	0	0	1	I	0	
Ethylene glycol, monoisopropyl ether	0	1	1	I	0	
Ethylene glycol, monobutyl ether	0	1	1	I	0	

Substances	A	B	C	D	E	Remarks
Ethylene glycol monophenyl ether	0	1	1	I	X	
Diethylene glycol	0	0	0	0	0	
Diethylene glycol, monomethyl ether	0	2	1	I	0	
Diethylene glycol, monoethyl ether	0	0	1	I	0	
Diethylene glycol, monobutyl ether	0	0	1	I	0	
Diethylene glycol, diethyl ether	0	0	1	I	0	
Monopropylene glycol	0	0	0	0	0	
Propylene glycol, monoethyl ether	0	(1)	(1)	I	0	
Propyleneglycol monomethyl ether	0	(1)	0	0	0	
Dipropylene glycol	0	0	0	0	0	
Dipropylene glycol, monomethyl ether	0	(1)	1	I	0	
Tripropylene glycol	0	0	0	0	0	
Tripropylene glycol, monomethyl ether	0	(1)	1	I	0	
Tripropylene glycol, monomethyl ether acetate	0	(1)	1	I	0	
Ethylene glycol, (*mono*) acetate	0	(1)	1	0	0	
Ethylene glycol, monomethyl ether acetate	0	1	1	I	0	
Ethylene glycol, monoethyl ether acetate	0	(1)	1	I	0	
Ethylene glycol methyl butyl ester	0	-	-	-	0	
Ethylene glycol, monobutyl ether acetate	0	1	1	I	0	

Substances	A	B	C	D	E	Remarks
Diethylene glycol, monomethyl ether acetate	0	(1)	1	I	0	
Diethylene glycol, monoethyl ether acetate	0	(1)	1	I	0	
Diethylene glycol, monobutyl ether acetate	0	(1)	1	I	0	
8 Halogenated Aliphatic Hydrocarbons						
Choromethane	0	1	(1)	0	0	
Dichloromethane	0	1	1	I	0	
Trichloromethane	Z	2	2	I	XX	Carcinogen
Tetrachloromethane	Z	2	1	0	XX	Carcinogen
Bromomethane	0	2	-	II	XX	
Dibromomethane	Z	(2)	(1)	I	X	
Bromoform	Z	(3)	(2)	II	XX	
Carbon tetrabromide	Z	(3)	1	I	0	
Vinyl chloride	0	N/A	N/A	II	XXX	Gas, Human carcinogen
Chloroethane	0	0	N/A	0	0	
1,1-Dichloroethane	Z	(1)	1	0	0	
1,2-Dichloroethane	Z	1	2	II	XX	Carcinogen
Vinylidene chloride	Z	1	2	II	XX	Carcinogen
1,2-Dichoroethylene	0	(1)	1	I	X	
1,1,1-Trichloroethane	Z	2	1	0	0	
1,1,2-Trichloroethane	Z	2	1	0	0	
1,1,2-Trichloroethylene	Z	2	1	II	XX	Carcinogen
1,1,2,2-Tetrachloro-ethane	Z	3	2	II	X	
1,1,2,2-Tetrachloro-ethylene	Z	3	0	0	X	
Pentachloroethane	Z	3	2	0	X	
Bromoethane	0	-	-	I	X	
Monobromoethylene	0	-	2	I	X	
1,1-Dibromoethane	Z	(2)	(2)	I	X	

Substances	A	B	C	D	E	Remarks
Ethylene dibromide	Z	2	2	II	XXX	Carcinogen
1,2-Dibromoethylene	Z	2	2	II	XXX	Carcinogen
Acetylene tetrabromide	Z	(3)	2	II	XX	
n-Propyl chloride	Z	(1)	(0)	0	0	
2-Chloropropane	Z	-	-	-	-	
1-Chloropropylene	Z	-	1	-	-	
2-Chloropropylene	Z	-	-	-	-	
3-Chloropropylene	Z	2	2	II	XX	
1,1-Dichloropropane	Z	2	0	I	X	
Propylene dichloride	Z	2	1	II	XX	
1,3-Dichloropropane	Z	2	(1)	I	X	
1,1-Dichloropropylene	Z	-	-	-	-	
1,2-Dichloropropylene	Z	-	-	-	-	
1,3-Dichloropropylene	Z	2	2	I	X	
2,3-Dichloropropylene	Z	(2)	2	I	X	
3,3-Dichloropropylene	Z	-	-	-	-	
3-Bromopropene	Z	(3)	3	II	XX	
1-Chlorobutane	Z	-	1	-	-	
2-Chloro 1,3-butadiene	Z	(2)	1	II	XXX	Human carcinogen
Trichlorobutene	Z	(2)	(2)	0	0	
1-Chloropentane	-	-	-	-	-	
1-Chlorohexane	-	-	-	-	-	
Dichlorohexane	Z	1	1	0	0	
1-Chloroheptane	-	-	-	-	-	
n-Octyl chloride	-	-	-	-	-	
9 Organophosphorus Compounds						
Acid butyl phosphate	0	-	-	II	XX	
Triethyl phosphate	0	1	1	II	XX	
Tributyl phosphate	0	3	1	II	XX	
Tricresyl phosphate (less than 1% ortho-isomers)	0	3	1	II	XX	Delayed neurotoxicity

Substances	A	B	C	D	E	Remarks
Tricresyl phosphate (more than 1% ortho-isomers)	0	4	1	II	XXX	Delayed neurotoxicity
Trixylenyl phosphate	0	(3)	(1)	II	XXX	
Tetraethyl pyrophosphate	0	4	4	II	XXX	
iso Propyl acid phosphate	0	-	-	I	-	
Di-iso octyl acid phosphate	0	-	-	II	XX	
Tris (1-aziridinyl) phosphine oxide (solution)	0	-	3	0	XX	Carcinogen
Phosgene	0	-	-	II	XX	
Dimethyl thiophosphoryl chloride	0	-	1	I	XX	
Azinphos methyl	0	4	4	II	XXX	
Chlorofenvinphos	-	-	3	II	XXX	
Malathion	0	4	1	0	XXX	
Guthion	0	4	4	II	XXX	
Carbophenothion	-	4	3	II	XXX	
Demeton-S-methyl	-	-	2	II	XXX	
Diazinon	-	4	2	I	XXX	
Dichlorvos	-	4	2	II	XX	
Disulfoton	-	4	4	II	XXX	
Fenitrothion	0	-	2	I	XXX	
Menazon	-	-	2	I	XX	
Methyl parathion	0	4	3	II	XXX	
Mevinphos	-	4	4	II	XXX	very high dermal toxicity
Parathion	0	4	4	II	XXX	
Phorate	-	4	4	II	XXX	very high dermal toxicity
Phosphamidon	-	3	3	II	XX	
Pirimphos ethyl	-	-	2	I	XX	

Substances	A	B	C	D	E	Remarks
10 Phthalates						
Dimethyl phthalate	0	2	1	0	X	
Diethyl phthalate	0	4	1	I	X	
Dipropyl phthalate	0	(3)	(1)	0	X	
Dibutyl phthalate	0	3	1	I	X	
Di-iso-butyl phthalate	0	3	0	0	X	
Dihexyl phthalate	0	(2)	0	0	X	
Diheptyl phthalate	0	(2)	(0)	0	X	
Di-n-octyl phthalate	0	(0)	0	I	X	
Di-2-ethyl hexyl phthalate	0	0	0	0	X	
Di-iso-octyl phthalate	0	1	0	I	X	
Dinonyl phthalate	0	0	1	0	XX	
Di-iso-nonyl phthalate	0	0	0	0	XX	
Di-iso-decyl phthalate	0	0	0	0	XX	
Diundecyl phthalate	0	(0)	(1)	0	XX	
Ditridecyl phthalate	0	(0)	0	0	XX	
Octyl decyl phthalate	0	(0)	0	0	XX	

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ANNEX 7

Date Sheet used to record basis of decisions for Future Reference Purposes

1. Correct technical/scientific name		identification number
Alternative names	uses?	formula/composition

2. Physical Properties

Boiling point _____

Melting Point _____

Relative density _____

Vapour pressure _____

Solubility in water _____

Viscosity _____

Colour _____

Odour _____

3. Chemical and Biological Properties

Chemical stability

Reactivity with sea water

Biodegradability

Chemical oxygen demand

Biochemical oxygen demand

Biotransformation

Polymerisation

Lipid solubility

4. Bioaccumulation

Uptake and retention

Tainting

Appearance changes

6. Damage to marine living resources

7. Hazard to human health by oral intake, skin contact and inhalation

8. Effect on amenities

9. Additional remarks including transport in bulk/container size etc.

10. Assigned hazard profile

Date

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ANNEX 8

GUIDELINES FOR THE CATEGORIZATION OF
NOXIOUS LIQUID SUBSTANCES

(International Convention for the Prevention of
Pollution from Ships, 1973, Annex II, Appendix I)

1. Text of Guidelines

Category A Substances which are bioaccumulated and liable to produce a hazard to aquatic life or human health; or which are highly toxic to aquatic life (as expressed by a Hazard Rating 4, defined by a TLm less than 1 ppm); and additionally certain substances which are moderately toxic to aquatic life (as expressed by a Hazard Rating 3, defined by a TLm of 1 or more, but less than 10 ppm) when particular weight is given to additional factors in the hazard profile or to special characteristics of the substance.

Category B Substances which are bioaccumulated with a short retention of the order of one week or less; or which are liable to produce tainting of the sea food; or which are moderately toxic to a TLm of 1 ppm or more, but less than 10 ppm); and additionally certain substances which are slightly toxic to aquatic life (as expressed by a Hazard Rating 2, defined by a TLm of 10 ppm or more, but less than 100 ppm) when particular weight is given to additional factors in the hazard profile or to special characteristics of the substance.

Category C Substances which are slightly toxic to aquatic life (as expressed by a Hazard Rating 2, defined by a TLm of 10 or more, but less than 100 ppm); and additionally certain substances which are practically non-toxic to aquatic life (as expressed by a Hazard Rating 1, defined by a TLm of 100 ppm or more, but less than 1,000 ppm) when particular weight is given to additional factors in the hazard profile or to special characteristics of the substance.

Category D Substances which are practically non-toxic to aquatic life, (as expressed by a Hazard Rating 1, defined by a TLm of 100 ppm or more but less than 1,000 ppm); or causing deposits blanketing the seafloor with a high biochemical ozygen demand (BOD); or

highly hazardous to human health, with an LD_{50} of less than 5 mg/kg; or produce moderate reduction of amenities because of persistency, smell or poisonous or irritant characteristics, possibly interfering with use of beaches; or moderately hazardous to human health, with an LD_{50} of 5 mg/kg or more, but less than 50 mg/kg and produce slight reduction of amenities.

Note: Polution categories A, B, C and D set out above refer to detailed requirements of the Convention for the discharge of noxious liquid substances.

2. Categorization table

As part of an interpretation of the Guidelines set out above, the following table was prepared by the IMCO Sub-Committee on Bulk Chemicals (BCH IX/21, Annex 3).

The Column D rating by GESAMP has been dispensed with for this categorization as that rating related to hazard to human health (skin contact and inhalation) which in the view of the Sub-Committee has no direct bearing on aquatic pollution.

Hazard Profile				Annex II Pollution Category
A	B	C	E	
+	-	-	-	Category A
-	4	-	-	
T	3	-	-	
Z	3	-	XXX	
T	-	-	-	Category B
Z	-	-	-	
-	3	-	-	
-	2	-	XXX*	
-	2	-	-	Category C
-	1	4	XX	
-	1	3	XX	
-	1	-	-	Category D
-	-	4	-	
-	-	3	X	
-	-	-	XXX	
-	-	-	XX	
-	D/BOD	-	-	

* If the substance is non-volatile and insoluble (vapour pressure < 1 mm Hg at 20°C and solubility < 2g/100 ml at 20°C; otherwise it may be rated as Category C.

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ANNEX 9

BIBLIOGRAPHY

For the very large number of substances which have been considered by the Working Group it would be impossible to list all the reference works consulted. The individual data sheets for each substance include such references as part of the record of decisions taken.

The following list is intended only as a general guide to the most commonly used reference sources. In most cases these reference works are compilations of data rather than primary reference works. The primary reference is consulted if this appears necessary. The list below is not exclusive and may other sources of data are used both published and unpublished.

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Registry of Toxic Effects of Chemical Substances. Publ. United States National Institute of Occupational Safety and Hygiene.

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