INTERNATIONAL MARITIME ORGANIZATION
4 ALBERT EMBANKMENT
LONDON SE1 7SR

Telephone: 020-7735 7611
Fax: 020-7587 3210
Telex: 23588 IMOLDN G

IMO

E

Ref: T5/2.01

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HAZARD EVALUATION OF SUBSTANCES TRANSPORTED BY SHIPS

Report of the thirty-seventh session of the GESAMP Working Group on the Evaluation of the Hazards of Harmful Substances Carried by Ships

The report of the thirty-seventh session of the GESAMP Working Group on the Evaluation of the Hazards of Harmful Substances Carried by Ships (EHS 37/11) is attached for information. This report was approved by the thirty-first session of GESAMP, which was held in New York, from 13 to 17 August 2001.

Any comments would be welcome and should be addressed to:

Mr J Crayford
IMO Technical Secretary of the GESAMP/EHS Working Group
Marine Environment Division
4 Albert Embankment
London SE1 7SR
United Kingdom

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WORKING GROUP ON THE EVALUATION OF THE HAZARDS OF HARMFUL SUBSTANCES CARRIED BY SHIPS
36th session
Agenda item 11

EHS 37/11
4 April 2001
ENGLISH ONLY

REPORT OF THE THIRTY-SEVENTH SESSION

1 INTRODUCTION

1.1 The thirty-seventh session of the GESAMP Working Group on the Evaluation of the Hazards of Harmful Substances Carried by Ships was held at IMO Headquarters, London, from 30 April to 4 May 2001 under the chairmanship of Dr C.T. Bowmer. The list of members attending this session is shown in annex 1 and the approved agenda is shown in annex 2.

1.2 On behalf of the Secretary-General of IMO and the Marine Environment Division, Mr Crayford welcomed the Members to the thirty-seventh session of the GESAMP Working Group on the Evaluation of the Hazards of Harmful Substances Carried by Ships. He informed the Group that he had replaced Dr Nauke as Technical Secretary and that Mr Koji Sekimizu and Mr René Coenen were now the Administrative Secretary and the Technical Secretary to GESAMP respectively.

1.3 The Group was informed that, as a result of its intense effort that had been put in over the last two years, the IMO Secretariat had been able to inform the BLG Sub-Committee of IMO that sufficient aspects of the revised GESAMP Hazard Profiles for products transported in bulk by sea had been completed to allow 50% of them to be assigned to the various Pollution Categories under the proposed *3-Category* and *5-Category Systems.*

1.4 The Group noted that the Sub-Committee had expressed its appreciation of the work that it was doing which had allowed preliminary discussions on the choice of Pollution Categorization Systems to take place as well as some initial proposals for the criteria for assigning Ship Types, based on the revised Hazard Profiles, to be developed.

1.5 In addition, the Group was informed that the Sub-Committee had appreciated the preliminary work that that had been done in evaluating the, so called, *Big Movers* which are products that are either moved in large amounts or, alternatively, moved frequently in small amounts which make them very important to both the chemicals industry and the shipping industry.

1.6 The Group also noted that BLG had made the decision to apply the Global Harmonized System approach to missing chronic aquatic toxicity data as a means of estimating chronic toxicity based on surrogate data (acute aquatic toxicity, bioaccumulation and biodegradation).

1.7 Finally, The Group was informed that, at the request of the Executive Director of UNEP, the eight UN Sponsoring Organizations of GESAMP agreed in May 2000 to carry out an in-depth and independent evaluation of GESAMP which is the first review since GESAMP was established in 1969. The Group was advised that a small Evaluation Team of independent scientists was determining GESAMP's achievements, its role as key UN adviser on marine

sciences and its *modus operandi* as well as making recommendations for its future. The report of the Evaluation Team will be presented in July 2001 to the UN Sponsoring Organizations, in August 2001 to the 31st regular session of GESAMP and, finally to the UN Commission on Sustainable Development (CSD) in January 2002.

2 REPORT OF THE *AD HOC* MEETING OF THE MAMMALIAN TOXICOLOGY AND ENVIRONMENTAL SUB-GROUPS

2.1 The Group noted that an *ad hoc* meeting of the environmental and mammalian toxicology Sub-groups had taken place from 4 to 7 December 2000 which had been financed by the Netherlands to complete those columns of the revised GESAMP Hazard Profile required by IMO for defining Pollution Categories, for as many products as possible.

2.2 The Group noted that, as the two sub-groups had been working on different ranges of products, a total of 177 products were reviewed which had resulted in a further 100 Hazard Profiles being sufficiently complete to allow IMO to translate into Pollution Categories.

2.3 The Group noted the resultant Hazard Profiles developed by the sub-groups as shown in annex 3.

3 PROBLEMS ARISING FROM THE *AD HOC* SUB-GROUPS MEETING

3.1 Apart from the general comments identified in agenda item 2, the Group noted that the following general issues had been discussed during the *ad* hoc meeting:

.1 **Skin irritation**: the mammalian toxicity sub-group noted that most of the old literature data on skin irritation were generated using 24h occluded exposures, whereas the revised GESAMP Hazard Evaluation Procedure (rGHEP), which is in line with the Global Harmonized System (GHS), uses 4h semi-occluded exposures.

.1.1 As the sub-group agreed that it was not possible to translate such old data into the current criteria, it was agreed to use the reported results from such tests directly, whilst recognizing that this would be erring on the side of caution.

.1.2 However, in order to accommodate the fact that the term severe irritant, associated with old data, included corrosivity, the Group agreed to evaluate skin irritancy/corrosion into the following classes:

0 Not irritating;
1 Mildly irritating;
2 Irritating;
3 Severely irritating or Corrosive (without any indication of the exposure time needed to cause necrosis)
3a Corrosive by 4h exposure;
3b Corrosive by 1h exposure; and
3c Corrosive by 3min exposure.

.1.3 Furthermore, in order to have compatible descriptive ratings, the Group agreed on the following classes for the evaluation of eye irritancy:

0 Not irritating;
1 Mildly irritating;
2 Irritating; and
3 Severely irritating

.2 **Long term toxicity and sensitisation:** The mammalian toxicity sub-group noted that the revised GESAMP Hazard Profile (rGHP) did not include a specific column for these properties and that an absence of any related description in column F could mean that either there were no data to evaluate or that the product was not a sensitizer.

.2.1 The Group agreed to utilize column (D3) to contain human health related properties, including sensitization, and that consideration should be given to assigning codes for each property rather than the full narrative descriptor. Such codes would be developed for important human health hazards including sensitization, carcinogenicity, mutagenicity and reproductive toxicity.

.3 **Tainting:** The sub-groups recognized the difficulties associated with maintaining column E1 but agreed that this issue should be given further consideration.

.4 **Column F** The Group recognized that many of the remarks currently assigned to column F required further consideration. Furthermore, the Group recognized that, once the human health related remarks had been transferred to column D3, this would leave column F for general remarks that may pertain to any other aspect of the Hazard Profile.

.4.1 As an interim measure, prior to the replacement of some human health remarks in the *Remarks* column with codes in column D3, the Group agreed to the following changes to the existing remarks as a means of simplifying the system whilst concentrating on the most relevant hazards.

Current remark	**Change**
Animal carcinogen	Replace with *carcinogen*
Aspiration hazard	No change
Cholinesterase inhibitor (ChE inhibitor)	Change to *Neurotoxic*
Convulsant	Delete
Delayed neurotoxicity	Change to *neurotoxic*
Delayed lung injury	Change to *Lung injury*
Developmental toxicity	Replace with *Reprotoxic*
Epigenetic carcinogen	Replace with *Carcinogenic*
Hematotoxic	Delete
High acute (peroral), (percutaneous), (inhalation) toxicity	Delete, now covered in specific columns
Human carcinogen	Change to *Carcinogenic*
Immunotoxic	No change
Lachrymator	Delete
Methemoglobin generator	Delete

Current remark	Change
Mutagenicity	New
Neurotoxic	No change
Photosenitizer	No change
Phototoxic	Delete
Reproductive toxicity	Replace with *Reprotoxic*
Sensitizer (skin and/or respiratory)	Change to *sensitizer*
Testicular toxicity	Replace with *Reprotoxic*

.5 **Column E3** The Group recognized the need to develop further criteria for the assignment of column E3 ratings based on both toxicology and physical properties. Furthermore, the Group agreed that such criteria should also contain a reference to flammability, which would be an important factor in emergency response decision making processes.

.6 **Inhalation toxicity** Having given consideration to the circumstances under which inhalation toxicity might be estimated in the absence of experimental data, the Group recognized that, because of the complexity and the need to minimize testing in animals there was considerable interest in being able to estimate inhalation toxicity based on expert judgement and assessment of all other available information for the product and its chemical analogues.

.6.1 The Group agreed that, although techniques had been proposed for the extrapolation of inhalation toxicity from other routes of exposure, there was, at present, no scientifically accepted nor validated method for doing this.

.6.2 However, the Group recognized that it may be possible, for regulatory purposes, to take other evidence into account in order to provide an estimate of the inhalation hazard.

.6.3 As a result, and after thorough investigation, the Group decided to refrain from any extrapolation in this respect and note missing values accordingly. However, it was agreed that an evaluation of a number of toxicological data and physical data of one chemical or inhalation test results from chemicals with similar structures may enable the Group to estimate the toxic potential, thus allowing a rating in brackets. Furthermore, the Group agreed that, in the absence of a measured inhalation LC_{50} value, a provisional rating in brackets may be developed for column C3 based on:

.1 the oral and dermal toxicity;
.2 the irritation/corrosion potential to skin and eye; and
.3 other information related to inhalation toxicity to aerosols, mists etc of the chemical itself or other related chemicals recognized as having similar bioreactive properties.

4 FINALIZATION AND APPROVAL OF GESAMP REPORTS AND STUDIES 64

4.1 The Group recalled that a considerable amount of work had already been put into the development of *the Revised GESAMP Hazard Evaluation Procedure for Chemical Substances Carried by Ships* (GESAMP Reports and Studies 64). As a result, the Group considered the fourth draft of this document and finalized the text, in principle, for sections 4.3 and 4.4, related to columns C and D, as shown in annex 4 whilst recognizing that this may still require some minor editorial amendments.

4.2 In addition, the Group continued discussions on the merits of including the hazard of flammability within Column E3 (interference with the use of coastal amenities) and concluded that it would be appropriate to incorporate this factor. For harmonization purposes, the flashpoints of 23°C and 61°C were selected as the cut-off points. Liquids with a flashpoint below 23°C and those with a flashpoint between 23°C and 61°C that are floaters and also possess evaporative or evaporative and dissolving behaviour, as defined by FE or FED in the Standardized European Behaviour Classification system (SEBC), would be assigned a rating of 2 unless the substance has other hazards that would warrant a higher rating. The Group considered that one of the present descriptions associated with the 2 rating would be adequate to cover flammability if it were expanded slightly by adding this hazard as an example of the properties to be taken into account. As a result, the Group agreed that this concept should be reflected in Reports and Studies 64.

4.3 The Group had a lengthy discussion on the information that should be reflected in column E2. Whilst it was agreed that the prime purpose of this column was to identify floaters (F), persistent floaters (Fp) and sinkers (S), the Group agreed that the results of applying the SEBC system to products should also be shown either in column E2 or the Remarks Column.

4.4 Having agreed that the remarks related to mammalian toxicology would be reflected in column D3 and that the remaining remarks, in the Remarks Column, did not need to be reflected as part of the revised Hazard Profile, the Group agreed that the results of applying the SEBC system should be shown in column E2 but, in order to emphasise those behaviour patterns (F, Fp and S) that were deemed to have an impact on marine life, these would be highlighted in bold in the Hazard Profile.

4.5 In this context, the Group agreed that GESAMP Reports and Studies 64 should also contain an explanation on how certain physical properties of products may affect marine wildlife and benthic habitats.

4.6 In addition, the Group finalized the text, in principle, for section 4.5.2 and Annex 11 of the GESAMP Reports and Studies 64, related to column E2, as shown in annex 5 whilst recognizing that this may still require some minor editorial amendments.

4.7 Having considered the biological and physical properties that were deemed to be important factors that may cause interference with coastal amenities, the Group refined the criteria for assigning ratings to column E3 and the associated text to replace section 4.5.3 of the GESAMP Reports and Studies 64, as shown in annex 6.

4.8 In addition to these specific issues, the Group identified a number of editorial changes to improve the text of Reports and Studies 64 and agreed to provide further editorial suggestions to the Chairman during the three weeks following the meeting so that the text could be finalized for external review.

5 EVALUATION OF NEW SUBSTANCES PROPOSED FOR CARRIAGE BY SHIPS (EXISTING AND REVISED PROCEDURE)

5.1 The Group considered the following new products, which had been submitted for evaluation by industry and governments. The resultant evaluations are shown in annex 7.

.1 Alkyl dithiocarbamate (C19-C35)
.2 1-Bromopropane
.3 Bis(hydrogenated tallow alkyl) methylamine
.4 *tert*-Dodecanethiol
.5 *N*-Ethyl-2-methylallylamine
.6 Methylene bisthiocyanate
.7 Resin intermediate RI-1116
.8 Syndril E51
.9 Zinc bromide solution and Drilling brines containing zinc

5.2 Whilst recognizing that the products submitted to the Group for evaluation were done so under cover of the above names, the Group agreed that the following products should be identified by their chemical names as shown below:

Submitted Name	**EHS Preferred name**
Resin Intermediate RI-1116	Copolymer of C5 Olefins
Syndril E51	2-Ethylhexyl ester of fatty acids (C_8-C_{10})

6 AMENDMENTS OF EXISTING PROFILES OF SUBSTANCES BASED ON CORRESPONDENCE WITH THE CHEMICALS INDUSTRY

6.1 The Group recalled that some of the information associated with products submitted for evaluation had been inadequate and, as a result, the companies concerned had been requested to submit the relevant data to allow the hazard profiles to be completed.

6.2 As a result, the Group re-evaluated the following products, under the existing system and the revised system, based on additional data supplied by industry:

EHS Number	**Product Name**
2210	Thixatrol Plus
0978	Methylcyclopentadienyl manganese tricarbonyl
2213	Hitec 3000
2082	2,6-di-tert-butylphenol
2214	Mobilad G252
2147	Polyether glycol (mw 600-700)
2148	Polyether glycol (mw 950-1050
2149	Polyether glycol (mw 1350-1450)
2150	Polyether glycol (mw 1900-2100)
2151	Polyether glycol (mw (2825-2975)

2095	Polyolefin aminoester salt
0871	2-Hydroxy-4-(methylthio)butanoic acid

6.3 Prior to consideration of these products, the Group were advised that:

.1 methylcyclopentadienylmanganese tricarbonyl and Hitec 3000 were synonyms for the same product; and

.2 the company has requested that, if possible, the polyether glycols be evaluated as one group.

6.4 Having taken these factors into account, the Group evaluated these products under the existing and the revised systems, the results of which are shown in annex 7.

6.5 Whilst recognizing that the products submitted to the Group for evaluation were done so under cover of the above names, the Group agreed that the following products should be identified by their chemical names as shown below:

Polyether glycol (various)	Poly (tetramethylene) ether glycols (mw 600-3000)
HiTec 3000	Methylcyclopentadienylmanganese tricarbonyl

7 RE-EVALUATION OF PRODUCTS IN THE IBC CODE IN ACCORDANCE WITH THE CRITERIA FOR THE REVISED GESAMP HAZARD EVALUATION PROCEDURE

7.1 In order to re-evaluate those products in the IBC Code, in accordance with the criteria for the revised GESAMP Hazard Evaluation Procedure, the Group split into the following sub-groups:

.1 mammalian toxicology;
.2 environmental toxicology; and
.3 Physical properties.

7.2 As the difficulties associated with evaluating the various properties differed from one sub-group to another, this resulted in the sub-groups evaluating different groups of products.

7.3 As a result, the products evaluated by each of the sub-groups is shown below:

.1	mammalian toxicology:	dodecyl benzene to ferric chloride;
.2	environmental toxicology:	Furfural to isopropylbenzene
.3	physical properties:	*N,N*-dimethylcyclohexylamine to 2-ethylpropylacrolein

7.4 In addition to these basic groups of products, the Group noted the request by IMO to evaluate so called *Big movers*. As a result, priority was given to the following products prior to consideration of the products in alphabetical order:

Furfural
Furfuryl alcohol
Isopropyl alcohol
Isopropyl benzene

Heptene
Hexane (all isomers)
Hexanol
Hexene (all isomers) as well as 1-Hexene and propylene dimmer
Methyl methacrylate
Methyl ethyl ketone
Nonene (all isomers) as well as 1-Nonene and propylene trimer
Octanol (all isomers) as well as 1-Octanol and iso-Octanol
Paraffin wax
Pentene (all isomers) as well as 1-Pentene, 2-Pentene and iso-Pentene
Perchloroethylene
Potassium hydroxide solution
Propylene dimer
Propylene glycol
Propylene trimer to be considered along with Nonene (all isomers)
Sodium hydroxide solution
Tetrahydrofuran
Toluene diisocyanate
Trichloroethylene
Triethanolamine
Urea
Vinyl acetate

7.5 The results of the evaluation of these products are reflected in annex 7

8 DISCUSSION ON WORK CARRIED OUT UNDER AGENDA ITEMS 5, 6 AND 7

8.1 The Group recognized that the revised Hazard Profiles had been completed for all of the products identified by IMO as *Big Movers* with the exception of animal/vegetable oils and their oleo-chemical derivatives.

8.2 The Group recognized that whilst the intention had been to complete the Hazard Profiles of a further 100 products it was also very important to complete the revised text for GESAMP Reports and Studies 64 as this report included all of the information necessary to show how a product would be evaluated. The Group recognized that this was important, not only for members carrying out the evaluations, but also for other interested parties who may be either submitting data for evaluation or using the Hazard Profiles for a specific purpose.

8.3 As a result, the Group noted that the mammalian toxicology of approximately 53 products, the aquatic toxicology of about 62 products and the environmental behaviour of about 84 products had been evaluated.

8.4 The Group were informed that some data from industry on oils and fats had been received just prior to the meeting. However, the Group were unable to review these data at this session but members agreed to review them intersessionally in order to provide feedback to industry should additional information be deemed necessary in order to evaluate the products fully. It was also recognized that such feedback would assist industry in completing submissions for the other products associated with this sector of the chemicals industry.

8.5 In this context, the Group recognized that, whilst the Federation of Oils Seeds and Fats Associations Ltd (FOSFA) were coordinating the collection of data from industry on vegetable/animal oils and their derivatives, data would be submitted to GESAMP for evaluation from specialised industry sectors such as the European Oleo-chemicals and Allied Products Group (APAG). Notwithstanding this point, the Group recognized that the feedback that it would provide on the data submitted for one group of related chemicals would be useful to all the sectors involved.

9 FUTURE WORK PROGRAMME AND DATE OF THE NEXT SESSION

9.1 The Group noted that the following arrangements had been made to evaluate additional products in the IBC Code:

6-10 Aug 2001	Meeting of the mammalian toxicologists (financed by the Netherlands); and
Nov 2001	Meeting of the aquatic toxicologists (financed by the Japanese Ministry of the Environment)

9.2 In addition, the Group noted that the Physical Properties Sub-Group would attempt to evaluate further products using e-mail as a means of communication but that, if resources could be made available, it would facilitate the discussion necessary to complete this task effectively.

9.3 In order to facilitate this additional work, the Secretariat was instructed to provide each sub-group with a list of products to be evaluated, along with their associated reporting forms containing the information currently in the files.

9.4 Having noted that the next meeting of IMO's BLG Sub-Committee was in June 2002 and that it would be necessary to have as many products evaluated as possible for this meeting, it was agreed that the next full meeting of the Group would be from 22 to 26 April 2002.

10 ANY OTHER BUSINESS

10.1 Coal Tar Products

10.1.1 The Group were informed that the North American Coal Tar Industry anticipated providing data on coal tar products for evaluation at the next meeting.

10.2 Difficult Products to Evaluate

10.2.1 The Group agreed that, once the majority of products, identified in the IBC Code, had been evaluated, those remaining would be the more difficult ones to obtain data on as many are complex mixtures such as the coal tar products.

10.3 Composite List

10.3.1 In order to provide a complete overview of products evaluated, the Secretariat was instructed to send a complete composite list including Hazard Profiles under the old and revised system, to the Group.

10.4 Tainting

10.4.1 The Group were informed that one member had consolidated all of the data associated with products that had previously either been identified as *Tainters* or had been tested and found not to be a *Tainter*. As a result, the Group agreed that column E1 of the rGHP would be updated to reflect the results of this exercise whilst recognizing the previous decision not to carry out any further evaluations of tainting in the future.

10.5 Data Reporting Form

10.5.1 Whilst recognizing that the data reporting form was used both by IMO and GESAMP, the Group requested the Secretariat to rearrange the order of the data in the form to be in line with the rGHP i.e. environmental data followed by mammalian toxicity data.

10.5.2 In addition, the Secretariat was instructed to include facilities for reporting the mammalian toxicity reflected in column D3 of the rGHP.

10.5.3 In order to facilitate the data gathering and evaluation process, the Secretariat was instructed to transfer only the data in the EHS files onto the Reporting Form and to leave members to collect data from other sources e.g. IUCLID.

11 CONSIDERATION AND ADOPTION OF THE REPORT

11.1 The Group adopted the report and, having thanked members for the considerable amount of effort that they had put into, *inter alia*, the collection, collation and evaluation of data to generate revised Hazard Profiles as well as the refinement of the text of GESAMP Reports and Studies 64, the Chairman closed the session on Friday 4 May 2001 at 17:00 hrs.

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ANNEX 1

LIST OF MEMBERS ATTENDING THE THIRTY-SIXTH SESSION OF THE WORKING GROUP

Dr C. T. Bowmer (Chairman)
Department of Environmental Toxicology
Toxicology Division
TNO Chemistry
Schoemakerstraat 97
P.O. Box 6011
2600 JA Delft
The Netherlands
E-mail: bowmer@voeding.tno.nl
Tel: +31 15 2 696252
Fax: +31 15 2 572649

Dr. T. Höfer
BGVV
Ref.823
Thielallee 88-92
D-14195 Berlin
Germany
E-mail: thomas.hoefer@bgvv.de
Tel: +49 30 8412 3267
Fax: +49 30 8412 3685

Dr D. James
Ty Llwyd
Llanwrda
Camarthenshire
Wales SA19 8AW
E-mail derek-a.james@virgin.net
Tel: +44 1550 779034

Dr M. Marchand
IFREMER
Centre de Brest
BP 70
29280 Plouzane
France
E-mail: mmarchan@ifremer.fr
Tel: +33 02 98 22 4320
Fax: +33 02 98 22 4594

Dr. S. Micallef
IMO/UNEP Regional Marine Pollution
Emergency Response Centre for the
Mediterranean Sea (REMPEC)
Manoel Island
Malta G2R 05
E-mail: rempecsm@waldonet.net.mt
Tel: +356 337297
Fax: +356 339951

Mr M. Morrissette
Director of Technical Support
Hazardous Materials Advisory Council
Suite 301
1101 Vermont Avenue, NW
Washington, D.C. 20005-3521
U.S.A.
E-mail: mmorrissette@hmac.org
Tel: +1 202 289 4550
Fax: +1 202 289 4074

Dr T. Syversen
Norwegian University of Science and Technology
Faculty of Medicine
Department of Pharmacology and Toxicology
Medisinsk Teknisk Senter — E-mail: tore.syversen@medisin.ntnu.no
N-7005 Trondheim — Tel: +47 73 59 88 48
Norway — Fax: +47 73 59 86 55

Dr M. Wakabayashi
Tokyo Metropolitan Research Institute
for Environmental Protection
7-5 Shinsuna 1-Chome Koto-ku — E-mail: w_meiko@tokyo-eiken.go.jp
Tokyo 136 — Tel: +81 3 3699 1331 (ext. 350)
Japan — Fax: +81 3 3699 1345

IMO SECRETARIAT

Mr J.V. Crayford
Secretary of the Working Group
International Maritime Organization
Marine Environment Division
4 Albert Embankment — E-mail: jcrayford@imo.org
London SE1 7SR — Tel: +44 (0)20 7735 7611
United Kingdom — Fax: +44 (0)20 7587 3210

Mr N. M. Soutar
IMO Consultant
International Maritime Organization
Marine Environment Division
4 Albert Embankment — E-mail: nsoutar@imo.org
London SE1 7SR — Tel: +44 (0)20 7735 7611
United Kingdom — Fax: +44 (0)20 7587 3210

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ANNEX 2

DRAFT AGENDA FOR THE THIRTY-SEVENTH SESSION OF THE GESAMP/EHS WORKING GROUP

1 Adoption of the agenda

2 Report of the *ad hoc* meeting of the mammalian toxicology and environmental toxicology sub-groups

3 Problems arising from the *ad hoc* sub-groups meeting

4 Finalisation and approval of GESAMP Reports and Studies 64

5 Evaluation of new substances proposed for carriage by ships (Existing and Revised procedure)

6 Amendments of existing profiles of substances based on correspondence with the chemicals industry

7 Re-evaluation of products in the IBC Code in accordance with the criteria for the Revised GESAMP Hazard Evaluation Procedure

8 Discussion on work carried out under agenda items 6, 7 and 8

9 Future work programme and date of the next session

10 Any other business

11 Consideration and adoption of the report

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Products discussed during the sub-groups meeting (Dec 2000)

02-May-01

Sorted by Lead Name

	----- Existing GHP -------						---------- Revised GESAMP Hazard Profile (GHP) system ----------														
NAME	**EHS**	**A**	**B**	**C**	**D**	**E**	**A1a**	**A1b**	**A2**	**B1**	**B2**	**C1**	**C2**	**C3**	**D1**	**D2**	**D3**	**E1**	**E2**	**E3**	**F**	**Last Update**
Calcium bromide (solutions)	427	0	0	1	I	0	Inorg	0	Inorg	1	0							0		0		01/12/2000
Choline chloride, solutions	485	0	1	1	0	0	0	NI	R	1	NI	0	(0)	(0)	0	0		0	0	0		01/12/2000
Citric acid	493	0	1/BOD	0	0	0	0	NI	R	1	0	0	NI	NI	1	2		0	2	0		01/12/2000
Clay	495	0	0/D	0	0	0	Inorg	0	Inorg	0	0	0	0	0	0	0		0	S	0		01/12/2000
Coal slurry	498	0	0/D	0	0	X	Inorg	0	Inorg	0	0	0	0	0	0	0		0	S	1		01/12/2000
Coal tar	499	T	3	-	II	XXX	NI	NI	NR	3		0	0	0	1	NI	Yes	Ta	S	3	Human carcinogen, Phototoxic	01/12/2000
Coal tar naphtha	500	T	2	1	II	XXX	NI	NI	NR	3	NI	0	0	(1)	1	1	Yes	Ta	0	3	Human carcinogen	01/12/2000
Coal tar pitch (molten)	491	0	1	-	II	XXX	NI	NI	NR	NI	NI	0	0	NI	1	0	Yes	0	S	3	Human carcinogen; Phototoxic	01/12/2000
Cobalt naphthenate in solvent naphtha	501	T	3	1	II	XXX	NI	NI	NR	3	NI	0	(0)	NI	NI	1	Yes	Ta	S	2	Animal carcinogen	01/12/2000
Creosote (coal tar)	524	T	3	1	II	XXX	NI	NI	NR	5	NI	1	0	NI	2	1	Yes	Ta	S	2	animal carcinogen, Phototoxic	01/12/2000
Creosote (wood tar)	525	T	3	2	II	XXX	NI	NI	NR	NI	NI	1	0	NI	2	1	2	Ta		2	Animal carcinogen, Phototoxic	01/12/2000
Cresols (mixed isomers)	527	T	3	2	II	XXX	2	2	R	3	0	2	2	(4)	3A	3		Tt	0	3		01/12/2000
Cresylic acids, dephenolized	1875	T	3	1	II	XXX	2	2	R	3	0	(2)	(2)	(4)	(3A)	(3)		Ta	0	(3)		01/12/2000

NAME	EHS	A	B	C	D	E	A1a	A1b	A2	B1	B2	C1	C2	C3	D1	D2	D3	E1	E2	E3	F	Last Update
Cresylic acids, Sodium salt solutions	1914	T	3	1	II	XXX				3		1	(2)	(4)	3	3		Ta		3		01/12/2000
Crotonaldehyde	528	0	4	2	II	XX	0	NI	NR	3	1	2	4	4	1	2		0	0	2		01/12/2000
1,5,9-Cyclododecatriene	534	+	4	1	II	XXX	5	5	NR	4	NI	0	0	2	2	2	Yes	0	F	2	Skin sensitizer, Aspiration hazard	01/12/2000
Cycloheptane	535	0	3	(1)	II	X	4	NI	NI	3	NI	(0)	(0)	(1)	(0)	(1)		0	0	1		01/12/2000
Cyclohexane	536	0	3	1	II	X	3	3	NR	3	NI	0	0	1	0	1	1	0	0	1		01/12/2000
Cyclohexanol	537	0	2	1	II	XX	1	NI	R	2	NI	0	0	0	2	2		0	0	2		01/12/2000
Cyclohexanone	539	0	1	1	II	XX	0	1	R	1	0	1	1	1	2	2		0	0	2		01/12/2000
Cyclohexanone/Cyclohexanol mixture	1436	0	1	1	II	XX	1	1	R	2	NI	1	1	1	2	2		0	0	2		01/12/2000
Cyclohexyl acetate	541	0	(3)	0	II	XX	2	NI	(R)	(2)	NI	0	0	(0)	2	1		0	0	2		01/12/2000
Cyclohexylamine	542	0	2	2	II	XXX	1	NI	R	2	NI	2	2	3	3	3	Yes	0	0	3	Lachrymator, Sensitizer	01/12/2000
1,3-Cyclopentadiene dimer (molten)	545	T	3	2	II	XXX	3	3	NR	3	NI	2	0	3	2	2	Yes	Ta	F	2	Lachrymator	01/12/2000
Cyclopentane	546	0	3	(1)	I	X	3	NI	NR	3	NI	(0)	(0)	(1)	(0)	(1)		0	0	(1)		01/12/2000
Cyclopentene	547	0	(3)	1	0	0	2	NI	NI	3	NI	1	1	0	NI	NI		0	0	NI		01/12/2000
Decahydronaphthalene	551	0	(1)	1	0	X	4	4	NR	3	NI	0	0	2	1	1		0	F	1		01/12/2000
Decane	554	0	0	(1)	0	0				0				0				0		0		01/12/2000
1-Decene	558	0	3	(1)	0	0	5	NI	NI	NI	NI	0	0	0	(0)	(0)		0	F	0		01/12/2000
Decyl acetate	1767	0	(3)	0	I	X						0	0	NI	(1)	(1)		0	F	(1)		01/12/2000
Decyl acrylate	559	0	4	1	I	X	5	NI	NI	5	NI	0	0	NI	2	1		0	Fp	1		01/12/2000

NAME	EHS	A	B	C	D	E	A1a	A1b	A2	B1	B2	C1	C2	C3	D1	D2	D3	E1	E2	E3	F	Last Update
Decyloxytetrahydrothiophene dioxide	1859	0	4	0	I	XX	3	NI	NI	4	NI	0	NI	NI	1	0		0	Fp	2		01/12/2000
Diacetone alcohol	563	0	1	1	I	X	0	NI	R	1	0	0	0	(1)	2	2		0	0	2		01/12/2000
Dibromomethane	574	0	2	2	I	X	1	NI	NR	(2)	NI	1	0	0	NI	NI		0	0	NI		01/12/2000
Di-n-butylamine	577	0	2	2	II	XX	2	NI	R	3	NI	2	2	3	3	3		0	0	3		01/12/2000
Dibutyl hydrogen phosphonate	1857	0	2	1	II	XXX	1	NI	NI	2	NI	0	0	(0)	3	3	Yes	0	0	3		01/12/2000
3,4-Dichlorobut-1-ene	2079	0	3	1	II	XX	2	2	NR	3	NI	1	0	2	2	3		0	S	3		01/12/2000
1,1-Dichloroethane	590	0	(1)	1	0	0	1	NI	NR	1	NI	1	NI	0	NI	NI		0	0	NI		01/12/2000
1,2-Dichloroethane	591	0	1	2	II	XX	1	1	NR	2	0	1	0	2	1	2		0		2	Animal carcinogen	01/12/2000
1,6-Dichlorohexane	593	Z	3	1	0	0	3	NI	NI	3	NI	NI	NI	NI	NI	NI		0	0	NI		01/12/2000
Dichloromethane	594	0	1	1	II	XX	1	2	NR	1	0	1	NI	0	2	2	Yes	0	0	2	Animal carcinogen	01/12/2000
2,4-Dichlorophenol	596	T	3	1	II	XX	3	2	R	3	2	3	2	3	3	3		Tt	S	3		01/12/2000
2,4-Dichlorophenoxyacetic acid, diethanolamine salt, solution	599	T	3	1	II	XX	0	1	R	3	NI	1	0	NI	(1)	3		Ta	0	3		01/12/2000
2,4-Dichlorophenoxyacetic acid, dimethylamine salt, 70 % or less solution	600	T	3	1	II	XX	0	1	R	3	NI	1	1	NI	NI	NI	Yes	Tt	0	NI		01/12/2000
2,4-Dichlorophenoxyacetic acid, triisopropanolamine salt soln.	602	T	3	2	II	XX	0	1	R	3	NI	NI	NI	NI	NI	NI		Ta	0	NI		01/12/2000
1,1-Dichloropropane	605	0	2	0	I	X	2	1	NR	2	1	0	0	1	1	1		0	S	1		01/12/2000
1,2-Dichloropropane	606	0	2	1	II	XX	2	1	NR	2	1	1	0	2	2	2		0	0	2		01/12/2000
1,3-Dichloropropane	607	0	1	(1)	I	X	2	1	NR	2	1	0	NI	NI	NI	NI		0	0	NI		01/12/2000

NAME	EHS	A	B	C	D	E	A1a	A1b	A2	B1	B2	C1	C2	C3	D1	D2	D3	E1	E2	E3	F	Last Update
Dichloropropane and dichloropropene, mixture	608	0	3	2	II	XX	2	1	NR	4	1	2	1	2	3	3	Yes	0	0	3	Animal carcinogen, Sensitizer	01/12/2000
1,3-Dichloropropene	612	0	3	2	II	X	1	NI	NR	4	1	2	1	2	3	3	Yes	0	0	3	Animal carcinogen, Sensitizer	01/12/2000
2,2-Dichloropropionic acid	609	0	1	1	II	X	2	2	NR	2	NI	1	0	NI	3	3		0	0	3		01/12/2000
Di-(2-chloro-iso-propyl) ether	615	0	2	2	I	XX	2	2	NR	2	NI	2	0	2	0	2		0	0	2		01/12/2000
Diethanolamine	620	0	1	1	II	XX	0	NI	R	1	0	1	0	0	1	2		0	0	2		01/12/2000
Diethylamine	621	0	2	2	II	XXX	0	NI	R	2	NI	1	2	3	3C	3	Yes	0	0	3	Lachrymator; Aspiration hazard	01/12/2000
2,6-Diethylaniline	1437	0	2	1	II	X	3	3	NR	2	NI	1	1	NI	1	2		0	0	2		01/12/2000
Diethyl benzene (mixed isomers)	624	T	3	1	I	X	4	4	NR	3	NI	0	NI	NI	2	1		Ta	F	2		01/12/2000
Diethylene glycol	628	0	0	2	I	XX	0	NI	R	0	0	1	0	2	1	1		0	0	1		01/12/2000
Diethylene glycol di-n-butyl ether	629	0	1	1	I	X	2	NI	NI	1	NI	0	0	NI	1	1		0	0	1		01/12/2000
Diethylene glycol diethyl ether	630	0	0	1	I	X	0	NI	NR	0	NI	1	0	NI	NI	2		0	0	2		01/12/2000
Diethylene triamine	638	0	1	1	II	XX	0	1	(R)	2	NI	1	3	3	3A	3	Yes	0	0	3	Skin sensitizer	01/12/2000
Diethylenetriamine pentaacetic acid, pentasodium salt (40% solution in water)	2076	0	0	1	0	0	0	NI	NR	0	NI	0	NI	NI	0	0		0	0	0		01/12/2000
Diethyl ethanolamine	622	0	2	1	II	XX	0	NI	NR	3	NI	1	1	2	3	3		0	0	3		01/12/2000
Diethyl ether	640	0	0	1	I	XX	0	1	NR	0	NI	1	0	0	1	1		0		1		01/12/2000
Di-(2-ethylhexyl) adipate	641	0	0	0	II	XX	0	2	R	4	2	0	0	0	1	1	Yes	0	Fp	2	Male reproductive toxicity	01/12/2000
Di-(2-ethylhexyl) phosphoric acid	643	0	2	1	I	X	(2)	1	NR	2	NI	0	1	NI	2	2		0	Fp	2		01/12/2000

NAME	EHS	A	B	C	D	E	A1a	A1b	A2	B1	B2	C1	C2	C3	D1	D2	D3	E1	E2	E3	F	Last Update
Diethyl sulphate	649	0	(2)	1	II	XXX	1	NI	(NR)	(2)	NI	1	2	3	2	3	Yes	0	0	3	Animal carcinogen	01/12/2000
Diglycidyl ether of Bisphenol A	653	0	3	0	II	XX	3	NI	NR	4	NI	0	0	NI	1	2	Yes	0	S	2	Testicular toxicity	01/12/2000
Diglycidyl ether of Bisphenol F	728	0	3	0	II	XX	2	NI	NI	3	NI	0	(0)	NI	1	(2)	Yes	0	S	(2)	Testicular toxicity, Sensitizer	01/12/2000
Di-n-hexyl adipate	656	0	3	0	0	XX	5	NI	(NR)	5	0	0	0	(0)	)	1		0	0	1		01/12/2000
Diisobutylamine	576	0	(2)	2	II	XX	2	NI	R	3	NI	2	(2)	2	(3)	(3)		0	0	(3)		01/12/2000
Diisononyl adipate	690	0	0	0	0	XX	0	NI	NI	0	NI	0	0	NI	1	1		0	Fp	2		01/12/2000
Diisopropanolamine	703	0	2	0	I	X	0	NI	NR	1	NI	0	0	0	1	2		0	F	2		01/12/2000
Diisopropylamine	705	0	2	3	II	XXX	1	NI	NR	2	0	1	1	2	3	3	Yes	0	0	3	Lachrymator; Aspiration hazard	01/12/2000
1,3-Diisopropylbenzene	706	T	4	0	0	0	5	4	NR	4	NI	0	0	2	2	1		Tt		3		01/12/2000
Diisopropylnaphthalene, mixed isomers	712	+	3	1	I	XX	5	4	NR	(3)	NI	0	0	NI	1	1		0	Fp	2		01/12/2000
Dimethyl acetamide	658	0	0	1	II	XX	0	NI	R	1	NI	0	0	2	1	2		0		2		01/12/2000
Dimethyl adipate	659	0	3	0	I	0	1	NI	NI	4	NI	0	0	0	0	0		0		0		01/12/2000
Dimethylamine (40-50% aq.sol.)	661	0	2	2	II	XX	0	NI	R	3	0	2	0	2	3B	3	Yes	0	0	3	Sensitizer, Lachrymator	01/12/2000
Dimethylamine (anhydrous)	660	0	2	2	II	XXX						2	0	2	3B	3	Yes	NT		3	Lachrymator, Sensitizer	01/12/2000
N,N-Dimethyl cyclohexylamine	665	0	2	2	II	XX	2	NI	NR	2	NI							0		2		01/12/2000
Dimethylethanolamine	667	0	(0)	1	II	XX	0	NI	R	2	NI	1	1	2	3	3		0		3		01/12/2000
Dimethyl formamide	676	0	0	0	II	XX	0	0	R	1	0	0	1	2	1	2		0		2	Reproductive toxicant	01/12/2000
Dimethyl glutarate	670	0	2	0	I	0	0	NI	R	3	NI	0	0	2	3	2		0		3	Respiratory damage on repeated inhalation	01/12/2000

NAME	EHS	A	B	C	D	E	A1a	A1b	A2	B1	B2	C1	C2	C3	D1	D2	D3	E1	E2	E3	F	Last Update
Dimethyl hydrogen phosphite	673	0	(3)	1	I	X	0	NI	NR	2	NI	1	0	0	1	1		0		1		01/12/2000
Dimethyl phthalate	678	0	2	1	0	X	2	2	R	2	0							0		1		01/12/2000
Dimethyl succinate	681	0	2	0	I	0	0	NI	NI	2	NI	0	0	0	0	2		0		2		01/12/2000
Dinitrotoluene	688	0	4	2	II	XXX	2	2	NR	4	2	2	NI	NI	1	0	Yes	0		2	Animal carcinogen	01/12/2000
1,4-Dioxane	682	0	0	1	II	XXX	0	0	NR	0	0	0	0	0	0	2	Yes	0		2	Animal carcinogen, Respiratory irritant	01/12/2000
Dipentene	686	T	2	1	I	X	4	NI	NR	(4)	NI	0	0	NI	2	2		Ta		2	Sensitizer	01/12/2000
Diphenyl	694	+	3	1	II	XXX	3	4	R	4	1	0	0	(0)	2	1		0		2		01/12/2000
Diphenylamine (molten)	2186	0	3	0	I	X	3	3	NR	3	1	0	0	NI	1	1		0		1	Methaemoglobin generator	01/12/2000
Diphenylamine, reaction product with 2,4,4-trimethylpentene	1500	-	(4)	0	II	XX	NI	NI	NR	3	NI	0	0	NI	1	1	Yes	NI		2	Skin sensitizer	01/12/2000
Diphenylamines, alkylated	1770	+	3	0	0	0	5	NI	NR	3	NI	0	NI	0	NI	NI		0		0		01/12/2000
Diphenyl/Diphenyl ether (mixtures)	698	T	3	1	II	XXX			NR	4	1	0	0	(0)	1	1		Tt		1	Respiratory irritant	01/12/2000
Diphenyl ether	699	T	3	1	I	X	4	4	NR	4	NI	0	0	0	1	1		Tt		1	Respiratory irritant	01/12/2000
Diphenyl ether/ Biphenyl phenyl ether mixtures	702	T	3	1	I	XX	5	NI	NR	4	NI	0	0	0	1	1		Ta		1	Respiratory irritant	01/12/2000
Diphenylmethane-4,4'-diisocyanate	700	0	1	1	II	XXX	5	2	NR	0	0	0	NI	4	NI	2	Yes	0		3	Skin sensitizer. Respiratory sensitizer.	01/12/2000
Di-n-propylamine	704	0	2	1	II	XXX	1	NI	NR	3	NI	2	2	2	3C	3	Yes	0		3	Lachrymator	01/12/2000
Dipropylene glycol	707	0	0	0	0	0	0	1	NR	0	NI	0	0	0	1	1		0		1		01/12/2000
Diundecyl phthalate	715	0	0	(1)	0	XX	0	NI	NR	0	0							0		2		01/12/2000

NAME	EHS	A	B	C	D	E	A1a	A1b	A2	B1	B2	C1	C2	C3	D1	D2	D3	E1	E2	E3	F	Last Update
1-Dodecanol	719	0	3	0	0	X	5	NI	R	4	1	0	0	NI	2	1		0		2		01/12/2000
2-Dodecenyl succinic acid, dipotassium salt, solution	727	0	0	1	0	0	NI	NI	NI	0	NI	0	NI	NI	NI	NI		0		NI		01/12/2000
Dodecylamine/Tetradecylamine mixture	721	-	4	2	II	XX	5	NI	NI	4	NI	1	NI	NI	3C	3		NI		3		01/12/2000
Dodecyl benzene	126	0	0	0	I	X	0	NI	NR	0	0							0		1		01/12/2000
Dodecyl diphenyl oxide disulphonate (solns.)	723	0	4	1	II	X	(5)	NI	NI	4	NI							0		1		01/12/2000
Dodecyl/pentadecyl methacrylate (mixture)	724	0	0	0	0	X												0		1		01/12/2000
Dodecyl phenol	725	+	4	1	II	XX	0	4	NI	4	NI							0		2		01/12/2000
Dodecylxylene	1763	0	0	0	0	0	0	NI	NI	0	NI							0		0		01/12/2000
Epichlorohydrin	731	0	4	2	II	XXX	0	NI	R	3	1						Yes	0		3	Carcinogen	01/12/2000
Ethanol	732	0	0	0	I	0	0	NI	R	0	NI	0	0	0	1	2		0		1	Narcotic	01/12/2000
Ethanolamine	733	0	1	1	0	0	0	NI	R	2	0							0		0		01/12/2000
Ethyl acetate	735	0	1	0	0	0	0	2	R	1	0							0		0		01/12/2000
Ethyl acetoacetate	736	0	(1)	1	I	X	0	0	R	1	NI							0		1		01/12/2000
Ethyl acrylate	734	T	3	2	I	X	1	NI	R	3	1							Tt		1		01/12/2000
Ethylamine	1016	0	2	2	II	XXX	0	NI	R	2	NI						Yes	0		3	Lachrymator;Aspiration hazard	01/12/2000
Ethyl amyl ketone	1784	T	2	-	-	-	2	NI	NI	2	NI							Ta		NI		01/12/2000
Ethylbenzene	740	0	3	1	I	XX	3	2	R	3	1						Yes	0		2	Lachrymator	01/12/2000
N-Ethyl butylamine	745	0	(2)	(3)	II	XX	1	NI	NI	NI	NI							0		2		01/12/2000

NAME	EHS	A	B	C	D	E	A1a	A1b	A2	B1	B2	C1	C2	C3	D1	D2	D3	E1	E2	E3	F	Last Update
Ethyl butyrate	748	0	2	0	I	X	1	NI	NI	2	NI							0		1		01/12/2000
Ethyl cyclohexane	751	0	(3)	1	0	0	4	NI	NI	3	NI							0		0		01/12/2000
Ethylene carbonate	755	0	0	0	I	X	0	NI	R	0	NI							0		1		01/12/2000
Ethylene chlorohydrin	756	0	2	2	II	XX	0	0	R	3	NI							0		2		01/12/2000
Ethylene diamine	758	0	2	2	II	XX	0	1	R	3	1						Yes	0		2	Potent skin sensitizer	01/12/2000
Ethylene diamine, tetra acetic acid, di- and tetra-sodium salt	759	0	0	1	II	0	0	NI	NR	2	0							0		0		01/12/2000
Ethylene dibromide	760	0	3	2	II	XXX	1	2	NR	3	NI						Yes	0		3	Animal carcinogen;Male reproductive toxicity;Lachrymator	01/12/2000
Ethylene glycol	761	0	0	2	II	XX	0	NI	R	0	0	1	(1)	(1)	0	0		0		2	Reproductive toxicant	01/12/2000
Ethylene glycol butyl ether acetate	764	0	(2)	1	I	X	1	NI	R	2	NI							0		1		01/12/2000
Ethylene glycol diacetate	765	0	2	1	0	0	0	NI	NI	2	NI							0		0		01/12/2000
Ethylene glycol ethyl ether acetate	767	0	2	1	II	XX	0	NI	R	2	0							0		2	Teratogen	01/12/2000
Ethylene glycol methyl butyl ether	772	0	1	-	-	-	1	NI	NI	1	NI							0		NI		01/12/2000
Ethylene glycol methyl ether acetate	773	0	2	1	II	XXX	0	NI	R	2	NI						Yes	0		3	Teratogen;Testicular toxicity;Hematotoxic	01/12/2000
Ethylene glycol monoacetate	762	0	(1)	1	I	X	0	NI	R	2	NI							0		1		01/12/2000
Ethylene glycol phenyl ether	775	0	1	1	II	XX	1	NI	R	1	NI							0		2		01/12/2000
Ethylene glycol phenyl ether/Diethylene glycol phenyl ether, mixture	1740	0	1	1	II	XX			R	1	NI							0		2		01/12/2000

NAME	EHS	A	B	C	D	E	A1a	A1b	A2	B1	B2	C1	C2	C3	D1	D2	D3	E1	E2	E3	F	Last Update
Ethylene vinyl acetate copolymer (emulsion)	779	0	0	0	0	0	0	1	NR	0	0							0		0		01/12/2000
Ethyl-3-ethoxypropionate	1439	0	2	1	I	X	1	NI	NR	2	NI							0		1		01/12/2000
2-Ethylhexanoic acid	776	0	1	1	I	0	2	NI	R	2	NI							0		0		01/12/2000
2-Ethylhexyl acrylate	782	0	(3)	0	I	X	3	NI	R	2	NI							0		1		01/12/2000
5-Ethylidene-2-norbornene	783	0	3	1	I	X	3	3	NR	3	0							0		1		01/12/2000
Ethyl methacrylate	785	0	(1)	1	I	XX	1	NI	NI	2	NI						Yes	0		2	Skin sensitizer	01/12/2000
o-Ethyl phenol	788	T	(3)	2	II	XX	2	NI	NI	(2)	NI							Tt		2		01/12/2000
Ethyl propionate	790	0	1	1	I	X	1	NI	NI	2	NI							0		1		01/12/2000
2-Ethyl-3-propyl acrolein	791	(T)	3	1	II	XX	2	NI	R	3	NI							Ta		2		01/12/2000
Ferric chloride	339	0	2	2	0	X	Inorg	5	Inorg	2	0							0		1		01/12/2000
Ferric hydroxyethyl ethylene diamine triacetic acid, tri- sodium salt, solution	796	0	1	1	II	0	NI	NI	NI	NI	NI							0		0		01/12/2000
Ferric nitrate/nitric acid solution	337						Inorg	5	Inorg	2	0							?		?		01/12/2000
Fish solubles	1509	0	0/BOD	0	0	X	NI	NI	NI	NI	NI							0		1		01/12/2000
Fluosilicic acid	806	0	2	2	II	XXX	Inorg	0	Inorg	2	NI							0		3		01/12/2000
Formaldehyde (37%-50% solution)	807	0	2	2	II	XX	0	NI	R	2	NI						Yes	NT		2	Skin sensitizer;Animal carcinogen	01/12/2000
Formamide	808	0	0	1	I	XX	0	NI	NR	1	NI							0		2	Teratogen	01/12/2000
Formic acid	809	0	1	1	II	XX	0	NI	R	2								0		2		01/12/2000

NAME	EHS	A	B	C	D	E	A1a	A1b	A2	B1	B2	C1	C2	C3	D1	D2	D3	E1	E2	E3	F	Last Update
Fumaric adduct of rosin (water disper- sion)	810	0	3	1	0	X	0	NI	R	3	NI							0		1		01/12/2000
Furfural	812	0	2	2	II	XX	0	NI	R	2	NI							0		2		01/12/2000
1-Heptene	832	0	2	(1)	0	0												0		0		01/12/2000
Isodecanol	557	T	3	0	II	X	3	NI	R	3	NI	0	0	0	2	1		Ta	Fp	1		01/12/2000
Isooctylamine	1081	0	3	2	II	XX	2	NI	NI	3	NI							0		2		01/12/2000
Isopropyltoluenes	549	T	4	1	I	X	4	4	(NR)	3	NI	0	NI	1	2	NI		Ta	0	2		01/12/2000
Lauryl methacrylate	893	0	0	0	I	X	5	NI	NR	0	NI							0		1		01/12/2000
Methanol	951	0	0	3	II	XX	0	NI	R	0	0	3	(3)	(3)	2	2		0		2	Causes optic atrophy	01/12/2000
2-Methyl-4-chlorophenoxyacetic acid, diethylamine salt solution	1538	0	2	2	I	XXX	2	NI	NI	2	NI						Yes	0	S	3	Sensitizer; Lachrymator	01/12/2000
1,4-Methyl ethyl benzene	985	T	3	0	0	0	3	NI	NI	(3)	NI							Ta		0		01/12/2000
Molasses	1013	0	0	0	0	X	0	NI	R	0	NI	0	0	0	0	0		0		0		01/12/2000
1,5-Pentanedial solution, (5-50%)	1107	0	1	2	II	XX	0	NI	R	3	0						Yes	0		2	Skin sensitizer	01/12/2000
Phenol	1124	0	2	2	II	XX	1	2	R	3	0	2	2	(4)	3	3		NT		3		01/12/2000
Phosphoric acid	1138	0	1	1	I	0	Inorg	NI	Inorg	1	NI	(3)	(3)	3	3	3		0		3		01/12/2000
Polysiloxane	1161	0	0	0	0	0	NI	4	NI	2	NI							0		0		01/12/2000
Propylene oxide/Ethylene oxide mixture	78	0	2	2	II	XX	0	NI	R	1	NI						Yes	0		2	Animal carcinogen;Neurotoxic;Reproductive toxicity	01/12/2000
Sodium borohydride/sodium hydroxide mixture (soln.)	1239	0	1	2	II	X				1								0		1		01/12/2000

NAME	EHS	A	B	C	D	E	A1a	A1b	A2	B1	B2	C1	C2	C3	D1	D2	D3	E1	E2	E3	F	Last Update
Styrene (monomer)	1273	T	3	2	II	XXX	3	NI	R	3	NI	1	NI	2	2	2	Yes	Tt		3	Animal carcinogen	01/12/2000
Sulphuric acid	1280	0	2	3	II	XX	Inorg	NI	Inorg	2	NI	(3)	(3)	4	3C	3		0		3	Human carcinogen (by inhalation of mists)	01/12/2000
sym-Dichlorodiethyl ether	588	T	2	2	I	XX	1	1	NR	1	0	2	3	4	1	3		Tt	0	3		01/12/2000
Tallow	1288	0	0/BOD	0	0	XX	0	NI	(R)	0	NI							0		2		01/12/2000
Tetradecanoic acid (Myristic acid)	1298	0	0	0	I	X	5	NI	R	0	NI							0		1		01/12/2000
Toluene	330	0	2	1	II	XXX	2	2	R	3	0	(1)	0	0	1	1	Yes	NT		2	Neurotoxic;Ototoxic;	01/12/2000
Urea	1384	0	0/BOD	0	0	0	0	0	R	1	NI	0	0	(1)	1	(1)		0		1		01/12/2000
Vinyl acetate	1400	0	2	1	0	0	0	NI	R	2	NI	1	0	2	1	1		0		2	Animal carcinogen	01/12/2000
Xylene (mixed isomers)	1408	0	3	1	II	XX	3	2	NR	3	0	0	0	0	2	2		NT		2		01/12/2000
Zinc chloride	1425	0	3	2	0	0	Inorg	4	Inorg	4	1							0		0		01/12/2000

ANNEX 4

FINALIZED TEXT FOR SECTION 4.3 AND 4.4 OF REPORTS AND STUDIES 64

4.3 Acute mammalian toxicity by swallowing, skin contact and inhalation (Column C)

4.3.1 Introduction

Column C addresses the toxic potential of chemicals to humans after single or short-term exposures. Column C has three sub-columns in order to rank the hazards related to three potential exposure routes: swallowing (Column C1), skin contact (Column C2) and inhalation (Column C3). The rating system is based on numerical dose or concentration values expressed as LD_{50}, approximate LD_{50} or LD_{50} ranges, accordingly LC_{50} for the inhalation hazard.

LD_{50} or LC_{50} values have been used for many decades to indicate the dose leading to severe life threatening acute toxic effects. Historically, these numerical data are used by many regulations as the first and sometimes most important hazard classification criterion for the protection of human health. The lethal doses often form the basis by which chemicals are compared with each other regarding hazards for human health. However, GESAMP is aware of the limited practical value of numerical lethal doses in estimating the human health hazards of spillages into the sea.

Acute toxicity tests with death as the single endpoint are evaluated for rating with no other variables examined. GESAMP is aware of the short-comings of this approach. The issues have been extensively discussed in a variety of forums and publications. It is agreed that in principle there should be considerably more aspects evaluated for defining an acute hazard profile than determining the median lethal dose. GESAMP is also aware that despite all standardization efforts a precise LD_{50} (or LC_{50}) for one chemical is not warranted when measured in different laboratories or when using different kinds of animals. In particular, because IMO´s regulatory hazard classification systems ask for ratings based on LD_{50} and LC_{50} values, Column C has been re-designed according to the integrated hazard classification system developed by OECD.

Although most toxicological knowledge in this topic derives from animal experiments, human experience in instances of accidental poisoning has to be taken into account. All available information is considered together by the experts and rating is made on the basis of the total weight of evidence.The quality and consistency of the data are important. Generally, reliable human data will have precedence over animal data. In determining the hazard rating, values from the most susceptible mammalian species or sex should be used, except if there is convincing evidence that toxicity in humans might be different. In general, for interspecies extrapolation detailed models of extrapolation (i.e. based on metabolism or body volume) are not taken into account, dose values in "mg/kg" are used directly.

There has been growing public concern about the use of laboratory animals for lethal dose testing in the past. Based on animal welfare principles such tests are heavily criticized. The OECD has already published guidelines as alternatives to the classic LD_{50} tests aimed at a reduction in the numbers and the stress of test animals used. Alternative testing approaches based on structure-activity relationships (SAR) or the use of *in vitro* test systems have been presented in the scientific literature. However, these approaches could not be validated up to now and have not been integrated into IMO´s regulations. Developments of this kind will be closely monitored by GESAMP and the content of this chapter may be amended appropriately in the future.

4.3.2 Ratings

The ratings, and the data on which these should be based, are as follows:

Table 7

Rating	Relative Hazard	C1 Oral LD_{50} (mg/kg)	C2 Percutaneous LD_{50} (mg/kg)	C3 Inhalation LC_{50} (mg/l/4hrs)
0	Negligible	> 2000	>2000	>20
1	Slight	300-2000	1000-2000	10-20
2	Moderate	50-300	200-1000	2-10
3	Moderately high	5-50	50-200	0.5-2
4	High	<5	<50	<0.5

4.3.3 Application

4.3.3.1 Acute oral toxicity (swallowing) : Column C1

Standardized tests are preferred for evaluation (see Box 6). In evaluating a chemical whose toxic potential is unknown, it is often useful to conduct a range-finding study or a limit-test. The LD_{50} (LC_{50}) would be reported as "greater than" if no death of experimental animals is observed within 14 days. Such results could fit into the rating scale and will be evaluated accordingly.

4.3.3.2 Acute dermal toxicity (skin contact) : Column C2

Standardized tests are preferred for evaluation (see Box 6). From an animal welfare standpoint and sometimes also from a scientific standpoint, the dermal toxicity testing of corrosive or strongly irritating chemicals is not recommended. If tests are rejected or test data are missing based on such considerations, a comment should be added to the *Remarks* column to explain the lack of acute dermal toxicity information.

Experience has shown that those chemicals which are non-toxic by the oral route are generally also non-toxic by the dermal route. Experience has also shown that orally toxic chemicals are also toxic by dermal application. Some physical-chemical properties (like high molecular weight combined with low solubility in oil) restrict the passage of chemicals through the skin. Such facts may enable experts to estimate the toxic potential roughly, thus allowing a rating in brackets. Range-finding studies and limit-tests are taken into account as outlined for oral toxicity testing.

4.3.3.3 Acute inhalation toxicity: Column C3

The criteria for inhalation toxicity are based on LC_{50} data relating to 4 hours exposure. Where such information is available it should be used. Where LC_{50} data relating to 1 hour exposure are available such figures can be divided by 4 to be considered equivalent to LC_{50} (4hrs). However, from a scientific viewpoint and from practical experience in inhalation toxicity testing, the test atmosphere will not just be vapour but will consist of a mixture of liquid (mist) and vapour phases in most cases. As long as there is no validated extrapolation method, GESAMP will stay on the safe side when evaluating data near the classification limits and especially in case of experimental designs using nearly saturated vapour concentrations. Submissions to GESAMP should state the original data, no extrapolated data in that case.

Conversion from "ppm" to "mg/l" should be based on the formula:

$$mg/l = \frac{ppm \times molecular\ weight}{24 \times 1000}$$

Because of the complexity of acute inhalation studies and the need to minimize testing in animals, there is considerable interest to estimate inhalation toxicity based on other data, inter alia the acute oral lethal toxicity. Although there have been proposals for extrapolation indicators there is no scientifically accepted nor validated method. It may be possible based on regulatory reasons to take such indicators into account for defining the need for testing or estimating the inhalation hazard. After thorough investigation GESAMP has decided to refrain from any extrapolation in this respect and note missing values accordingly. However, an evaluation of a number of toxicological data and physical data of one chemical or inhalation test results from chemicals with similar structures may enable GESAMP experts to estimate the toxic potential, thus allowing a rating in brackets.

Data for acute inhalation toxicity may not be available due to severeal reasons, e.g.:

- it is deemed unethical to carry out animal experiments on substances known to cause undue pain and stress to the animal

- the physical or chemical properties of the chemical is such that relevant tests cannot be carried out

In such cases GESAMP will make an attempt to make a provisional rating in order to advise relevant bodies as to the hazards believed to be presented by inhaling the chemical. Such a rating will be identified by a numer in the C3 column given in a bracket ().

In making such an advisory rating GESAMP will consider the following:

- the oral and dermal toxicity

- the irritating/corrosion potential to the skin and eye

- any information regarding inhalation toxicity to aerosols, mists etc of the chemical itself or other chemicals recognized to have similar bioreactive properties

There will be cases where an advisory rating cannot be made and where GESAMP also recognize that inhalation studies cannot be carried out. In such cases an NI will be applied in the C3 column and a remark added to the Remarks column indicating that inhalation studies will not be requested by GESAMP.

Box 6: Guidance on acute oral, dermal and inhalation toxicity testing

Over the last twenty years, appropriate test guidelines for assessing acute toxicity to mammals have been consolidated and published by the OECD, to the extent that other guidelines are now seldom considered. However, old test data published in the literature derived from other testing procedures than those listed (including the use of different mammalian species) should be evaluated before new testing is done. Such existing data are equally used for rating if procedures are considered acceptable. It should be known that small differences in protocols can cause large differences in the median lethal dose values. It is recommended to evaluate old data by using original test reports as far as possible to reduce the need for any new animal testing.
New testing should be based on *OECD Guidelines for Testing of Chemicals* and should be performed under *Good Laboratory Practice* (GLP).

Acute oral toxicity
Wherever possible, testing for peroral toxicity should be based on standardized 14 day post-dosing observation tests with rats. The recommended methods are
OECD 401, Acute Oral Toxicity (1987) (outdated)
OECD 420, Acute Oral Toxicity - Fixed Dose Method (1992)
OECD 423, Acute Oral toxicity - Acute Toxic Class Method (1996)
OECD 425, Acute Oral Toxicity: Up-and-Down Procedure (1998).
However, based on concerns for animal welfare, GESAMP does not recommend the OECD guideline 401 for determining the LD_{50}.

Acute dermal toxicity
For percutaneous toxicity, standardized LD_{50} tests with rats or rabbits are preferred, using 24 hour occlusion with two weeks of observation. The recommended guideline is OECD 402, Acute Dermal Toxicity (1987).
Alternative guidelines similar to OECD´s 420, 423 and 425 guidelines are drafted and discussed under OECD´s evaluation process.

Acute inhalation toxicity
Wherever possible, ratings for inhalation toxicity should be on standardized 14 day post-dosing observation tests with rats. The recommended guideline is
OECD 403, Acute Inhalation Toxicity, draft updated guideline (1996) based on (1981).
In the absence of LC_{50} data chemicals may be rated based on simple threshold toxicity tests, e.g. as outlined in the UN Model Regulations on the Transport of Dangerous Goods.

4.4. Column D. Long term health effects and irritation

The skin and eyes of individuals may be contaminated in a number of situations, e.g. work environment, swimming in the ocean and during rescue operation. Effects of chemicals on direct contact with the skin and eyes are rated separately under sub-columns D1 and D2 respectively. A numerical rating is used based on data from human experience or test animals.

4.4.1 Skin Irritation/Corrosion, column D1

Toxic insults to the skin are of significant importance to the health and well being of an individual. Skin is one the largest organs of our body (about 10% of the normal body weight) and is readily exposed to our environmental conditions. A number of environmental factors may play an important role in the development of chemically induced skin damage; e.g. temperature, humidity, friction, wind speed. Chemicals cause irritation and corrosion of skin through several mechanisms. In most cases several pathological pathways may occur at the same time. The classification of irritative or corrosive damage to the skin is done on basis of morphology rather than measures of specific mechanisms.

The most prominent effects of chemicals on the skin can be grouped as follows:

- *Irritant dermatitis* which includes *sensory irritation* (burning, stinging or itching sensations which are not due to infections), *irritation and chemical burns* (a continuum of varying tissue destruction) and *cumulative dermatitis* (effects occur after repeated exposure to mild irritants)
- *Allergic contact dermatitis* where the chemical is an allergen that induces an allergic reaction in the skin
- *Photosensitization* including *phototoxicity* (a non-immunological light induced dermatitis caused by a photoreactive chemical) and *photoallergy* (similar to allergic contact dermatitis except that the chemical must react with light before becoming allergenic).
- *Skin carcinogenesis*
- *Acne* and specifically *chloracne* (induced by some chlorohydrocarbons)

The sub column D1 only addresses the first of these groups (irritant dermatitis), the others being covered by specific remarks when appropriate.

Data for skin irritation/corrosion can be obtained from human experience, animal experiments and to a limited extent *in vitro* assays. Testing in animals include studies on sensitisation and irritation. Standard procedures as well as standard rating systems for evaluation have been developed. For the purpose of assigning a rating in the D1 column data is collected from current databases, the literature and testing protocols. These sources may reflect experiments carried out during a wide time period and performed under variable quality surveillance. Sometimes the test has not been carried out according to present day standards or evaluated towards the scoring limits currently used. In such cases a cautious approach is taken and a higher rating is assigned.

The exposure is preferably 4 hr exposure, but data from 24 hr exposure will also be accepted. The use of data from 24 hr exposure is used directly whilst recognizing that this would be erring on the side of caution.

4.4.1.2 Ratings

The following ratings and descriptors are used for column D1

Rating	Descriptor	Signs
0	Not irritating	No clinical signs and/or inflammation
1	Mildly irritating	Mild erythema with or without oedema (rapidly reversible)

Rating	Descriptor	Signs
2	Irritating	Marked erythema Obvious and marked oedema Other signs of local injury
3	Severly irritating or corrosive	Severe irritation indicating local tissue damage Full-thickness skin necrosis Exposure time is not reported
3A	Corrosive	Full-thickness skin necrosis by 4 hr
3B		Full-thickness skin necrosis by 1 hr
3C		Full-thickness skin necrosis by <3 min

4.4.1.3. Comparison with the OECD harmonized system

The following table will illustrate the relations between the GESAMP rating and the OECD harmonized system.

GESAMP		OECD	
Rating	**Descriptor**	**Rating**	**Descriptor**
0	Not irritating		
1	Mildly irritating	Class 3	Mild Irritant
2	Irritating	Class 2	Irritant
3	Severly irritating or corrosive without exposure time		
3A	Corrosive 4 hr	Corrosive subclass 1C	Corrosive 4 hr
3B	Corrosive 1 hr	Corrosive subclass 1B	Corrosive 1 hr
3C	Corrosive <3 min	Corrosive subclass 1A	Corrosive < 3 min

Comments:

- GESAMP always have a rating of "0" indicating that the compound has been tested and that no effects have been found for the category in question
- GESAMP always numbers the rating from low numerical (low toxicity or hazard) to a high numerical (very toxic or high hazard)
- Apart from this it should be possible for most chemicals to be rated in both systems using the same set of data.

4.4.2 Eye Irritation, column D2

Chemical injuries to the eye are unfortunately quite common both at the workplace and in private homes. In most cases such accidents could have been prevented through information combined with proper safety measures. Correct classification of chemicals that may cause eye injury is therefore of prime importance in any registry of toxic chemicals.

The eye can be a target or a route for toxicity:

- Direct contact with the eye causing irritant, corrosive, allergic or deep tissue damage to the eye itself or the surrounding tissue
- Chemicals can be absorbed through surrounding blood vessels and cause systemic toxicity

- Chemicals can be absorbed through other routes and reach the eye through systemic circulation

The D2 sub column address only the first of these issues.

Testing possible effects of chemicals on the eye has been carried out in a rather simple manner by exposing the eye to a small amount of solid or dissolved material. The eye and the surrounding tissue is then inspected at various time intervals, e.g. 1, 24, 48 and 72 hours. Effects on the cornea, iris and conjunctivae are noted and scoring systems have been developed in order to summarize the effects. Draize and co-workers introduced the best known of these in 1944. Alternative testing methods have been developed where fewer animals are used, and also *in vitro* methods have been introduced.

Recently a Global Harmonized System (GHS) has been developed. The classification used by GESAMP will accommodate data from existing studies as well data produced through the GHS. However, the GESAMP rating does not, at this time, readily accept data from *in vitro* studies as such methods have yet to be properly validated.

4.4.2.2. Ratings

The following ratings and descriptors are used for column D2

Rating	Descriptor	Signs
0	Not irritating	No clinical signs and/or inflammation
1	Mildly irritating	Reversible mild conjunctival hyperaemia with or without chemosis
2	Irritating	Marked conjunctival hyperaemia, chemosis, corneal injury *All reversible within three weeks*
3	Severe irritation with irreversible corneal injury	Severe conjunctoblepharitis, chemosis, irreversible corneal injury (may be accompanied by deformity, ulceration and neovascularisation)

4.4.2.3. Comparison with the OECD harmonized system

The following table will illustrate the relations between the GESAMP rating and the OECD harmonized system.

GESAMP		OECD	
Rating	**Descriptor**	**Rating**	**Descriptor**
0	Not irritating		
1	Mildly irritating	Class 2A	Mild Irritant
2	Irritating	Class 2	Irritant
3	Severe irritation with irreversible corneal injury	Class 1	Corrosive

Comments:

- GESAMP always has a rating of "0" indicating that the compound has been tested and that no effects have been found for the category in question
- GESAMP always numbers the rating from low numerical (low toxicity or hazard) to a high numerical (very toxic or high hazard)

- Apart from this it should be possible for most chemicals to be rated in both systems using the same set of data.

Box 8: Guidance on acute dermal and eye irritation and corrosion tests

Both of the current guidelines are under review and, while these revisions have not yet been officially published, the reader is none the less advised to take advances in the draft, updated guidelines into account when commissioning testing.

Acute dermal irritation & corrosion
The recommended test is:
OECD 404: Acute Dermal Irritation/Corrosion (1992), and revised draft, updated guideline (2000).

Acute eye irritation & corrosion
The recommended test is:
OECD 405: Acute Eye Irritation/Corrosion (1987), and revised draft, updated guideline (2000).

Guidance on acute dermal and eye effects (to include reference to new in vitro test)

4.4.3. Column D3. Other long term health effects

This column include remarks relevant to human health hazards not covered by other columns. The remark is abbreviated and the table below indicate the criteria used when remarks are assigned to chemicals.

4.4.3.1. List of human health hazards

Abbreviation	Hazard	Criteria
C	Carcinogenic	Chemicals which have been shown to induce or increase the incidence of cancer in epidemiological studies or in well conducted animal experiments
A	Aspiration hazard	Lung injury directly or after swallowing .
N	Neurotoxic	Chemicals causing damage to the central or peripheral nervous system documented by epidemiological studies or well documented animal experiments
L	Lung injury	Chemicals causing injury to the lung after single or repeated inhalation exposure documented by epidemiological studies or well documented animal experiments
R	Reprotoxic	Chemicals causing adverse effects on reproductive ability or capacity, or on the development of offspring documented by epidemiological studies or well documented animal experiments

Abbreviation	Hazard	Criteria
I	Immunotoxic	Chemicals causing adverse effects to the immune system and interfering with body defence mechanisms documented by epidemiological studies or well documented animal experiments
M	Mutagenic	Chemicals shown to cause increased incidence of permanent changes in the amount or structure of the genetic materials. Evidence for such effects must be based on *in vivo* studies on mammalian somatic or germ cells.
P	Photosenitizer	Chemicals inducing sensitization which require light to become active documented by epidemiological studies or well documented animal experiments
S	Sensitizing	Chemicals causing skin or airway hypersensitization documented by epidemiological studies or well documented animal experiments

4.4.3.2. Moderate long-term health effects

Immunotoxic

The term Immunotoxic denotes chemical substances or mixtures which are capable of causing injury to the immune system and to interfere with body defence mechanisms. Evidence to substantiate the statement Immunotoxic should be available from epidemiological studies and/or from well conducted and appropriate studies in experimental animals.

Aspiration

Aliphatic, alicyclic and aromatic hydrocarbons of low viscosity that experience indicate may cause lung damage when reaching the lung directly or after being swallowed. Other compounds when indicated by clinical experience. Injury is caused by the compounds severe irritancy or corrosivity and may cause a granulomatous reaction because of its insolubility and persistence in the respiratory tract.

Sensitizers

The term sensitising denotes chemical substances or mixtures which can induce a condition of hypersensitivity in individuals following inhalation (respiratory sensitizer) or skin contact (contact sensitizer). Evidence to substantiate the statement sensitising should be available from human experience and/or from appropriate studies using experimental animals

Photosensitizing

The term photosensitising denotes chemical substances or mixtures which require light to become active an may subsequently induce a condition of contact sensitivity. Evidence to

substantiate the statement sensitising should be available from human experience and/or from appropriate studies using experimental animals

4.4.3.3. Serious long-term health effects

Carcinogenic

The term Carcinogenic denotes chemical substances or mixtures which are presumed to induce cancer or to increase its incidence in humans. Evidence to substantiate the statement Carcinogenic should be available from epidemiological studies and/or from well conducted studies in experimental animals. On a case by case basis, scientific judgement may warrant a decision of presumed human carcinogenicity derived from studies showing limited evidence in humans with limited evidence in experimental animals. In principle, GESAMP will base its decision on adding the remark on the evaluation of reliable evidence and on expert judgement.

Mutagenic

A mutation is a permanent change in the amount or structure of the genetic material in a cell. The term mutation applies to genetic changes both for somatic cells and for germ cells which may give rise to subsequent adverse changes at the phenotypic level. The term Mutagenic denotes chemical substances or mixtures which can give rise to an increased occurrence of mutations *in vivo*, in populations of cells and/or organisms. Evidence to substantiate a conclusion of mutagenicity is normally provided from studies conducted *in vivo* on mammalian somatic cells or germ cells.

It is recognised that genetic events are central in the overall process of cancer development. Therefore evidence of mutagenicity indicates that a chemical has a potential to induce carcinogenic effects.

Reprotoxic

Reproductive toxicity includes adverse effects on sexual function and fertility in adult males and femalesor on the development of the offspring.

The remark reprotoxic includes substances for which there is reliable evidence from human experience or from experimental animals of an adverse effect on reproductive ability or capacity, or on development of the offspring in the absence of other toxic effects.

Neurotoxic

The term Neurotoxic denotes chemical substances or mixtures which are capable of causing injury to the central nervous system (brain and spinal cord) and/or peripheral nervous system (nerves arising from the brain and spinal cord). Neurotoxicity may appear some time after a single exposure or may be the result of repeated exposure, even to very low dose/concentration. Evidence to substantiate the statement Neurotoxic should be available from epidemiological studies and/or from well conducted and appropriate studies in experimental animals.

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ANNEX 5

FINALIZED TEXT FOR SECTION 4.5.2 AND ANNEX 11 OF REPORTS AND STUDIES 64

4.5.2 Sub-column E2: Behaviour of chemicals in the marine environment and physical effects on marine wildlife and on benthic habitats

4.5.2.1 Introduction

The tendency of a spilled chemical to form a slick or to sink and blanket the sea-bed determines to a large extent the physical effect of a chemical on marine wildlife and benthic habitats. The Standard European Behaviour Classification system for evaluating the short term behaviour of chemicals spilled at sea (Annex 11) utilized within regional agreements for the North, Baltic and Mediterranean Seas for co-operation in dealing with marine pollution emergencies as well as within the IMO has been used as a basis for assessing this physical effect [Ref; Ref; Ref; Ref;]. The system was slightly modified to include the criterium of viscosity when evaluating persistent floaters.

4.5.2.2 Ratings

Ratings and the associated criteria for determining potential physical effects on wildlife and on benthic habitats are given below in Table 13.

Table 13 *Revised GESAMP hazard profile ratings for determining potential effects on wildlife and benthic habitats*

Rating	Description & criteria	Physical effects	Examples
F	Floating substance, not likely to evaporate or to dissolve quickly ♦ Density: ≤ sea water (1025kg/m^3@20°C) ♦ Vapour pressure ≤ 0.3 kPa ♦ Solubility ≤ 0.1% (for liquids) ≤ 10% (for solids)	Effects on marine wildlife	Tallow Ethylbenzene Olefins (C12+)
Fp	Persistent slick forming substance. ♦ All of the criteria for a floating substance as well as: ♦ Viscosity > ca 10 cSt (at 10 - 20°C)	Effects on marine wildlife	Pine oil Octanol Dodecyl alcohol
S	Sinking substance that would deposit on the seabed, not likely to dissolve quickly ♦ Density: > seawater (1025kg/m^3@20°C) ♦ Solubility ≤ 0.1% (for liquids) ≤ 10% (for solids)	Effects on benthic habitats	Trichlorothylene Perchloroethylene Phenol

The revised GESAMP hazard evaluation procedure uses only the rating F (floater), Fp (persistent floater) and S (sinker). However, for the benefit of other users of the GESAMP hazard profiles, the other physical behaviour categories are also included in column E2 (see Table 14 and Annex 11).

For mixtures, which will have a range of values for each of the relevant properties, the *worst case* property will be used.

Table 14 *Designations of the other behaviour group, including some examples. The letter coding refers to the primary behaviour of a substance whereas subsequent letters describe subsidiary behaviour(s)*

Rating	Behaviour of the substance	Examples
G	Gas	propane, butane, vinyl chrloride
GD	Gas /dissolves	ammonia
E	Evaporates	benzene, hexane, cyclohexane, heptane
ED	Evaporates/dissolves	methyl-t-butyl ether, vinyl acetate, ethyl acrylate
FE	Floats/evaporates	toluene, xylene
FED	Floats/evaporates/dissolves	butyl acetate butyl acrylate
FD	Floats/dissolves	aniline cyclohexanol
D	Dissolves	Hydrochloric acid, n-butanol, isobutanol
DE	Dissolves/evaporates	acetone, acrylonitrile, mono-ethyl amine (sol.), propylene oxide, methyl ethyl ketone
SD	Sinks/dissolves	dichloromethane, carbon disulphide

4.5.2.3 Application

1. The behaviour groups are defined, according to the physical state of the substance (e.g. gas, liquid, solid) and their density, vapour pressure and solubility which should be given at temperatures of 10°C to 20°C.

2. For mixtures where a range is given for the viscosity at the carriage temperature, a "best estimate" will be made to establish the maximum of the viscosity range at 20°C. Conversion methods such as that given by Gambill (1959) [..] may be used in such cases.

Example: Using the method of Gambill (1959 [..] which is based on the exponential relationship betwween dynamic viscosity (cP) and temperature, the viscosity of most chemicals at any temperature can be estimated if the viscosity is known at one temperature. Polybutene (density = 0.83) has a reported kinematic viscosity of 125 cSt at 37°C, equivalent to 104 cP at 37°C. Its dynamic viscosity is estimated to be 280 cP at 20^{o}C giving a kinematic viscosity of 340 cSt at 20°C.

3. For solutions, and where no specific data are provided, e.g., ammonium sulphide solution (45% or less), the following selected properties of seawater will be used to arrive at a behaviour category of the substance:

   - Freezing point –1.91^{o}C
   - Solubility 100%
   - Vapour pressure 2000Pa (nominal value based on sea water)

4. Frequently, solubility in water is indicated by a range of more or less vague expressions, e.g., soluble, slightly soluble, poorly soluble, etc. The table below is based on a review of the interpretation of solubility phrases from data sources where the descriptive term is qualified by a solubility range. The following table will only be used as a guide in estimating the solubility range for purposes of assigning a rating to column E2.

5. However, whilst this table shows how vague expressions will be used for assigning ratings to column E2, when such vague expressions are encountered, they will be reflected more precisely in the background documentation associated with the product concerned.

Table 13 *Descriptive terms of solubility*

Descriptive term	**Solubility for purposes of Column E2**
Infinite; completely soluble; soluble in all proportions; miscible; very soluble; soluble	≥ 5% for liquids ≥ 100% for solids
Partially soluble; moderately soluble; slightly soluble	0.1-5% for liquids 10-100% for solids
Insoluble; barely soluble; immiscible; almost insoluble	≤ 0.1% for liquids <10% for solids

6. It is recognised that the presence of dissolved salts or minerals in water leads to moderate decreases in solubility, however, since for most substances data for solubility in saline water are not available, the solubility quoted for pure water at 10^{o}C to 20^{0}C will be used.

7. *Floating* substances with an F rating in column E2 would receive a “1” rating under column E3 whilst *Persistent floating* substances with an Fp rating in column E2 would receive a "2" rating under column E3 to indicate the likelihood of stranding and interference with the use of coastal amenities.

Box 10: Guidance for measuring solubility in water, relative density, vapour pressure and viscosity

Solubility in water
The solubility of a substance in water is defined as the maximum amount of the substance that will dissolve in water at a specified temperature (Lyman et al., 1990) (usually 20°C). Aqueous concentrations are usually expressed in terms of weight per weight (g/kg) or weight per volume (g/l). The OECD 105 guideline (1995) recommends one of two methods, i.e. the flask method or the column elution method. The former is suitable for solubilities above 10 mg/l , while the latter is suitable for solubilities below this value.

Relative density
The density of substance is the quotient of its mass and its volume and is expressed in kilogrammes per cubic metre (kg/m^3). OECD 109 guideline (1995) indicates that a wide variety of methods can be used and refers the reader to the specific guidelines for their applicability.

Vapour pressure
The vapour pressure is defined as the pressure exerted when a solid or a liquid is in equilibrum with its own vapour (CRC Handbook of Chemistry and Physics, 1989). At thermodynamic equilibrium, the vapour pressure is a function of temperature only. Vapour pressure can be measured in several ways depending on the expected range. The OECD 104 guideline (1995) lists seven different methods. The static, effusion and gas saturation methods are suitable for low melting point solids and liquids over a wide range of possible vapour pressures. Vapour pressure is measured in Pascals (Pa).

Viscosity
Viscosity of a liquid is a measure of the forces that work against or flow when a shearing stress is applied (Lyman et al., 1990). The OECD 114 guideline defines viscosity as the property of a fluid substance of absorbing stress during deformation which depends on the rate of the deformation. Viscosity is measured in milliPascal second (mPa.s). Three measurement principles are used for measuring the dynamic viscosity of Newtonian liquids, and most of the available methods (with the exception of the 'flow cup' seem to be suitable for measuring a wide range of viscosities:
- flow under gravity through a capilliary (capilliary viscometer or flow cup)
- shearing of the fluid between concentric cylinders, consplate and parallel plate (rotational viscometer)
- dynamic viscosity can be measured by movement of a ball in a vertical or inclined liquid-filled cylindrical tube (e.g. a rolling ball viscometer,, drawing ball viscometer, etc.).

Only the rotational viscometer method is suitable for non-Newtonian liquids.

- Dynamic viscosity: 0.01 poise (P) = 0.01 g cm^{-1} s^{-1}= 1 mPa.s.
- Kinematic viscosity: 1 Centistoke (cSt) = 1 mm^2/s
- Kinematic viscosity (cSt) is the ratio of viscosity (cP) to density (d) at a given temperature,
- 1 cSt = 1 cP / d

ANNEX 11 (to Reports and Studies 64)

STANDARD EUROPEAN BEHAVIOUR CLASSIFICATION SYSTEM

Chemicals which are spilled into the sea behave in different ways depending on their properties and environmental conditions. In principle, spilled chemicals can either evaporate, float, dissolve or sink. In reality, they often show complex behaviours in contact with sea-water. A spill of e.g. isobutanol will spread out onto the water surface and float for a while during simultaneous vaporisation into the air and dissolution into the water. Based on information about physical properties of chemicals (physical state, density, vapour pressure, solubility), their behaviours after release into water can be predicted.

The European Behaviour Classification System has been elaborated within the framework of the Regional Bonn Agreement for the North Sea, aimed at cooperation in dealing with marine pollution emergencies in order to classify chemicals according to their physical behaviours when spilled into the sea. The classification system covers gaseous, liquid and solid chemicals. The main principle of the system is a characterisation of spilled loose chemicals as evaporators, floaters, dissolvers and sinkers. From this basic characterisation and from other details regarding physical properties, the chemicals are classified in the following 12 Property Groups:

Main group		Subgroup	
G	Gas	GD	Gas that dissolves
E	Evaporator	ED	Evaporator that dissolves
F	Floater	FE	Floater that evaporates
		FD	Floater that dissolves
		FED	Foater that evaporates and dissolves
D	Dissolver	DE	Dissolver that evaporates
S	Sinker	SD	Sinker that dissolves

GROUPING OF CHEMICALS BY THEIR PHYSICAL PROPERTIES

The Property Groups of the European Behaviour Classification System are defined, according to the physical state of the substance (gas, liquid, solid) and by certain limits of vapour pression (v.p.), density (d), solubility (s). The method of classifying chemicals by physical property limits is shown by the Flow Diagram of the European Classification System in Section 25.5.

Physical state of the substance. Gases are in the context, chemicals that boil below ambient temperature at normal atmospheric pressure of 100 kPa. This means that gases are those chemicals with vapour pressures above 100 kPa at ambient temperature. The meaning of liquids and solids refers to the state of aggregation at ambient temperature and atmospheric pressure (100 kPa). Liquids are chemicals that boil above ambient temperature at 100 kPa, but melt below ambient temperature (melting point < ambient temperature). Solids are chemicals that melt above ambient temperature at 100 kPa (m.p. > ambient temperature).

Density.The relative density related to seawater makes it possible to know wheteher a susbtance floats or not. The density of seawater (about 1025 kg m^{-3}) may affect the floating/sinking behaviour of a chemical with low solubility..

Vapour pressure. The vapour pressure is only used for liquid substance. As below 0.3 kPa, a floating substance does not evaporate and over 3 kPa evaporation is fast. A dissolved substance evaporates if the vapour pressure is higher than 10 kPa.

Solubility. The adopted criteria of solubility are different according to the physical state of the substance. Substances are considered insoluble when solubility is less than 0.1 % for liquids and 10% for solids. The dissolving process is predominant over a solubility of 5% for liquids and 100% (« totally miscible ») for solids.

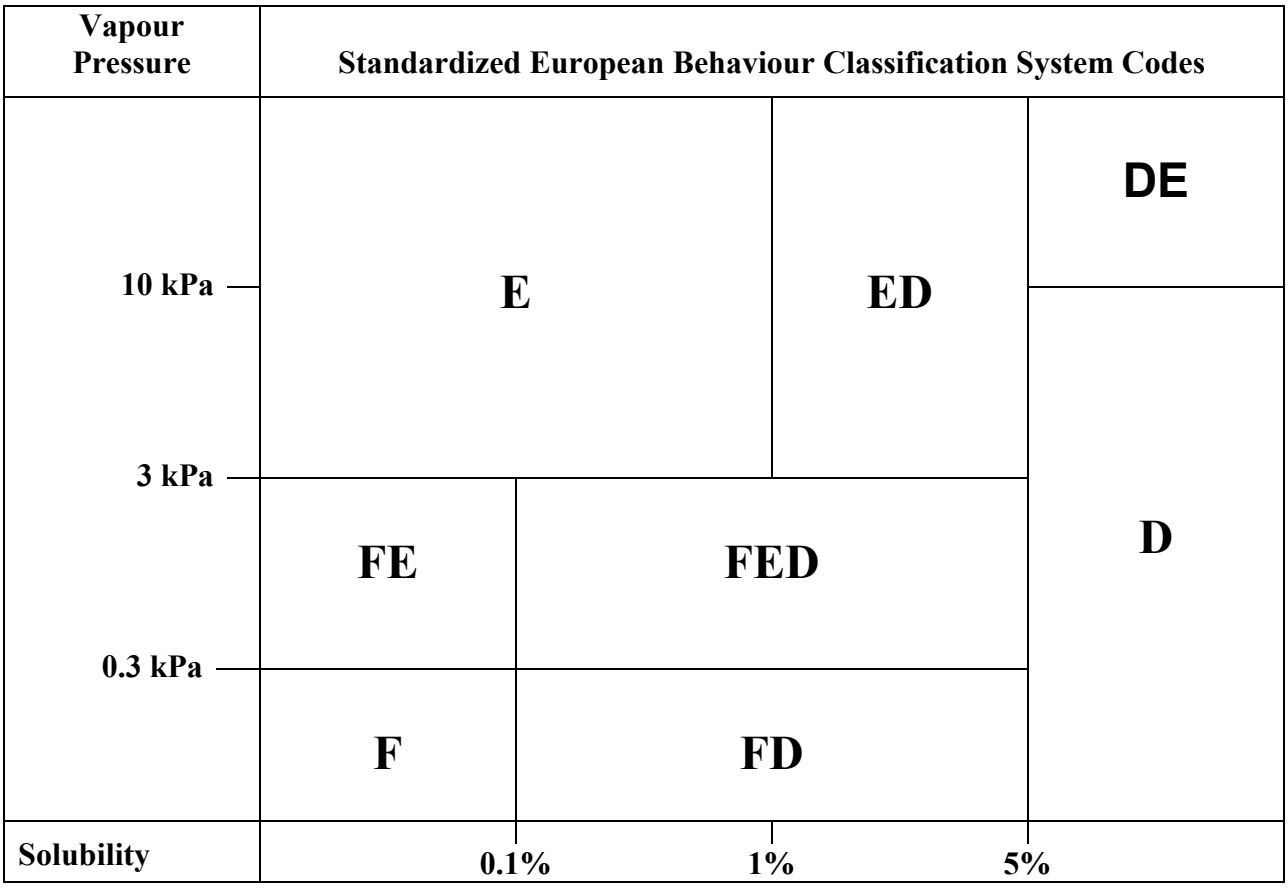
The representation below shows the principles of the European Behaviour Classification System for chemicals which may be spilled into the sea. Starting from their physical state and their properties, chemicals can be classified into 12 groups (G, GD, E, ED, F, FE, FED, FD, D, DE, S and SD). By this classification system, whole groups of chemicals can be related to the same response strategies. Thus, contingency planning and preparedness for actions against outflows of chemicals can be simplified.

European Behaviour Classification System of Accidentally Spilled Chemical Products According to the Physical State and Physical Properties

GASES (Vapour Pressure > 101.3 kPa at 20°C)

SEBC Code:	**G**	**GD**
Solubility:	**0%**	**10%**

FLOATING LIQUIDS (Density ≤ Seawater)



SINKING LIQUIDS (Density > Seawater)

SEBC Code:	**S**	**SD**	**D or DE (if v.p>10kPa)**
Solubility:	**0.1%**	**5%**	

FLOATING SOLIDS (Density ≤ Seawater)

SEBC Code:	**F**	**FD**	**D**
Solubility:	**10%**	**100%**	

SINKING SOLIDS (Density > Seawater)

SEBC Code:	**S**	**SD**	**D**
Solubility:	**10%**	**100%**	

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ANNEX 6

FINALIZED TEXT FOR SECTION 4.5.3 OF REPORTS AND STUDIES 64

4.5.3 Column E3: Interference with the use of coastal amenities

4.5.3.1 Introduction

Interference with coastal amenities refers to the potential of a chemical to interfere with activities in coastal waters, including ports or estuaries, fishing activities, usage of beaches, appearance of an area, the health of coastal populations and the preservation of living resources. A physical hazard is one in which harm could be caused to humans or wildlife as a consequence of the physical properties of the chemical, e.g., stickiness, flammability, etc. Column E3 is supported by data as well as information on environmental and human health hazard from columns A to D.

For purposes of E3 rating, the follow substances are considered to be flammable :

(i) liquids with a flashpoint below 23°C,
(ii) liquids with a flashpoint between 23°C and 61°C that are floaters and also possess evaporative (FE) or evaporative and dissolving (FED) behaviour.

Oftentimes, objectionable odour is taken as an indication of a potential health hazard by local authorities. Strong odours at the beach may induce symptoms of ill-health (for example, nausea or headache) in humans that have a relatively high sensitivity to chemical odours. As a result, warnings may be issued and beaches may be closed. There is only a limited amount of data on the characteristic odours of various chemicals and the concentration levels at which their vapors can be detected by humans. Because of the lack of information in this area and the difficulty in classifying an odour as ‘objectionable’, this property of chemicals has not been evaluated by GESAMP.

4.5.3.2 Ratings

The ratings in sub-column E3 are presented in Table 15 below. It should be kept in mind that these ratings with associated hazard warnings are for guidance purposes only to aid in decision making with respect to closure of beaches in the event of chemical contamination. This rating system is not based on a thorough risk assessment. Additional factors related to the spill situation, such as weather and hydrodynamic conditions, quantity spilled, local conditions, etc... must be evaluated by competent spill response authorities before a decision is taken on closure of the beach.

Table 15 *Revised GESAMP hazard profile rating scheme for interference with coastal ameneties*

Rating	Relative Interference	Description	Hazard warning
0	None	● No health problems from exposure to substance are expected. ● Substance not expected to reach or remain on a coastal amenity.	***None***
1	Slightly objectionable	● Substance may produce mild irritant effects ● Substance remains on a coastal amenity for abrief period and may cause minor short-term physical hazard (e.g. floater).	***Warning issued but no closure of amenities***
2	Moderately objectionable	● Substance remains on coastal amenity and may cause physical hazards (e.g. persistent floater or flammable substance). ● Substance could produce slight to moderate acute systemic toxic effects from acute exposure conditions. ● Substance is irritating to tissues (but not corrosive) or is a sensitize.r	***Warning issued and possible closure of amenities***
3	Highly objectionable	● Substance will persist on a coastal amenity, resulting in physical hazards with serious health effects and increasing potential for exposure. ♦ Substance is likely to produce serious toxic effects from acute exposure conditions. ♦ Substance is severely irritating/ corrosive to tissues. ♦ Carcinogen and/or potential serious long-term adverse health effects.	***Warning issued leading to closure of amenities***

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Products discussed during the meeting

15-May-01

Sorted by Lead Name

	----- Existing GHP -------					---------- Revised GESAMP Hazard Profile (GHP) system ----------															
NAME	**EHS**	**A**	**B**	**C**	**D**	**E**	**A1a**	**A1b**	**A2**	**B1**	**B2**	**C1**	**C2**	**C3**	**D1**	**D2**	**D3**	**E1**	**E2**	**E3**	**F**	**Last Update**
Alkyl (C12 and C14) dimethylamine	1489	0	4	1	II	XX				4		1	0	NI	NI	NI		0		NI		01/05/2001
Alkyl dithiocarbamate (C19-C35)	2236	0	1	0	0	0	0	NI	NI	1	NI	0	0	(0)	0	0			(NI)	0		01/05/2001
bis(hydrogenated tallow alkyl) methylamines	2232	-	-	0	1	X	Ni	NI	NI	NI	NI	0	NI	NI	1	NI			F	1		01/05/2001
1-Bromopropane	2229	0	-	1	II	XX	2	NI	NI	NI	NI	0	(0)	0	(2)	(2)			SD	(2)		01/05/2001
2-Butanone	385	0	0	1	I	X	0	NI	R	1	0							0	DE	1		01/05/2001
Calcium bromide (solutions)	427	0	0	1	I	0	Inorg	0	Inorg	1	0							0	D	0		01/05/2001
2,6-Di-tert-butyl phenol	2082	+	4	0	I	XX	4	Ni	NR	4	NI	0	0	NI	1	1		NI	F	1		01/05/2001
1,2-Dichloroethane	591	0	1	2	II	XX	1	1	NR	2	0	1	0	2	1	2		0	SD	2	Animal carcinogen	01/05/2001
N,N-Dimethyl cyclohexylamine	665	0	2	2	II	XX	2	NI	NR	2	NI							0	FD	2		01/05/2001
Dimethylethanolamine	667	0	(0)	1	II	XX	0	NI	R	2	NI	1	1	2	3	3		0	D	3		01/05/2001
Dimethyl formamide	676	0	0	0	II	XX	0	0	R	1	0	0	1	2	1	2		0	D	2	Reproductive toxicant	01/05/2001
Dimethyl glutarate	670	0	2	0	I	0	0	NI	R	3	NI	0	0	2	3	2		0	SD	3	Respiratory damage on repeated inhalation	01/05/2001
Dimethyl hydrogen phosphite	673	0	(3)	1	I	X	0	NI	NR	2	NI	1	0	0	1	1		0	D	1		01/05/2001
2,2-Dimethyloctanoic acid	675	0	2	1	II	XX												0	F	2		01/05/2001
Dimethyl phthalate	678	0	2	1	0	X	2	2	R	2	0							0	SD	1		01/05/2001

NAME	EHS	A	B	C	D	E	A1a	A1b	A2	B1	B2	C1	C2	C3	D1	D2	D3	E1	E2	E3	F	Last Update
Dimethyl succinate	681	0	2	0	I	0	0	NI	NI	2	NI	0	0	0	0	2		0	SD	2		01/05/2001
Dinitrotoluene	688	0	4	2	II	XXX	2	2	NR	4	2	2	NI	NI	1	0	Yes	0	S	2	Animal carcinogen	01/05/2001
Di-n-octyl phthalate	692	0	0	0	I	XX												0	Fp	2		01/05/2001
1,4-Dioxane	682	0	0	1	II	XXX	0	0	NR	0	0	0	0	0	0	2	Yes	0	D	2	Animal carcinogen, Respiratory irritant	01/05/2001
Dipentene	686	T	2	1	I	X	4	NI	NR	(4)	NI	0	0	NI	2	2		Ta	F	2	Sensitizer	01/05/2001
Diphenyl	694	+	3	1	II	XXX	3	4	R	4	1	0	0	(0)	2	1		0	S	2		01/05/2001
Diphenylamine, reaction product with 2,4,4-trimethylpentene	1500	-	(4)	0	II	XX	NI	NI	NR	3	NI	0	0	NI	1	1	Yes	NI	NI	2	Skin sensitizer	01/05/2001
Diphenylamines, alkylated	1770	+	3	0	0	0	5	NI	NR	3	NI	0	NI	0	NI	NI		0	NI	0		01/05/2001
Diphenyl/Diphenyl ether (mixtures)	698	T	3	1	II	XXX			NR	4	1	0	0	(0)	1	1		Tt	S	1	Respiratory irritant	01/05/2001
Diphenyl ether	699	T	3	1	I	X	4	4	NR	4	NI	0	0	0	1	1		Tt	S	1	Respiratory irritant	01/05/2001
Diphenyl ether/ Biphenyl phenyl ether mixtures	702	T	3	1	I	XX	5	NI	NR	4	NI	0	0	0	1	1		Ta	S	1	Respiratory irritant	01/05/2001
Diphenylmethane-4,4'-diisocyanate	700	0	1	1	II	XXX	5	2	NR	0	0	0	NI	4	NI	2	Yes	0	S	3	Skin sensitizer. Respiratory sensitizer.	01/05/2001
Diphenylol propane-epichlorohydrin resins	2237																		S			01/05/2001
Di-n-propylamine	704	0	2	1	II	XXX	1	NI	NR	3	NI	2	2	2	3C	3	Yes	0	FED	3	Lachrymator	01/05/2001
Dipropylene glycol	707	0	0	0	0	0	0	1	NR	0	NI	0	0	0	1	1		0	D	1		01/05/2001
Ditridecyl adipate	2230																		Fp			01/05/2001
Diundecyl phthalate	715	0	0	(1)	0	XX	0	NI	NR	0	0							0	Fp	2		01/05/2001

NAME	EHS	A	B	C	D	E	A1a	A1b	A2	B1	B2	C1	C2	C3	D1	D2	D3	E1	E2	E3	F	Last Update
Dodecane	718	0	0	(1)	0	0												0	Fp	0		01/05/2001
tert-Dodecanethiol	2233			0	I	XX	5	NI	NR	4	NI	0	0	(0)	2	1			F	2	Sensitizer	01/05/2001
1-Dodecanol	719	0	3	0	0	X	5	NI	R	4	1	0	0	NI	2	1		0	Fp	2		01/05/2001
Dodecene (all isomers)	720	0	(3)	(1)	I	0												0	F	0		01/05/2001
2-Dodecenyl succinic acid, dipotassium salt, solution	727	0	0	1	0	0	NI	NI	NI	0	NI	0	NI	NI	NI	NI		0	NI	NI		01/05/2001
Dodecylamine/Tetradecylamine mixture	721	-	4	2	II	XX	5	NI	NI	4	NI	1	NI	NI	3C	3		NI	FD	3		01/05/2001
Dodecyl benzene	126	0	0	0	I	X	0	NI	NR	0	0	0	(0)	NI	NI	NI		0		NI		01/05/2001
Dodecyl diphenyl oxide disulphonate (solns.)	723	0	4	1	II	X	(5)	NI	NI	4	NI	1	NI	NI	(2)	(2)		0		(2)		01/05/2001
Dodecyl/pentadecyl methacrylate (mixture)	724	0	0	0	0	X						0	NI	NI	(2)	(2)		0	Fp	(2)		01/05/2001
Dodecyl phenol	725	+	4	1	II	XX	0	4	NI	4	NI	0	0	(1)	3	2		0	Fp	2		01/05/2001
Dodecylxylene	1763	0	0	0	0	0	0	NI	NI	0	NI	0	0	(0)	1	1		0	Fp	1		01/05/2001
Drilling Brines	2238						Inorg	0	Inorg	1	0								D			01/05/2001
Drilling Brines (containing zinc)	2239						Inorg	4	Inorg	3	NI	1	NI	NI	3B	3			D	3		01/05/2001
Epichlorohydrin	731	0	4	2	II	XXX	0	NI	R	3	1	2	2	3	3a	3		0		3		01/05/2001
Ethanolamine	733	0	1	1	0	0	0	NI	R	2	0	1	1	3	3a	3		0	D	3		01/05/2001
Ethyl acetate	735	0	1	0	0	0	0	2	R	1	0	0	0	1	0	1		0	DE	1		01/05/2001
Ethyl acetoacetate	736	0	(1)	1	I	X	0	0	R	1	NI	0	0	(0)	1	1		0	D	1		01/05/2001
Ethyl acrylate	734	T	3	2	I	X	1	NI	R	3	1	1	2	2	2	2		Tt	ED	1	Sensitizer	01/05/2001

NAME	EHS	A	B	C	D	E	A1a	A1b	A2	B1	B2	C1	C2	C3	D1	D2	D3	E1	E2	E3	F	Last Update
Ethylamine	1016	0	2	2	II	XXX	0	NI	R	2	NI	2	2	1	3	3		0	GD	3		01/05/2001
Ethylamine solutions (72% or less)	2219								R	2	NI	2	2	1	3	3			DE	3		01/05/2001
Ethyl amyl ketone	1784	T	2	-	-	-	2	NI	NI	2	NI	0	0	NI	2	NI		Ta	FD	NI		01/05/2001
Ethylbenzene	740	0	3	1	I	XX	3	2	R	3	1	0	0	0	2	2		0	F	2		01/05/2001
N-Ethyl butylamine	745	0	(2)	(3)	II	XX	1	NI	NI	NI	NI	1	1	2	3	3		0	FED	3		01/05/2001
Ethyl butyrate	748	0	2	0	I	X	1	NI	NI	2	NI	0	0	NI	2	NI		0	FED	2		01/05/2001
Ethyl cyclohexane	751	0	(3)	1	0	0	4	NI	NI	3	NI	NI	NI	NI	NI	NI		0	FE	NI		01/05/2001
N-Ethyl cyclohexylamine	752	0	1	1	II	XX	2	NI	NI	(3)	NI	1	2	2	3	3		0	FED	3		01/05/2001
Ethylene carbonate	755	0	0	0	I	X	0	NI	R	0	NI	0	0	(1)	1	2		0	SD	2		01/05/2001
Ethylene chlorohydrin	756	0	2	2	II	XX	0	0	R	3	NI	2	3	4	2	3		0	D	3		01/05/2001
Ethylene cyanohydrin	757	0	(1)	1	I	X	0	0	NI	2	NI	1	0	(1)	1	2		0	D	2		01/05/2001
Ethylene diamine	758	0	2	2	II	XX	0	1	R	3	1	1	2	1	3	3		0	D	3	Potent skin sensitizer	01/05/2001
Ethylene diamine, tetra acetic acid, di- and tetra-sodium salt	759	0	0	1	II	0	0	NI	NR	2	0	1	NI	NI	1	2		0	D	2		01/05/2001
Ethylene dibromide	760	0	3	2	II	XXX	1	2	NR	3	NI	2	2	2	3	3		0	SD	3	Carcinogen; Reprotoxic	01/05/2001
Ethylene glycol	761	0	0	2	II	XX	0	NI	R	0	0	1	(1)	(1)	0	0		0	D	2	Reproductive toxicant	01/05/2001
Ethylene glycol acrylate	869	0	3	1	II	XX	0	NI	R	4	NI							0		2		01/05/2001
Ethylene glycol butyl ether acetate	764	0	(2)	1	I	X	1	NI	R	2	NI	0	1	(1)	1	1		0	FD	1		01/05/2001
Ethylene glycol diacetate	765	0	2	1	0	0	0	NI	NI	2	NI	0	0	(1)	1	NI		0	D	1		01/05/2001
Ethylene glycol ethyl ether acetate	767	0	2	1	II	XX	0	NI	R	2	0	1	0	1	1	2		0	D	3	Reprotoxic	01/05/2001

NAME	EHS	A	B	C	D	E	A1a	A1b	A2	B1	B2	C1	C2	C3	D1	D2	D3	E1	E2	E3	F	Last Update
Ethylene glycol methyl butyl ether	772	0	1	-	-	-	1	NI	NI	1	NI	NI	NI	NI	NI	NI		0	NI	NI		01/05/2001
Ethylene glycol methyl ether acetate	773	0	2	1	II	XXX	0	NI	R	2	NI	1	0	NI	NI	1		0	D	3	Teratogen;Testicular toxicity;Hematotoxic	01/05/2001
Ethylene glycol monoacetate	762	0	(1)	1	I	X	0	NI	R	2	NI	0	0	NI	NI	(3)		0	D	(3)	Reprotoxic	01/05/2001
Ethylene glycol monobutyl ether	763	0	1	2	II	XX	0	NI	R	2		2	2	2	1	2		0	D	2		01/05/2001
Ethylene glycol phenyl ether	775	0	1	1	II	XX	1	NI	R	1	NI	1	0	NI	1	2		0	SD	2		01/05/2001
Ethylene glycol phenyl ether/Diethylene glycol phenyl ether, mixture	1740	0	1	1	II	XX			R	1	NI	1	0	NI	(2)	(2)		0	NI	2		01/05/2001
Ethylene vinyl acetate copolymer (emulsion)	779	0	0	0	0	0	0	1	NR	0	0	0	NI	NI	NI			0	S	NI		01/05/2001
Ethyl-3-ethoxypropionate	1439	0	2	1	I	X	1	NI	NR	2	NI	0	0	2	1	1		0	FD	1		01/05/2001
2-Ethylhexanoic acid	776	0	1	1	I	0	2	NI	R	2	NI	0	0	(1)	2	2		0		2		01/05/2001
2-Ethylhexyl acrylate	782	0	(3)	0	I	X	3	NI	R	2	NI	0	0	(1)	2	2		0	F	2		01/05/2001
2-Ethyl-2-(hydroxymethyl)propane-1,3-diol C8-C10 ester (LOA)	2054	0	0	0	0	XX												0	NI	2		01/05/2001
5-Ethylidene-2-norbornene	783	0	3	1	I	X	3	3	NR	3	0	0	0	2	1	2		0	FE	2		01/05/2001
Ethyl methacrylate	785	0	(1)	1	I	XX	1	NI	NI	2	NI						Yes	0	FE	2	Skin sensitizer	01/05/2001
N-Ethyl-2-methallylamine	2228	0	2	3	-	-	0	NI	NR	2	NI	3	(2)	(2)	NI	NI			NI	NI		01/05/2001
o-Ethyl phenol	788	T	(3)	2	II	XX	2	NI	NI	(2)	NI	1	NI	NI	NI	NI		Tt	S	2		01/05/2001
Ethyl propionate	790	0	1	1	I	X	1	NI	NI	2	NI	0	NI	NI	2	2		0	ED	2		01/05/2001
2-Ethyl-3-propyl acrolein	791	(T)	3	1	II	XX	2	NI	R	3	NI	0	0	1	3	3		Ta	FE	3		01/05/2001

NAME	EHS	A	B	C	D	E	A1a	A1b	A2	B1	B2	C1	C2	C3	D1	D2	D3	E1	E2	E3	F	Last Update
Ferric chloride	339	0	2	2	0	X	Inorg	5	Inorg	2	0	1	(0)	(1)	2	3		0		3		01/05/2001
Furfural	812	0	2	2	II	XX	0	NI	R	2	NI							0	D	2		01/05/2001
Furfuryl alcohol	813	0	2	2	0	0	0	NI	R	(3)	NI							0	D	0		01/05/2001
Glycerine	814	0	0	0	0	0	0	NI	R	0	NI							0		0		01/05/2001
Glycerine (83%)/ Dioxane-dimethanol (17%) mixture	1743	0	1	1	I	X	NI	NI	R	1	NI							0		1		01/05/2001
Glycerol polyalkoxylate	815	0	0	0	0	0	NI	NI	NR	0	NI							0		0		01/05/2001
Glyceryl triacetate	816	0	(0)	1	0	0	0	NI	R	1	0							0		0		01/05/2001
Glycidyl ester of C10 trialkyl acetic acid	441	0	3	1	II	XX	3	NI	NR	3	NI							0		2		01/05/2001
Glycine, Sodium salt, solution	817	0	0	0	0	0	0	NI	NI	0	NI							0		0		01/05/2001
Glyoxal solutions (40% or less)	84	0	1	1	I	X	0	NI	R	1	NI							0		1		01/05/2001
Heptanoic acid	831	0	1	0	I	X	2	NI	R									0		1		01/05/2001
Heptanol (all isomers)	2223						2	NI	R	3	NI											01/05/2001
1-Heptanol	828	0	2	1	I	0	2	NI	R	3	NI							0		0		01/05/2001
Heptene (all isomers)	2225						3	NI	NI	2	NI								E			01/05/2001
1-Heptene	832	0	2	(1)	0	0	3	NI	NI	2	NI							0	E	0		01/05/2001
Heptyl acetate	833	0	(3)	0	I	X	3	NI	NI	(3)	NI							0		1		01/05/2001
Hexamethylene diamine	845	0	2	1	II	XX	0	NI	R	2	NI							0	D	2	Potent skin sensitizer	01/05/2001
Hexamethylene diamine adipate, 50% in water	846	0	1	1	II	X	0	NI	R	1	NI							0		1		01/05/2001

NAME	EHS	A	B	C	D	E	A1a	A1b	A2	B1	B2	C1	C2	C3	D1	D2	D3	E1	E2	E3	F	Last Update
Hexamethylene glycol	847	0	0	1	0	0	0	NI	R	1	NI							0		0		01/05/2001
Hexamethyleneimine	848	0	2	3	II	X	1	NI	NI	2	NI							0		1		01/05/2001
Hexamethylene tetramine	849	0	0	1	II	XX	0	NI	R	0	NI						Yes	0		2	Skin sensitizer	01/05/2001
Hexane	850	0	3	0	II	X	3	NI	NI	3	NI							0	E	1	Neurotoxic	01/05/2001
Hexanoic acid	853	0	1	1	I	X	2	NI	R									0		1		01/05/2001
1-Hexanol	854	0	1	1	II	XX	1	0	R	2	NI							0	FD	2		01/05/2001
Hexene (all isomers)	2224						3	NI	R	3	NI								E			01/05/2001
1-Hexene	855	0	2	(1)	0	0	3	NI	R	3	NI							0	E	0		01/05/2001
2-Hexene (mixed isomers)	856	0	(2)	-	0	0	3	NI	R	3	NI							0	E	0		01/05/2001
Hexyl acetate	857	0	3	0	0	0	2	NI	NI									0		0		01/05/2001
sec-Hexyl acetate	858	0	(2)	0	0	0	2	NI	NI	3	NI							0		0		01/05/2001
Hexylene glycol	859	0	0	1	0	0	0	NI	R	0	0							0		0	(a candidate for review)	01/05/2001
Hitec 3000	2213	0	4	2	II	XX	3	NI	NR	4	NI	2	3	4	1	1			S	3		01/05/2001
Hydrochloric acid	864	0	1	1	0	0	Inorg	0	Inorg	1	NI							0		0		01/05/2001
Hydrogen peroxide, more than 60%	867	0	2	0	I	0	Inorg	0	Inorg	3	NI							0		0		01/05/2001
Hydrogen peroxide, more than 8% but not more than 60%	2231						Inorg	0	Inorg	3	NI											01/05/2001
N-(2-Hydroxyethyl) ethylene diamine triacetic acid, trisodium salt (solution)	870	0	1	1	II	0	0	NI	NI	1	NI							0		0		01/05/2001

NAME	EHS	A	B	C	D	E	A1a	A1b	A2	B1	B2	C1	C2	C3	D1	D2	D3	E1	E2	E3	F	Last Update
2-Hydroxy-4-(methylthio) butanoic acid	871	0	2	1	II	XX	1	NI	R	2	NI							0		2		01/05/2001
Icosa(oxypropane-2,3-diyl)s	2092	0	3	(1)	I	X	NI	NI	NI	NI	NI							0		1		01/05/2001
Isobutyl formate	405	0	1	1	I	X	1	NI	NI	1	NI							0		1		01/05/2001
Isooctanol	1076	T	2	1	0	X	3	NI	NI	2	0							Ta		1		01/05/2001
Isooctylamine	1081	0	3	2	II	XX	2	NI	NI	3	NI	1	1	3	3	3		0	FD	3		01/05/2001
Isopentene	1113	0	2	-	0	0	2	NI	NI	2	NI							0		0		01/05/2001
Isophorone	879	0	2	1	II	XX	1	1	R	2	0							0		2		01/05/2001
Isophorone diamine	880	0	1	1	II	XXX	0	0	NR	2	0						Yes	0		3	Potent skin sensitizer; Aspiration hazard	01/05/2001
Isophorone diisocyanate	881	-	3	1	II	XXX	1	NI	NR	4	NI						Yes	NI		3	Potent skin sensitizer; Aspiration hazard	01/05/2001
Isoprene	882	0	2	0	I	0	2	2	NR	2	NI							0		0		01/05/2001
Isopropanol	1181	0	0	1	0	0	0	NI	R	0	0							0	D	0		01/05/2001
Isopropanolamine	1182	0	2	1	I	X	0	NI	R	2	NI							0		1		01/05/2001
Isopropyl acetate	1192	0	(1)	1	I	X	1	NI	R	1	NI							0		1		01/05/2001
Isopropylamine	1195	0	2	1	II	XXX	0	NI	R	2	NI						Yes	0		3	Lachymator; Aspiration hazard	01/05/2001
Isopropyl benzene	1197	T	3	1	I	X	3	2	R	3	NI							Tt	FE	1		01/05/2001
Latex,ammonia inhibited	889	0	1	0	0	XX												0		2		01/05/2001
Lauryl methacrylate	893	0	0	0	I	X	5	NI	NR	0	NI	0	NI	NI	2	2		0	F	3		01/05/2001
Methanol	951	0	0	3	II	XX	0	NI	R	0	0	3	(3)	(3)	2	2		0	DE	2	Causes optic atrophy	01/05/2001

NAME	EHS	A	B	C	D	E	A1a	A1b	A2	B1	B2	C1	C2	C3	D1	D2	D3	E1	E2	E3	F	Last Update
Methyl tert-butyl ether	969	0	1	1	I	XX	1	NI	NR	(2)	NI	0	0	0	2	1		NI	ED	2		01/05/2001
1,4-Methyl ethyl benzene	985	T	3	0	0	0	3	NI	NI	(3)	NI							Ta	F	0		01/05/2001
Methyl isobutyl ketone	971	0	1	1	I	X												0	FED	1		01/05/2001
Methyl methacrylate	995	0	1	1	II	XXX	1	NI	R	2	NI						Yes	0	ED	3	Potent skin sensitizer; Aspiration hazard	01/05/2001
2-Methyl pentane	1000	0	3	(0)	0	0	3	NI	NI	3	NI							0		0		01/05/2001
Mobilad G252	2214	0	2	(0)	0	0	5	NI	NR	2	NI	(0)	(0)	(0)	0	0			FE	0		01/05/2001
Mobil syndril E51	2221	0	1	1	-	-	0	NI	R	1	NI	0	(0)	NI	NI	NI			Fp	NI		01/05/2001
Molasses	1013	0	0	0	0	X	0	NI	R	0	NI	0	0	0	0	0		0	D	0		01/05/2001
Nonene (All isomers)	2222						4	NI	NI	3	NI								FE			01/05/2001
1-Nonene	1060	0	3	(1)	0	0	4	NI	NI	3	NI							0	FE	0		01/05/2001
1-Octanol	1075	T	2	1	0	X	3	NI	NI	2	0							Ta	Fp	1		01/05/2001
Palm nut oil fatty acid	1095	0	2	-	-	-												0	F	NI		01/05/2001
Paraffin wax	1086	0	0	0	0	0	0	NI	R	0	NI							0	F/Fp	0		01/05/2001
Pentene (all isomers)	1992	0	2	(1)	0	0	2	NI	NI	2	NI							0	E	0		01/05/2001
1-Pentene	1114	0	(2)	(1)	0	0	2	NI	NI	2	NI							0	E	0		01/05/2001
2-Pentene	1115	0	2	(1)	0	0	2	NI	NI	2	NI							0	E	0		01/05/2001
Phenol	1124	0	2	2	II	XX	1	2	R	3	0	2	2	(4)	3	3		NT	S	3		01/05/2001
Phosphoric acid	1138	0	1	1	I	0	Inorg	NI	Inorg	1	NI	(3)	(3)	3	3	3		0	D	3		01/05/2001
Pine oil	1148	0	2	1	I	X											Yes	0	Fp	1	Skin sensitizer	01/05/2001

NAME	EHS	A	B	C	D	E	A1a	A1b	A2	B1	B2	C1	C2	C3	D1	D2	D3	E1	E2	E3	F	Last Update
Polyolefin aminoester salt	2095	0	1	0	I	XX	NI	NI	NR	1	NI	0	0	(0)	1	NI		0		2		01/05/2001
Polysiloxane	1161	0	0	0	0	0	NI	4	NI	2	NI							0	F	0		01/05/2001
Polytetramethylene ether glycol (mw 600-3000)	2147	0	3	0	I	XX	2	NI	NI	3	NI	0	NI	1	2	1		NI	F	2	Stabilized with 2,6-di-tert-butyl-p-cresol which may enhance aquatic toxicity	01/05/2001
Potassium hydroxide (sol.)	1171	0	1	2	II	X	Inorg	0	Inorg	2	NI							0	D	1		01/05/2001
Propylene dimer	1201	0	(2)	1	0	0	3	NI	R	3	NI							0		0		01/05/2001
1,2-Propylene glycol	1202	0	0	0	0	0	0	NI	R	0	0							0	D	0		01/05/2001
Propylene oxide/Ethylene oxide mixture	78	0	2	2	II	XX	0	NI	R	1	NI						Yes	0	DE	2	Animal carcinogen;Neurotoxic;Reproductive toxicity	01/05/2001
Propylene trimer	1207	0	3	1	0	0	5	4	NR	3	2							0		0		01/05/2001
Resin Intermediate RI-1116	2234			1	I	X	NI	NI	NR	2	NI	1	1	(2)	2	NI			FE	2		01/05/2001
Sodium hydroxide	1254	0	1	1	II	X	Inorg	0	Inorg	2	NI							0	D	1		01/05/2001
Styrene (monomer)	1273	T	3	2	II	XXX	3	NI	R	3	NI	1	NI	2	2	2	Yes	Tt	FE	3	Animal carcinogen	01/05/2001
Sulphuric acid	1280	0	2	3	II	XX	Inorg	NI	Inorg	2	NI	(3)	(3)	4	3C	3		0	D	3	Human carcinogen (by inhalation of mists)	01/05/2001
Tall oil, crude and distilled	1285	0	3	0	I	XX						0	NI	NI	1	1	Yes	0	F/Fp	1		01/05/2001
1,1,2,2-Tetrachloroethylene	1295	Z	2	0	0	X	3	2	NR	(3)	2							0	S	1		01/05/2001
Tetradecanoic acid (Myristic acid)	1298	0	0	0	I	X	5	NI	R	0	NI							0	F/Fp	1		01/05/2001
Tetrahydrofuran	1304	0	1	1	0	0	0	NI	R	0	NI							0	DE	0		01/05/2001
Thixatrol plus	2210	0	3	0	I	X	5	NI	R	3	NI	0	0	0	1	1			NI	NI		01/05/2001

NAME	EHS	A	B	C	D	E	A1a	A1b	A2	B1	B2	C1	C2	C3	D1	D2	D3	E1	E2	E3	F	Last Update
Toluene	330	0	2	1	II	XXX	2	2	R	3	0	(1)	0	0	1	1	Yes	NT	FE	2	Neurotoxic;Ototoxic;	01/05/2001
Toluene diisocyanate	1315	0	2	0	II	XXX	(3)	1	NR	2	NI						Yes	0	RwW	3	Respiratory sensitizer	01/05/2001
1,1,2-Trichloro-ethylene	329	0	2	1	II	XX	2	2	NR	3	NI						Yes	0	S	2	Animal carcinogen	01/05/2001
Triethanolamine	1338	0	1	0	I	0	0	0	R	1	NI							0	D	0		01/05/2001
Urea	1384	0	0/BOD	0	0	0	0	0	R	1	NI	0	0	(1)	1	(1)		0	S	1		01/05/2001
Urea-ammonium nitrate solutions	1387	0	1	1	0	0												0	D	0		01/05/2001
Vinyl acetate	1400	0	2	1	0	0	0	NI	R	2	NI	1	0	2	1	1		0	ED	2	Animal carcinogen	01/05/2001
Xylene (mixed isomers)	1408	0	3	1	II	XX	3	2	NR	3	0	0	0	0	2	2		NT	FE	2		01/05/2001
Zinc bromide solutions	2227			1	II	XXX	Inorg	4	Inorg	3	NI	1	NI	NI	3b	3			D	3	Sensitizer	01/05/2001
Zinc chloride	1425	0	3	2	0	0	Inorg	4	Inorg	4	1							0	D	0		01/05/2001