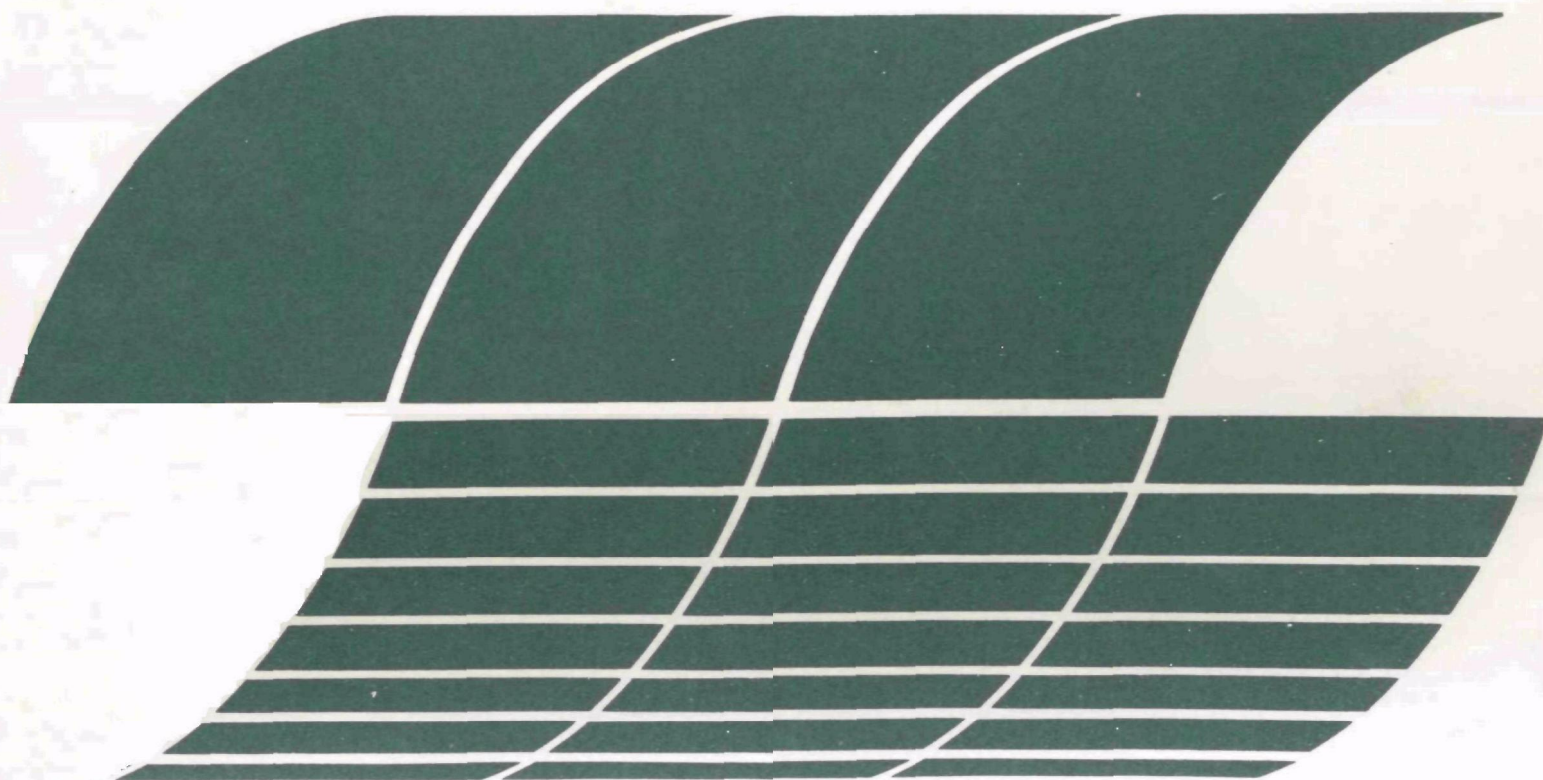


Research and Development



Oil Pollution Abstracts Vol. 6, No. 4 (October 1979 - December 1979)

Interagency
Energy/Environment
R&D Program
Report



RESEARCH REPORTING SERIES

Research reports of the Office of Research and Development, U.S. Environmental Protection Agency, have been grouped into nine series. These nine broad categories were established to facilitate further development and application of environmental technology. Elimination of traditional grouping was consciously planned to foster technology transfer and a maximum interface in related fields. The nine series are:

1. Environmental Health Effects Research
2. Environmental Protection Technology
3. Ecological Research
4. Environmental Monitoring
5. Socioeconomic Environmental Studies
6. Scientific and Technical Assessment Reports (STAR)
7. Interagency Energy-Environment Research and Development
8. "Special" Reports
9. Miscellaneous Reports

This report has been assigned to the INTERAGENCY ENERGY-ENVIRONMENT RESEARCH AND DEVELOPMENT series. Reports in this series result from the effort funded under the 17-agency Federal Energy/Environment Research and Development Program. These studies relate to EPA's mission to protect the public health and welfare from adverse effects of pollutants associated with energy systems. The goal of the Program is to assure the rapid development of domestic energy supplies in an environmentally-compatible manner by providing the necessary environmental data and control technology. Investigations include analyses of the transport of energy-related pollutants and their health and ecological effects; assessments of, and development of, control technologies for energy systems; and integrated assessments of a wide range of energy-related environmental issues.

EPA-600/7-80-053
March 1980

OIL POLLUTION ABSTRACTS

Volume 6, Number 4
(October 1979 - December 1979)

by

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This report has been reviewed by the Industrial Environmental Research Laboratory-Cincinnati, U.S. Environmental Protection Agency, and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the U.S. Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

FOREWORD

When energy and material resources are extracted, processed, converted, and used, the related pollutional impacts on our environment and even on our health often require that new and increasingly more efficient pollution control methods be used. The Industrial Environmental Research Laboratory - Cincinnati (IERL-Ci) assists in developing and demonstrating new and improved methodologies that will meet these needs both efficiently and economically.

This report is a product of the above efforts. It cites current literature, research, patents, and other materials relevant to the oil pollution abatement program and is published in an abstract format on a quarterly basis. As such, it serves as a basic reference document for all those interested in oil spill and oil pollution control. This project is part of the continuing program of the Oil and Hazardous Materials Spills Branch, IERL-Ci, to assess and mitigate the environmental impact of oil pollution.

David G. Stephan
Director
Industrial Environmental Research Laboratory
Cincinnati

ABSTRACT

OIL POLLUTION ABSTRACTS is a quarterly compilation of current literature and research project summaries. Comprehensive coverage of oil pollution and its prevention and control is provided, with emphasis on the aquatic environment. This issue contains bibliographic citations with abstracts of scientific and technical publications and patents covering the years 1976 to 1979. The literature and research entries are arranged in eight major categories comprised of thirty-seven specific sub-categories. A permuted Subject Keyword Index provides access to every entry, and author and patent indexes are included. This report is submitted in partial fulfillment of EPA Grant No. R-805803-01 by the Marine Science Institute, University of California, Santa Barbara, under the sponsorship of the US Environmental Protection Agency.

OIL POLLUTION ABSTRACTS - TOPICAL OUTLINE

- A. OIL POLLUTION DETECTION AND EVALUATION
 - 1. Detection and Monitoring
 - 2. Remote Sensing
 - 3. Sampling and Analysis
 - 4. Source Identification
- B. OIL POLLUTION PREVENTION AND CONTROL
 - 1. Containment
 - 2. Cleanup and Removal
 - 3. Environmental Restoration
 - 4. Personnel Training
 - 5. Contingency Planning and Spill Response
 - 6. Legal and Regulatory Aspects
 - 7. General Prevention and Control Measures
- C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION
 - 1. Biological Aspects
 - 2. Physical and Chemical Aspects
 - 3. Social and Economic Aspects
 - 4. Environmental Response and Recovery
 - 5. Baseline and Environmental Impact Studies
 - 6. Legal and Regulatory Aspects
 - 7. General Aspects
- D. FATE OF OIL IN THE ENVIRONMENT
 - 1. Biodegradation
 - 2. Physical and Chemical Processes
 - 3. Models, Simulations, and Predictions
 - 4. General Fate of Oil
- E. POLLUTION ASPECTS OF OIL EXPLORATION, DEVELOPMENT & PRODUCTION
 - 1. Biological Aspects
 - 2. Physical and Chemical Aspects
 - 3. Social and Economic Aspects
 - 4. Legal and Regulatory Aspects
 - 5. General Aspects

- F. POLLUTION ASPECTS OF OIL TRANSPORT, TRANSFER AND STORAGE
 - 1. Tankers and Ships
 - 2. Pipelines
 - 3. Loading and Offloading Facilities
 - 4. Storage Facilities
 - 5. Legal and Regulatory Aspects
 - 6. General Aspects
- G. PETROLEUM & PETROCHEMICAL INDUSTRY WASTE TREATMENT & DISPOSAL
 - 1. Waste Treatment and Disposal Methods
 - 2. Oil-Water Separation
 - 3. Waste Oil Reclamation and Reuse
 - 4. Legal and Regulatory Aspects
- H. MISCELLANEOUS

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ACKNOWLEDGEMENTS

The authors wish to thank the staff of the Marine Science Institute, the Sciences-Engineering Library, and the Interlibrary Loans office at the University of California, Santa Barbara, for their assistance during the research stages of this project.

INTRODUCTION

OIL POLLUTION ABSTRACTS is a quarterly abstracting series which reviews scientific and technical publications and research projects to inform readers about current developments in the field of oil pollution. This issue contains summaries of articles, reports, books, conference papers, patents, and other literature relating to oil pollution published after 1975 (Section I), and summaries of current research projects (Section II). Subject keyword, author, and patent indexes are included.

Subject coverage encompasses terrestrial and aquatic oil pollution, with emphasis on the marine environment. The citations in Section I are divided into nine major categories which are further divided into thirty-seven specific sub-categories (see p. v). A list of periodicals reviewed in preparing this series appears in Appendix A.

Section II presents titles of active or recently completed oil pollution research projects, summaries of project objectives, and information on the current status and publications resulting from the projects.

Each entry is provided with several descriptive terms selected from a controlled master list of approximately 400 keywords (see p. 147), and, if necessary, one or more specific free-language terms prefaced by an asterisk (*). The groups of keywords for each entry are alphabetically permuted by computer to form the Subject Keyword Index, permitting rapid access to every entry. OIL POLLUTION ABSTRACTS ordering information is included as Appendix B.

OIL POLLUTION ABSTRACTS*

Issues currently available, in press, or in preparation

*This series was formerly entitled:

OIL POLLUTION REPORTS (1978: Vol. 5, No. 2 to Vol. 5, No. 4)
OIL SPILL AND OIL POLLUTION REPORTS (1974 to 1978: Vol. 5, No. 1)

	<u>DATES COVERED</u>	<u>REPORT NUMBER</u>
1974	July 74 - Oct. 74	EPA-670/2-75-003
1975	Nov. 74 - Feb. 75	EPA-670/2-75-044
1975	Feb. 75 - Apr. 75	EPA-670/2-75-059
1975	May 75 - July 75	EPA-600/2-76-129
1975	Aug. 75 - Oct. 75	EPA-600/2-76-113
1976	Nov. 75 - Jan. 76	EPA-600/2-76-185
1976	Feb. 76 - Apr. 76	EPA-600/2-76-215
1976	May 76 - July 76	EPA-600/2-76-266
1976	Aug. 76 - Oct. 76	EPA-600/2-77-037
1977	Nov. 76 - Jan. 77	EPA-600/2-77-075
1977	Feb. 77 - Apr. 77	EPA-600/2-77-111
1977	May 77 - July 77	EPA-600/2-77-243
1977	Aug. 77 - Oct. 77	EPA-660/2-78-005
Vol. 5, No. 1	Nov. 77 - Jan. 78	EPA-600/2-78-071
Vol. 5, No. 2	Feb. 78 - May 78	EPA-600/7-78-160
Vol. 5, No. 3	June 78 - Sep. 78	EPA-600/7-78-218
Vol. 5, No. 4	Oct. 78 - Dec. 78	EPA-600/7-79-040
Vol. 6, No. 1	Jan. 79 - Mar. 79	EPA-600/7-79-160
Vol. 6, No. 2	Apr. 79 - June 79	Submitted 7/79
Vol. 6, No. 3	July 79 - Sep. 79	Submitted 10/79
Vol. 6, No. 4	Oct. 79 - Dec. 79	Submitted 1/80

For complete ordering information, please see Appendix B.

ABBREVIATIONS/ACRONYMS

atm	atmosphere	ml	milliliter
bbl	barrel	mm	millimeter
C	carbon	MS	mass spectrometry
°C	degrees Centigrade	N	nitrogen
cm	centimeter	N.A.	not available
COW	crude oil washing	nm	nautical mile
DWP	deepwater port	O	oxygen
dwt	dead weight ton	OCS	outer continental shelf
EIS	environmental impact statement	OPA	OIL POLLUTION ABSTRACTS
°F	degrees Fahrenheit	oz	ounce
ft	foot	PAH	polycyclic aromatic hydrocarbon
g	gram	pH	the negative log of the H ion concentration
gal	gallon	ppb	parts per billion
GC	gas chromatography	ppm	parts per million
GLC	gas-liquid chromatography	SBT	segregated ballast tank
gpd	gallons per day	sp.	species
gph	gallons per hour	TLC	thin-layer chromatography
gpm	gallons per minute	UK	United Kingdom
ha	hectare	US	United States
hr	hour	USSR	Union of Soviet Socialist Republics
in	inch	UV	ultraviolet
IR	infrared	VLCC	very large crude carrier
kg	kilogram	vs	versus
km	kilometer	WSF	water soluble fraction
kn	knot	wt	weight
L	liter	yr	year
lb	pound	μ	micron
LC	liquid chromatography	g	microgram
LD	lethal dose	%	percent
LNG	liquefied natural gas	/	per
LOT	load on top	~	approximately
LPG	liquefied petroleum gas	>	greater than
m	meter	<	less than
mg	milligram		
mi	mile		
min	minute		

ABBREVIATIONS/ACRONYMS (continued)

API	American Petroleum Institute
ASTM	American Society for Testing and Materials
BLM	Bureau of Land Management
CEQ	Council on Environmental Quality
DOE	Department of Energy
EPA	Environmental Protection Agency
ERDA	Energy Research and Development Administration
FAO	Food and Agricultural Organization
FEA	Federal Energy Administration
IMCO	International Maritime Consultative Organization
NASA	National Aeronautics and Space Administration
NBS	National Bureau of Standards
NOAA	National Oceanic and Atmospheric Administration
NTIS	National Technical Information Service
OHMSETT	Oil and Hazardous Materials Simulated Environmental Test Tank
SSIE	Smithsonian Science Information Exchange
UN	United Nations
UNEP	United Nations Environment Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
US	United States
USCG	United States Coast Guard
USDA	United States Department of Agriculture
USDI	United States Department of the Interior
USFWS	US Fish and Wildlife Service
USGS	United States Geological Survey
USN	United States Navy

SECTION I
REPORTS, PUBLICATIONS, AND PATENTS

A. OIL POLLUTION DETECTION AND EVALUATION

1. Detection and Monitoring

79D-1117

DETERMINATION OF MINERAL OILS IN SURFACE WATERS AND SEDIMENTS [in Italian]
Ariati, L., and P. Berbenni. 1979.
Inquinamento 21(2):31-33.

Sampling, Chemical analysis, Freshwater, Soils, Sediments

Oils in soils and sediments are detected by dehydrating the samples with anhydrous Na_2SO_4 and extracting with CCl_4 . Oils in water are extracted by ether, then dehydrated, the solvent distilled, and the residue weighed.

[from Chemical Abstracts 91(6):#44355c. 1979]

79D-1118

BIOMONITORING - A FINAL METHOD TO MEASURE POLLUTION ABATEMENT
Bender, E.S., and P.F. Robinson. 1978.
Report AD-A056 410. 3 p.

Detection, Monitoring, Bioindicators, Pollution prevention, *Biomonitoring
Summary not available.

[from Government Reports Announcements 78(21):83. #AD-A056 410. 1978]

79D-1119

APPARATUS FOR MEASURING THE OIL CONTENT IN WATER
Berthold, R., and H.D. Hess. 1978.
German patent application 2,751,738

Analytical techniques, Concentrations, Detection, Patent, *Oil-in-water,
*Fluorescence

The apparatus has a UV light source and two light conducting rods. The UV light passes through one of the rods into the sample where it excites fluorescence in oil present. A detector at the end of the second light conducting rod measures the UV fluorescence.

[from Chemical Abstracts 91(8):#59341u. 1979]

A. OIL POLLUTION DETECTION AND EVALUATION

79D-1120

A SYSTEMATIC APPROACH TO AQUATIC CONTAMINANT SURVEILLANCE

Craig, G.R., K. Suns, D.L. Wells, C.A. Curry, and T. Lagan. 1978.
Canada, Fisheries and Marine Service, Technical Report 818:54-64.

Monitoring, Wastewaters, Contamination, Toxicity, Analytical techniques,
Great Lakes

Contaminants and contaminant sources were identified in the Lower Great Lakes. Toxicity studies were then conducted either in the laboratory or by establishing an exposure facility at the point of contaminant discharge to the lake. [possibly oil pollution related]

[from Chemical Abstracts 91(1):#987f. 1979]

79D-1121

DETERMINATION OF AROMATIC HYDROCARBONS IN PPM BY UV SPECTROSCOPY

Dagga, F.A., and Z. Hameed. 1977.
Annual Research Report - Kuwait Institute of Scientific Research. p. 66-67.

Chemical analysis, Detection, Concentrations, Aromatic hydrocarbons,
Spectroscopy

"Aromatic hydrocarbons were detected in crude oil samples in heptane at 210-300 nm. The absorbances for the crude oils were measured and read directly from the chart. The technique was useful in determining oil pollutants in ppm concentrations."

[from Chemical Abstracts 91(6):#41632e. 1979]

79D-1122

DETERMINATION OF AROMATIC HYDROCARBONS IN SEAWATER

Dawson, R., and M. Ehrhardt. 1976.
Methods of Seawater Analysis. K. Grasshoff. Weinheim/New York, Verlag Chemie, 1976. p. 227-234.

Detection, Aromatic hydrocarbons, Seawater

Summary not available.[possibly oil pollution related]

[from Marine Pollution Research Titles 5(3):#415. 1978]

A. OIL POLLUTION DETECTION AND EVALUATION

79D-1123

ENERGY-RELATED POLLUTANTS IN THE ENVIRONMENT: USE OF SHORT-TERM TEST FOR MUTAGENICITY IN THE ISOLATION AND IDENTIFICATION OF BIOHAZARDS

Epler, J.L., F.W. Larimer, T.K. Rao, C.E. Nix, and T. Ho. 1978.

EHP, Environmental Health Perspectives, Vol. 27:45-50.

Contamination, Mutagens, Biological effects, Detection, Analytical techniques

"A review with 41 references." [possibly oil pollution related]

[from Chemical Abstracts 91(1):#848m. 1979]

79D-1124

THE SULLOM VOE MONITORING PROGRAMME

Foxton, P. 1979.

The Marine Environment of Sullom Voe and the Implications of Oil Development, Scottish Marine Biological Association, 18-19 April 1979. Oban, Scotland, Shetland Oil Terminal Advisory Group, 1979. p. 22. Abstract.

Hydrocarbons, Monitoring, Distribution, Concentrations, Marshes, Birds, Scotland, *Sullom Voe

Several elements of the monitoring program are discussed including regular surveys of hydrocarbon and heavy metal levels in marine sediments and animal tissues, surveys of benthic, rocky shore, soft shore, and salt marsh habitats, atmospheric monitoring, and a special project on ornithological monitoring. The procedure for results assessment and annual reporting is discussed.

79D-1125

DETERMINATION OF POLYCYCLIC AROMATIC HYDROCARBONS IN REFINERY EFFLUENTS
[in German]

German Society for Petroleum Sciences and Coal Chemistry. 1978.

Berichte-Deutsche Gesellschaft fuer Mineraloelwissenschaft und Kohlechemie 142. 50 p.

PAH, Hydrocarbons, Extraction, Detection, Wastewaters, Refineries, Analytical techniques, *Fluorometry

A thin-layer fluorometric method following extraction with cyclohexene is used for the title determination. An alternative UV method is described.

[from Chemical Abstracts 91(2):#9078t. 1979]

A. OIL POLLUTION DETECTION AND EVALUATION

79D-1126

APPARATUS FOR AUTOMATIC IR MEASUREMENT OF THE HYDROCARBON CONTENT OF AN AQUEOUS EFFLUENT

Guiges, F. 1977.

French Patent Application 2,351,404

Hydrocarbons, Detection, Wastewaters, *IR

An IR spectrophotometer is used to automatically measure the hydrocarbon content of an aqueous effluent. The hydrocarbons are separated using CCl_4 , an automatic reactor, and a chromatography column.

[from Chemical Abstracts 89(22):#185518d. 1978]

79D-1127

BIOINDICATORS OF POLLUTION. VOLUME 2. (A BIBLIOGRAPHY WITH ABSTRACTS)

Harrison, E.A. 1978.

Report NTIS/PS-78/1143, 248 p. Report for November 77 - October 78.

(Supersedes NTIS/PS-77/0993, NTIS/PS-76/0868, NTIS/PS-75/796, and NTIS/PS-75/024.)

Detection, Bioindicators, Microorganisms, Plants, Animals, Fish, Bibliographies

With 43 new abstracts to the previous edition this bibliography is concerned with the use of microorganisms, animals, plants, and fish for air and water pollution detection. [possibly oil pollution related]

[from Government Reports Announcements 78(25):77. #NTIS/PS-78/1143. 1978]

79D-1128

DETERMINATION OF OIL IN WATER BY ORGANIC CARBON ANALYSIS

Hearst, P.J. 1979.

Report TN-1541. 34 p.

Analytical techniques, Detection, Concentrations, *Oil-in-water

"A method was investigated for determination of oil in water by establishing the organic content attributable to the oil and by converting this value to the oil content. Samples were homogenized with the aid of an emulsifier, and a correction was made for the carbon contributed by the emulsifier."

A. OIL POLLUTION DETECTION AND EVALUATION

79D-1129

APPLICATION OF INFRARED SPECTROPHOTOMETRY TO THE DETERMINATION OF HYDROCARBONS AND PHENOLIC COMPOUNDS IN SEAWATER [English summary]

Kantin, R. 1977.

Tethys 7(4):413-418.

Detection, Concentrations, Hydrocarbons, Analytical techniques, Spectrometry, Seawater

Described are the principles and method of operation for the determination of hydrocarbons and phenolic compounds using infrared spectrophotometry. Preliminary results are presented for sea water concentrations around Marseilles.

79D-1130

THIN-LAYER FLUOROMETRIC DETERMINATION OF POLYCYCLIC AROMATIC HYDROCARBONS (PAH) IN VEHICLE EXHAUST CONDENSATE, MINERAL OIL PRODUCTS AND WASTE WATER

Kaschani, D.T., and R. Reiter. 1978.

Fresenius' Zeitschrift fuer Analytische Chemie 292 (2):141.

Analytical techniques, PAH, Wastewaters, *Fluorometry

The method allows detection of several PAHs with good repeatability.

[from Chemical Abstracts 89(24):199986s. 1978]

79D-1131

CHIRONOMUS LARVAE - INDICATOR ORGANISMS FOR PETROLEUM AND/OR HEAVY METAL POLLUTION. A LITERATURE SURVEY [in Swedish]

Landahl, C.C., and L. Lindestrom. 1978.

Institutet foer Vatten-och Luftvardsforskning B, B455. 10 p.

Bioindicators, Marine organisms, *Chironomus larvae

Observations in Swedish waters indicate that the larvae of Chironomidae can be used as indicators of pollution by the title compounds.

[from Chemical Abstracts 89(26):#220537h. 1978]

79D-1132

CHRONOLOGY OF EVENTS AND OIL SLICKS FROM THE ARGO MERCHANT

Mattson, J.S. 1978.

In the Wake of the Argo Merchant. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 15-18.

Oil slicks, Monitoring, Behavior, Movement, Argo Merchant spill

A. OIL POLLUTION DETECTION AND EVALUATION

The operational and scientific events associated with the Argo Merchant oil spill are presented in the context of the condition of the vessel and the location of the spilled oil. A series of maps indicates the movement of the slick from 17 December 1976 to 25 December 1976.

79D-1133

DETERMINATION OF VOLATILE CONSTITUENTS CONTAINED IN SOILS, SPECIFICALLY PETROLEUM HYDROCARBONS

Moeller, F., and H.G. Paesler. 1978.

East German Patent 132,211

Hydrocarbons, Analytical techniques, Soil, Equipment, Design-engineering, Patent, *Volatilization

The title determination involves heating samples of undisturbed soil to 60°, passing purified air through the samples to remove pollutants, and detecting hydrocarbons in the air by an indicator method.

[from Chemical Abstracts 91(3):#19032n. 1979]

79D-1134

APPARATUS FOR DETERMINING VOLATILE CONSTITUENTS CONTAINED IN SOILS, SPECIFICALLY PETROLEUM HYDROCARBONS

Moeller, F., H.G. Paesler, W. Hartwig, and G. Wermke. 1978.

East German Patent 132,212

Hydrocarbons, Analytical techniques, Soil, Equipment, Design-engineering, Patent, Detection

The title apparatus is described and a scheme for its construction is presented. The sample is heated in the apparatus and the volatiles are removed by an air current.

[from Chemical Abstracts 91(3):#19031m. 1979]

79D-1135

DETERMINATION OF POLYCYCLIC AROMATIC HYDROCARBONS IN AQUEOUS SAMPLES BY REVERSED-PHASE PERFORMANCE LIQUID CHROMATOGRAPHY

Ogan, K., E. Katz, and W. Slavin. 1979.

Analytical Chemistry 51(8):1315-1320.

Sampling, Chemical analysis, PAH, Chromatography, Detection, Concentrations,

An analytical method for detecting 16 PAHs in aquatic samples is described. These PAH types are of special environmental concern because 15 of the 16 are on the EPA Priority Pollutant list. In several cases the method is sensitive to levels of <10 nanograms/L in the original samples. [possibly oil pollution related]

[from Chemical Abstracts 91(6):#44322q. 1979]

A. OIL POLLUTION DETECTION AND EVALUATION

79D-1136

DENSITOMETER FOR DETERMINING THE OIL CONTENT OF LIQUIDS

Okada, M., T. Sato, T. Okuno, and M. Shima. 1978.

German Patent Application 2,715,118

Sampling, Detection, Waste oil, Concentrations

Oil is detected in the presence of suspended solids by subjecting the flowing sample to two intensities of ultrasonic emulsification and determining the turbidity optically. The turbidity difference resulting from the different emulsification intensities is a measure of the oil concentration.

[from Chemical Abstracts 89(21):#181583y. 1978]

79D-1137

DETERMINATION OF OIL CONCENTRATION IN WASTEWATERS BY OPTICAL METHOD

Otsuka, H., and S. Arisaka. 1978.

Japanese Patent Application 78 87,793

Wastewaters, Detection, Concentrations, Tankers, Patent, *Optical method

Oil-containing wastewater is homogenized by air and the oil content determined optically by comparing with a standard mixture. The method may be applied to bilge waters.

[from Chemical Abstracts 89(26):#220529g. 1978]

79D-1138

POLLUTION MONITORING--NEEDS AND APPROACHES

Ramanathan, N.L. 1978.

Electronics - Information and Planning 5(7):541-544.

Monitoring, Wastewater treatment, Rivers, Equipment, Design-engineering, Chemical analysis, India

Discussed are existing pollution monitoring systems, alternative approaches, the use of monitoring data, the need for design flexibility of equipment, and marketing potential for pollution monitoring systems in India.

[possibly oil pollution related]

A. OIL POLLUTION DETECTION AND EVALUATION

79D-1139

SENSITIZED FLUORESCENCE FOR THE DETECTION OF POLYCYCLIC AROMATIC HYDROCARBONS

Smith, E.M., and L. Levins. 1978.

Report EPA/600/7-78/182, Contract EPA-68-02-2150. 33 p.

Detection, PAH, Analytical techniques, *Fluorescence

This report describes a fluorescent spot test devised for PAH detection based on the sensitization of the inherent fluorescence of PAH compounds. The method has been shown to be specific with minimum interference from other compounds, and can be used to estimate the general levels (factors of 10) of PAHs in samples to aid in decisions for more specific analysis. [possibly oil pollution related]

[from Government Reports Announcements 79(2):76. #PB-287 181. 1979]

79D-1140

OIL POLLUTION DETECTION AND SENSING. VOLUME 2 (A BIBLIOGRAPHY WITH ABSTRACTS)

Smith, M.F. 1978.

Report NTIS/PS-78/1076. 140 p. Report for 1976-Aug. 1978. (Supersedes NTIS/PS-77/0934, NTIS/PS-76/0701, and NTIS/PS-75/595.)

Sampling, Remote sensing, Detection, Analytical techniques, Oil spills, Wastewaters, Bibliographies

"Citations of research on sampling, detection, and chemical analysis of oil in water are presented. Studies on remote sensing principally using radar, ocean wave damping, and infrared detection are included. The classification, pattern recognition, luminescence, gas chromatography, and neutron activation analysis of oils are reported in these abstracts. The majority of these citations concern oil spills, but studies on oil wastes, industrial wastes, bilge water, and sewage are also covered. (This updated bibliography contains 135 abstracts, 33 of which are new entries to the previous edition.)"

[from Government Reports Announcements 78(25):176. #NTIS/PS-78/1076. 1978]

2. Remote Sensing

79D-1141

REMOTE SENSING APPLIED TO ENVIRONMENTAL POLLUTION DETECTION AND MANAGEMENT (A BIBLIOGRAPHY WITH ABSTRACTS)

Hundemann, A.S. 1978.

Report NTIS/PS-78/0789. 163 p. Report for 1964-July 1978. (Supersedes NTIS/PS-76/0674, and updates NTIS/PS-76/0500.)

A. OIL POLLUTION DETECTION AND EVALUATION

Remote sensing, Bibliographies, Oil spills, Detection, Dispersion, Fate, Estuaries

Application of remote sensing to water and other types of pollution is discussed. Topic areas include characteristics of pollutant transport, remote sensing of estuarine problems, and monitoring of oil spills. This updated bibliography contains 156 abstracts, 23 of which are new.

[from Government Reports Announcements 78(20):203. #NTIS/PS-78/0789. 1978]

79D-1142

REMOTE SENSING FOR THE CONTROL OF MARINE POLLUTION. PRELIMINARY INVENTORY OF AVAILABLE TECHNOLOGIES

Massin, J-M. 1978.

Report NATO/CCMS-78. 343 p.

Remote sensing, Hydrocarbons, Oil spills, Detection, Monitoring, Equipment, Analytical techniques

This manual is an inventory of available techniques, instrumentation and research centers in the field of remote sensing of the marine environment for detection of pollution. Emphasis is placed on oil spills and hydrocarbon pollution and its detection. Satellite technology is not included in this report.

[from Government Reports Announcements 79(1):164. #PB-287 317. 1979]

3. Sampling and Analysis

79D-1143

HYDROCARBON CHEMISTRY OF THE WATER COLUMN OF GEORGES BANK AND NANTUCKET SHOALS, FEBRUARY-NOVEMBER 1977

Boem, P.D., G. Perry, and D. Fiest. 1978.

In the Wake of the Argo Merchant. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 58-64.

Analytical techniques, Chemical analysis, Hydrocarbons, Chromatography, Georges Bank, Argo Merchant spill

Described in the title article are analysis procedures carried out on large volume water samples (50-90 L) collected in mid-February, May, August, and September of 1977 at 12 stations in the Georges Bank/Nantucket Shoals area. Near surface and bottom samples were filtered on-board and the filtrate extracted by a countercurrent liquid-liquid extractor. Hydrocarbon compositions were determined by glass capillary gas chromatography and combined GC/MS. Results are discussed.

A. OIL POLLUTION DETECTION AND EVALUATION

79D-1144

CHEMICAL ANALYSIS OF DISPERSED OIL IN THE WATER COLUMN

Brown, C.W., P.F. Lynch, and M. Ahmadjian. 1978.

Chemical Dispersants for the Control of Oil Spills. L.T. McCarthy, Jr., G.P. Lindblom, and H.F. Walters (eds.). Philadelphia, American Society for Testing and Materials, 1978. p. 188-202. ASTM Special Technical Publication 659.

Chemical analysis, Hydrocarbons, Dispersion, Dispersants, Concentrations
Water column samples from treated and untreated experimental spills into 6 m-deep test tanks were analyzed for hydrocarbons. The concentration of oil in the water just beneath the surface was initially 27 times greater when a dispersant was used; however, during a 3-day experiment, the amount of oil in the water column decreased significantly in both the treated and untreated cases. When a dispersant was used, the maximum hydrocarbon concentration in the water column gradually moved toward the bottom of the tank.

79D-1145

OIL DROPLET MEASUREMENTS MADE IN THE WAKE OF THE ARGO MERCHANT

Carnillon, P. 1978.

In the Wake of the Argo Merchant. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January, 1978. University of Rhode Island, Center for Ocean Management Studies. 1978. p. 43-47.

Sampling, Physical aspects, Analytical techniques, Argo Merchant spill

The title article discusses the methods and results of experiments carried out to determine the size of entrained oil particles following the Argo Merchant spill. Three general droplet structures are identified and described.

79D-1146

DISTINGUISHING BIOGENIC HYDROCARBONS FROM THOSE OF PETROLEUM ORIGIN IN WATER AND SOLID SAMPLES [in German]

Erdmann, W., W. Giger, H. Hellmann, C. De Lorent, et al. 1978.

Hydrochemische und Hydrogeologische Mitteilungen 3 (Untersuchung Beurteilung Wassers Nutzungszyklus):113-145.

Sampling, Chemical analysis, Detection, Hydrocarbons, Biogenic hydrocarbons

"Methods for detecting hydrocarbons in water and solids, criteria for distinguishing biogenic from petroleum hydrocarbons, and their use in characterizing various samples (groundwater, wellwater, oil spills, suspended matter, street dust, clarifier sludge, recent sediments) are described."

[from Chemical Abstracts 91(6):#44313n. 1979]

A. OIL POLLUTION DETECTION AND EVALUATION

79D-1147

MANUAL FOR THE DIFFERENTIATION OF BIOGENIC AND PETROLEUM HYDROCARBONS
[in German]

Erdmann, W., W. Giger, H. Hellmann, W. Koelle, et al. 1977.

Berichte - Deutsche Gesellschaft fuer Mineraloelwissenschaft und Kohlen-
chemie, Vol. 150:44 p.

Wastewaters, Sediments, Analytical techniques, Hydrocarbons, Biogenic
hydrocarbons, Manuals

"Criteria and analytical methods for distinguishing biogenic hydrocarbons
from petroleum hydrocarbons in natural and wastewaters, oily deposits,
sediments, dust, etc. are described."

[from Chemical Abstracts 89(22):#181981b. 1978]

79D-1148

ENRICHMENT AND ANALYSIS OF POLYCYCLIC AROMATIC HYDROCARBONS IN WATER
[in German]

Faltusz, E. 1979.

Fresenius' Zeitschrift fuer Analytische Chemie 294(5):385-390.

PAH, Analytical techniques, Chromatography

PAHs are enriched by precipitating $Mg(OH)_2$ in the sample, centrifuging,
dissolving the solids in NH_4Cl , extracting the organic compounds with
cyclohexane, and analyzing by GC using electron capture detection. The
method is compared with rapid liquid extraction.

[from Chemical Abstracts 91(2):9280c. 1979]

79D-1149

PETROLEUM

Fraser, J.M., F.C. Truse11, N.H. Fick, N.P.T. Bradley, et al. 1979.

Analytical Chemistry 51(5):211R.

Petroleum products, Crude oil, Chemical analysis, Source identification,
Analytical techniques

A series of articles is presented, reviewing the application of analytical
techniques in the petroleum industry. Included are discussions of crude
oil analysis, "fingerprinting," fuels, lubricants, oils and greases, hydro-
carbons and metals in oils. Various works on methods of detection and
analysis are detailed.

A. OIL POLLUTION DETECTION AND EVALUATION

79D-1150

COMPARISON OF THIN-LAYER AND COLUMN CHROMATOGRAPHY FOR SEPARATION OF SEDIMENTARY HYDROCARBONS

Gearing, J.N., P.J. Gearing, T.F. Lytle, and J.S. Lytle. 1978.
Analytical Chemistry 50(13):1833-1836.

Chromatography, Sediments, Hydrocarbons, Analytical techniques, *TLC,
*Column chromatography

The title comparison suggests that column and thin-layer chromatography may be used interchangeably for purification of sedimentary hydrocarbon extracts.

79D-1151

CHARACTERIZATION OF PETROLEUM OILS BY HIGH SPEED GEL PERMEATION CHROMATOGRAPHY WITH ULTRA-VIOLET SPECTROMETRIC DETECTOR [in Japanese]

Higashi, K., and K. Hagiwara. 1978.
Osaka Kogyo Gijutsu Shikensho Kiho 29(3):249-255.

Sampling, Analytical techniques, Chromatography, Crude oil, Petroleum products

Oil samples were diluted with THF and analyzed by the title method with THF as eluent. The UV absorption of the eluate was recorded at 240-400 nm, and the chromatograms for several crude oils and petroleum products were evaluated. The oils could be classified into two groups by measuring the chromatograms at 254 nm, and each product could be discriminated by measuring retention time by gel or gas chromatography. Crude oils with similar profiles at 254 nm can be differentiated by measuring at 280 nm.

[from Chemical Abstracts 91(4):#23493f. 1979]

79D-1152

CHARACTERIZATION OF TAR BALLS BY GAS CHROMATOGRAPHY [in Japanese]

Higashi, K., C. Igarashi, and K. Hagiwara. 1978.
Osaka Kogyo Gijutsu Shikensho Kiho 29(4):360-363.

Sampling, Tar, Japan, Chromatography, Analytical techniques, Source identification

Tar balls collected from the ocean around Japan were characterized by gas chromatography with a Silicone SE-30 3%-Chromosorb W column. The chromatograms were compared with those of 8 crude oils. Petroleum was identified by the characteristic n-paraffins.

[from Chemical Abstracts 91(4):#27007y. 1979]

A. OIL POLLUTION DETECTION AND EVALUATION

79D-1153

DISCRIMINATION OF SPILLED OILS BY HIGH SPEED GEL PERMEATION CHROMATOGRAPHY WITH AN ULTRAVIOLET SPECTROMETRIC DETECTOR

Higashi, K., and K. Hagiwara. 1978.

Fresenius' Zeitschrift fuer Analytische Chemie 292(2):108-112.

Sampling, Chemical analysis, Chromatography, Spectrometry, Weathering

The title process is described. The discrimination capability was enhanced by comparing profiles of the chromatograms at several detection wavelengths. The change of profiles with weathering of the oils was small.

[from Chemical Abstracts 89(24):#199933x. 1978]

79D-1154

A COMPARISON OF ARGO MERCHANT OIL AND SEDIMENT HYDROCARBONS FROM NANTUCKET SHOALS

Hoffman, E.J., and J.G. Quinn. 1978.

In the Wake of the Argo Merchant. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 80-88.

Analytical techniques, Hydrocarbons, Sediments, Chromatography, Movement, Argo Merchant spill

Surface sediment samples collected from the Argo Merchant wreck site were analyzed for hydrocarbon content by gas chromatography. Findings indicated that significant hydrocarbon contamination extended at most 3-4 km from the wreck in a SE direction. Analysis of sediment grab subsections revealed no clear trend in hydrocarbon contamination as a function of depth.

79D-1155

WATER SOLUBLE FRACTION OF ARGO MERCHANT CARGO

Jadamec, J.R. 1978.

In the Wake of the Argo Merchant. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies. 1978. p. 53-57.

WSF, Concentrations, Analytical techniques, Sampling, Argo Merchant spill, *Fluorescence spectroscopy

A series of water column samples was collected adjacent to the wreck site to determine the extent and level of hydrocarbons entering the environment. Fluorescence spectroscopic analysis of the samples indicated that a physical-chemical fractionation occurred only with the lighter aromatic compounds. Concentrations decreased from a high of 340 ppb in late December 1976 to less than 20 ppb in February 1977.

A. OIL POLLUTION DETECTION AND EVALUATION

79D-1156

METHODS FOR ANALYSIS OF FOUL-SMELLING COMPONENTS AND HEAVY METALS IN FISH AND MOLLUSKS. I. RECOVERY OF HYDROCARBONS BY FREEZE DRYING

Kasano, K., M. Kusaka, and K. Yamashita. 1978.

A & R 16(9):385-390.

Chemical analysis, Aromatic hydrocarbons, Fish, Mollusks, Contamination, *Freeze drying

Foul-smelling hydrocarbons and other contaminants were recovered from homogenized tissue samples by freeze drying. The method used and the results obtained are detailed. Among the hydrocarbons isolated were tetra-, penta-, and hexadecane.

[from Chemical Abstracts 91(7):#54685z. 1979]

79D-1157

OIL POLLUTION IN KAOHSIUNG HARBOR [English summary]

Lain, J-L., C-L. Chen, and C-Y. Chung. 1977.

Journal of the Fisheries Society of Taiwan 5(2):73-84.

Hydrocarbons, Chemical analysis, Source identification, Contamination, Marine organisms, Harbors, *Taiwan

The state of oil pollution and water quality in Kaohsiung Harbor, Taiwan were studied. Results indicated that mineral oil is the major source of waste oil in the harbor, that shellfish contained high levels of hydrocarbons, and that 75% of the oil drifting on the water surface could be recovered by fractional distillation over 500° C.

79D-1158

CHARACTERIZATION OF CONFINED DISPOSAL AREA INFLUENT AND EFFLUENT PARTICULATE AND PETROLEUM FRACTIONS

Lu, J.C.S., and K.Y. Chen. 1978.

Report WES-TR-D-78-16, Contract DACW 39-76-C-0038. 187 p. Final Report.

Chemical analysis, Analytical techniques, Disposal, Hydrocarbons, Wastewaters

A detailed analysis of contaminants in influents and effluents from two confined dredged disposal areas near Mobile, Alabama and Detroit, Michigan is presented. Sample collection and testing procedures are detailed. Samples were analyzed for metals, nutrients, total carbon, organic carbon, chlorinated hydrocarbons, oil and grease and solids contents.

[from Government Reports Announcements 78(21):196. #AD-A056 371. 1978]

A. OIL POLLUTION DETECTION AND EVALUATION

79D-1159

HYDROCARBON PATTERNS IN SOME MARINE BIOTA AND SEDIMENTS FOLLOWING THE ARGO MERCHANT SPILL

MacLeod, W.D., Jr., M.Y. Uyeda, L.C. Thomas, and D.W. Brown. 1978. In the Wake of the Argo Merchant. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 72-79.

Analytical techniques, Hydrocarbons, Sampling, Marine organisms, Sediments, Fish, Argo Merchant spill

Over 60 samples of marine biota or sediments collected after the Argo Merchant spill were analyzed by gas capillary chromatography, and GC patterns from the samples were compared to the corresponding patterns from the Argo Merchant cargo. Findings of analyses from cod, flounder, sediments, and other biota are presented and discussed.

79D-1160

THEORY OF AUTOMATIC ANALYTICAL METHODS. 15. OIL FRACTIONS [in Japanese] Nishikawa, S. 1976.

Suishitsu Odaku no Jido Bunseki. T. Araki and A. Takahashi (eds.). Kyoto, Japan, Kagaku Dojin, 1976. p. 155-168.

Hydrocarbons, Analytical techniques, WSF

"A review with 5 references."

[from Chemical Abstracts 89(24):#203770m. 1978]

79D-1161

SOIL POLLUTION: SITUATION OF SOME AGRICULTURAL AND SEABOARD URBAN ZONES IN THE PROVINCE OF ROME [in Italian]

Sanna, M., N. Pelosi, C. Carocci, and S. De Vincenzi. 1979. Unione Ital. Lab. Prov. 5(2):260-270.

Soil, Hydrocarbons, Beaches, Surfactants, Chemical analysis

The contents of heavy metals, mineral oil, and some chemicals are given for several agricultural soils around Rome. Data are also given on pollution of beach sand by oils and by anionic surfactants.

[from Chemical Abstracts 91(3):#14875e. 1979]

A. OIL POLLUTION DETECTION AND EVALUATION

79D-1162

ANALYSIS OF RARITAN BAY BOTTOM WATERS FOR POLYNUCLEAR AROMATIC HYDRO-CARBONS

Stainken, D., and U. Frank. 1979.

Bulletin of Environmental Contamination and Toxicology 22(4/5):480-487.

PAH, Analytical techniques, Spectroscopy, Bays, New York

Analyses of bottom water samples were performed using synchronous excitation (SE) of fluorescence spectroscopy. PAH content was confirmed by high pressure liquid chromatography and infrared spectroscopy following sample extraction with freon. The SE method was found to be superior to single wavelength excitation fluorescence methods because it yields spectra that are resolved according to the number of aromatic rings. The low concentrations and infrequent presence of PAHs in the bottom waters sampled suggest that much of the pollution in the bay is a surface phenomenon.

79D-1163

ANION ACTIVE SURFACTANTS. II. CONTAMINATION OF THE INLAND SEA OF JAPAN BY ANIONIC SURFACTANTS [in Japanese]

Yoshida, H., and R. Takeshita. 1978.

Eisei Kagaku 24(2):78-82.

Chemical analysis, Concentrations, Contamination, Surfactants, Biological effects, Fish, Japan

The methylene blue method was used in showing high concentrations of anionic surfactants in the eastern Inland Sea six months after Amberlite XAD-2 columns were used to disperse an oil spill in the area. The effect of the surfactants on fish was not great.

[from Chemical Abstracts 89(24):#203844p. 1978]

79D-1164

DETERMINATION OF THE CHEMICAL COMPOSITION OF PETROLEUM OILS BY CONTINUOUS TWO-STAGE LIQUID CHROMATOGRAPHIC AND MASS SPECTROMETRIC METHODS [in Russian]

Zakupra, V.A., V. Kozack, E.V. Kolosova, and N.I. Vykhrestyuk. 1979.

Khimiya i Tekhnologiya Topliv i Masel 3:58-63.

Analytical techniques, Petroleum products, Source identification

The title analytical methods were used to determine the composition of ASVI and DSII oils. [possibly oil pollution related]

[from Chemical Abstracts 91(2):#7206j. 1979]

A. OIL POLLUTION DETECTION AND EVALUATION

4. Source Identification

79D-1165

WHERE THE ARGO MERCHANT OIL DIDN'T GO

Brown, C.W., P.F. Lynch, and M. Ahmadjian. 1978.

In the Wake of the Argo Merchant. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 65-71.

Source identification, Tar, Beaches, Argo Merchant spill, Massachusetts, Rhode Island

Weathered tar balls found on Massachusetts and Rhode Island beaches were analyzed in an attempt to determine their origin. The probabilities that the tar balls came from the same source, that they came from the Argo Merchant, that they came from the lost tanker Grand Zenith, or that they came from some other source have been determined and are discussed in the report.

79D-1166

CLASSIFICATION OF CRUDE OIL GAS CHROMATOGRAMS BY PATTERN RECOGNITION TECHNIQUES

Clark, H.A., and P.C. Jurs. 1979.

Analytical Chemistry 51(6):616.

Source identification, Crude oil, Chemical analysis, Chromatography

Pattern recognition methods are described by which crude oils can be classified according to their chromatograms. Four oils were represented by gas chromatograms taken before and after weathering. "Predictive abilities as high as 100% were obtained for some of the partitions of the data set."

79D-1167

THE CASE OF THE TAINTED MULLET

Connell, D.W. 1979.

Sea Frontiers 25(2):115-119.

Source identification, Contamination, Biological effects, Fish, Australia

A chronology of events leading to the discovery of the source of a "petroleum taint" in the sea mullet, Mugil cephalus, fishery in South Queensland, Australia is presented. In late 1968 the Fish Board initiated an investigation which eventually tracked down the source to a sewer discharge located on the Brisbane river. The incident resulted in new and stricter standards for sewer plant effluent.

A. OIL POLLUTION DETECTION AND EVALUATION

79D-1168

THE ORIGIN AND FATE OF HYDROCARBONS IN SULLOM VOE

Davies, J.M., R. Johnston, and K. Whittle. 1979.

The Marine Environment of Sullom Voe and the Implications of Oil Developments, Scottish Marine Biological Association, 18-19 April 1979. Oban, Scotland, Shetland Oil Environmental Advisory Group, 1979. p.11. Abstract.

Source identification, Hydrocarbons, Oil terminals, Distribution, Sediments, Fate, Scotland, *Sullom Voe

Petroleum hydrocarbons in the Sullom Voe environment are attributed to accidental and operational inputs. Two methods are used to estimate accidental inputs, one by analogy with world-wide averages and the other by analogy with other oil terminals. Petroleum hydrocarbon inputs are placed in the context of the natural hydrocarbons present, and their distribution and fate in the water column and sediments are considered.

79D-1169

THE ANALYSIS OF HYDROCARBONS AS INDICATORS OF POLLUTION

Douglas, A.G. 1979.

The Marine Environment of Sullom Voe and the Implications of Oil Developments, Scottish Marine Biological Association, 18, 19 April 1979. Oban, Scotland, Shetland Oil Terminal Environmental Advisory Group, 1979. p. 10. Abstract.

Source identification, Analytical techniques, GC/MS, Hydrocarbons, Sediments, Weathering, Detection

The title paper outlines methods used for analyzing polluted sediments for a number of n-alkanes, with the identification of oil spills being a major objective. For the purposes of computerized GC/MS analysis, the relative stereochemistry of some of the carbon atoms in steranes and triteranes plays an important part in the recognition of "matured" or crude oil alkanes.

79D-1170

AN ATLAS OF GAS CHROMATOGRAMS OF OILS USING DUAL FLAME-IONIZATION AND NITROGEN PHOSPHORUS DETECTORS

Frame, G.M., D.C. Carmody, and G.A. Flanigan. 1978.

Report CGR/DC-3/78, USCG-D-19-78. 57 p.

Source identification, Analytical techniques, Detection, Chromatography, Manuals

The title report details experimental techniques for using a thermionic nitrogen phosphorus detector (NPD) for gas chromatographic (GC) "fingerprinting" of petroleum and synthetic oils. An alumina column chromatography method is described and NPD detector GC curves of over 70 petroleum

A. OIL POLLUTION DETECTION AND EVALUATION

crudes and distillates run on a 50-foot Dexsil-300 SCOT column are re-produced to form a reference atlas.

[from Government Reports Announcements 78(18):209. #AD-A054 966. 1978]

79D-1171

THE USE OF CARBON AND SULFUR ISOTOPIC RATIOS AND TOTAL SULFUR CONTENT FOR IDENTIFYING THE ORIGIN OF BEACH TARS IN SANTA MONICA BAY, CALIFORNIA
Hartman, B.A. 1978.

Report USC/SG/TD-02-78, NOAA 78082804, Grant NOAA-04-6-158-4418. 113 p.
Master's thesis.

Source identification, Tar, Analytical techniques, Natural seepage, Bays, Weathering, California, *Santa Monica Bay

Carbon and sulfur isotopic ratios and total sulfur content are evaluated for use as chemical fingerprints for highly weathered petroleum. Analysis is confined strictly to the asphaltene fraction. Results suggest that 51% of the tars in Santa Monica Bay are from natural seeps at Coal Oil Point, 31% are from natural seepage in Santa Monica Bay, and 18% are from unknown sources.

[from Government Reports Announcements 79(1):85. #PB-286 780. 1979]

79D-1172

FINGERPRINTING OF CRUDE OIL

Jones, K. 1978.

Int. Environ. Saf., Dec:26-27.

Source identification, Fuel oil, Crude oil, Analytical techniques

The types and limitations of methods used for identifying fuel oil or petroleum spilled at sea are discussed.

[from Chemical Abstracts 91(4):#23504k. 1979]

79D-1173

DETERMINATION OF TOTAL ORGANIC NITROGEN AND ORGANOMETALLIC NICKEL IN OIL, SEDIMENTS AND MARINE PRODUCTS

Nakamura, A., and T. Kashimoto. 1979.

Bulletin of Environmental Contamination and Toxicology 22(3):345-349.

Source identification, Analytical techniques, Contamination, *Ni/N index

A digital nitrogen analyzer using a chemiluminescence detection method was used for total organic nitrogen determination in the title compounds. Organic nickel was measured with respect to porphyrins by flameless atomic absorption spectrometry, and the relation between nitrogen content and organometallic nickel was evaluated. The Ni/N indices may be used to clarify fingerprints of oil obtained from contaminated samples.

A. OIL POLLUTION DETECTION AND EVALUATION

79D-1174

A STUDY ON THE IDENTIFICATION METHODS FOR WATERBORNE OIL. PART I. THE PREVIOUS MANAGEMENT OF WATERBORNE OIL AND THE CHANGE OF ITS GENERAL PROPERTIES [in Japanese]

Ogawa, T. 1977.

Kaijo Hoan Daigakko Kenky Hokoku, Dai-2-Bu23(1-2, Sect. 2):55-70.

Source identification, Analytical techniques, Oil spills

Measurements of various elements were used for identification of oil spills on water.

[from Chemical Abstracts 89(22):#185658z. 1978]

B. OIL POLLUTION PREVENTION AND CONTROL

1. Containment

79D-1175

GELATINIZATION AGENT

Ajinomoto Co., Inc. 1979.

Kawasaki, Japan, Ajinomoto Co., Inc., 1979. 18 p.

Spill containment, Pollution control, Spill response, Japan, *Gelatinization

This booklet reviews oil spill accidents and preventive measures taken in Japan, from 1972 to 1977, and presents a description of the properties and application methods for a new gelatinization agent for oil spill treatment. The gelatinization agent is biodegradable, has low toxicity, and is considered environmentally acceptable. Information is available from Central Research Laboratories, Ajinomoto Co., Inc., Suzuki-cho, Kawasaki-ku, Kawasaki 210, Japan.

79D-1176

METHODS OF OIL SPILL CONTROL FROM PORT WATER SURFACE [in Polish]

Badkowski, A.I. 1978.

Gospodarka Wodna 38(6):178-181.

Spill containment, Oil slicks, Spreading, Equipment

Methods presently used for the control of oil spill spreading are reviewed.

[from Chemical Abstracts 89(24):#203930p. 1978]

79D-1177

BOOM CONFIGURATION TESTS FOR CALM WATER, MEDIUM CURRENT OIL SPILL DIVERSION

Breslin, M.K. 1979.

Report EPA/600/2-78/186, Contract EPA-68-03-0490. 49 p.

Spill containment, Booms, Performance testing, Equipment, Design-engineering, EPA, *OHMSETT facility

The title test program was designed to determine the effects of boom angle, length and rigging configuration on diversion of oil floating on moving streams. Boom performance was photographically recorded. Results were evaluated in terms of the percentage of oil lost beneath the boom and away from the rear of the boom. A "nozzle-shaped" boom configuration achieved the best diversion at tow speeds above 1.0 m/s.

[from Government Reports Announcements 79(5):166. #PB-287 754. 1979]

B. OIL POLLUTION PREVENTION AND CONTROL

79D-1178

EVALUATION OF OIL SPILL BARRIERS AND DEPLOYMENT TECHNIQUES FOR THE ST. CLAIR-DETROIT RIVER SYSTEM

Environmental Protection Service, Canada. 1976.

Report EPS-4-EC-76-4. 29 p.

Product information, Equipment, Booms, Spill containment, Performance testing, Rivers, Canada, US, Contingency planning

As part of "Operation Preparedness," a joint US-Canadian marine Pollution Contingency Plan, twelve commercially available barriers were evaluated in river conditions, with currents ranging from 1.3 to 3.2 km/hr (0.8 to 1.8 knots). Barriers by Acme Products, American Marine Co., Bennett Pollution Controls, B.F. Goodrich Co., Hurum Marine, and Slickbar were tested, and the results are presented.

79D-1179

HYDRODYNAMICS OF DIVERSIONARY BOOMS

McCracken, W.E. 1978.

Report EPA/600/2-78/075, Contract EPA-68-03-0490. 57 p. Final report.

Spill containment, Equipment, Booms, Design-engineering, Simulations

A method is suggested for overcoming the failure of booms to contain oil in currents above 0.5 m/s. This involves use of the boom in a diversionary mode to move the oil into regions of low currents where containment and removal can be effected. Three-dimensional flow fields were examined visually, using dye and oil droplets with a towed underwater video system. Turbulence intensity was simultaneously photographed and measured with a hot-film anemometer.

[from Government Reports Announcements 78(18):289. #PB-281 282. 1978]

79D-1180

REUSABLE OIL ABSORBENT BILGE AND FUEL TANK OPENING PADS

Pedone, V.S.

US Patent 4,031,839

Sorbents, Absorption, Bilges, Pollution prevention, Equipment, Patent

The pads are designed for removing and absorbing oil from the bilge area and fuel tank filter area of a boat. They are composed of a synthetic woven material that absorbs the oil and retains it without leakage. The pads are formed into a ring which fits around the opening to prevent and absorb spillage during fuel transfer.

[from ERDA Energy Research Abstracts 2(21):5283. #50911. 1977]

B. OIL POLLUTION PREVENTION AND CONTROL

79D-1181

V-SHAPED OIL CONTAINMENT BOOM

Steen, J.W., J. Bennett, and I. McAllister. 1979.

US Patent 4,146,344

Spill containment, Booms, Equipment, Design-engineering, Patent

The boom has front and rear wall sections joined along their lower edges. It is provided with ballast and floats. A method for containing spills in ice-infested water is provided.

[from Petroleum Abstracts 19(28):#265,129. 1979]

4,146,344

V-SHAPED OIL CONTAINMENT BOOM

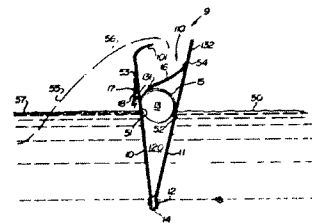
Jim W. Steen, Calgary; John Bennett, and Ian McAllister, both of Vancouver, all of Canada, assignors to Bennett Pollution Controls, Ltd., North Vancouver, Canada

Filed Jun. 6, 1977, Ser. No. 803,803

Int. Cl.² E02B 15/04

U.S. Cl. 405—68

9 Claims



2. Cleanup and Removal

79D-1182

RUSSIAN OIL SKIMMER UNDERGOES TESTS (NEWS BRIEF)

Anon. 1979.

Conservation News 44(14):12.

Spill cleanup, Skimmers, Performance testing, Design-engineering, EPA, US, USSR, *OHMSETT facility

Under a bi-national agreement, the US and USSR are testing a new Russian design for picking up floating oil spills. The nearly 20 m (58 foot), 40 ton skimmer will be tested at the US EPA OHMSETT facility in New Jersey. A special propeller-tunnel arrangement permits the device to advance forward in water or to remain stationary and pull the oil into itself.

B. OIL POLLUTION PREVENTION AND CONTROL

79D-1183

OIL SORBENTS

Abrahamsson, T. 1979.

Swedish patent 405,981

Spill cleanup, Sorbents, Patent

"Oil sorbents consisting of small torn pieces of soft foamed plastics and a binder may also be fabricated as disk- or bowl-shaped filters useful for removing oil from oil-containing media."

[from Chemical Abstracts 91(8):#58344k. 1979]

79D-1184

APPARATUS FOR APPLICATION OF CHEMICAL DISPERSANTS ON OPEN SEA

Allen, T.E. 1978.

Chemical Dispersants for the Control of Oil Spills. L.T. McCarthy, Jr., G.P. Lindblom, and H.F. Walter (eds.). Philadelphia, American Society for Testing and Materials, 1978. p. 266-276. ASTM Special Technical Publication 659.

Dispersants, Equipment, Performance testing, Pollution control, Design-engineering

A large durable boat sprayer system has been developed and tested for use on oil spills on the open sea. Designed for use on seagoing workboats, the system can be easily loaded onto the vessel, adapted to individual boats, and used in moderately rough seas. The system is designed to spray a path up to 18.3 m wide at a speed of 14.5 km/hr (8 knots), using a dispersant that requires low mixing energy in application.

79D-1185

OIL ADSORBING MATERIAL MADE FROM GRASS PEAT

Azuma, T., K. Hami, and K. Shima. 1979.

Japanese patent application 79 08,557

Adsorption, Sorbents, Plants, Patent, *Grass peat fibers

Grass peat is washed, crushed, heated under pressure, and the pressure is instantly reduced, to form fine grass peat fibers, which are then further processed into oil-adsorbing materials.

[from Chemical Abstracts 91(8):#61956s. 1979]

B. OIL POLLUTION PREVENTION AND CONTROL

79D-1186

WEAPONS AGAINST OIL POLLUTION

Bartlett, T. 1977.

Dock and Harbour Authority 58(680):114-116.

Spill cleanup, Spill removal, Booms, Skimmers, Dispersants, Sinking agents, Sorbents, Burning, IMCO, Manuals

Various means for combatting oil spills are discussed including dispersants, mechanical techniques, burning, sinking agents, and absorbents. Cleanup efforts following the wreck of the Torrey Canyon are briefly described. A list of "basic principles" for the prevention of oil pollution stemming from operational sources is cited from IMCO's Manual on Oil Pollution.

79D-1187

DISPERSANT USAGE FOR OFFSHORE OIL SPILLS

Coit, R.A. 1978.

Chemical Dispersants for the Control of Oil Spills. L.T. McCarthy, Jr., G.P. Lindblom, and H.F. Walter (eds.). Philadelphia, American Society for Testing and Materials, 1978. p. 226-235. ASTM Special Technical Publication 659.

Dispersants, Offshore, Pollution control, Equipment, Guidelines, Contingency planning

Since 1967, US federal regulations have discouraged the use of dispersants to control oil spills. This paper summarizes the current consensus of an American Petroleum Institute task force on dispersant use. It concludes that new low-toxicity dispersants often are the best way of reducing or preventing environmental damage, that equipment is available for effective application, and that the National Contingency Plan needs revision to incorporate guidelines for dispersant usage when appropriate.

79D-1188

OIL POLLUTION - LOCAL EFFLUENT PROBLEMS

Clark, C.J. 1978.

Chemistry and Industry, No. 21:821-826.

Spill cleanup, Onshore, Wastewaters, Industries, Pollution prevention

Several alternatives available for oil cleanup following a pollution incident in an inland water course are discussed. These include cleanup by the offender with on-scene assistance and guidance from the water authority, and engaging the services of a firm specializing in oil decontamination.

[from Petroleum Abstracts 19(27):#264,931. 1979]

B. OIL POLLUTION PREVENTION AND CONTROL

79D-1189

A SYSTEM FOR THE APPLICATION OF DISPERSANTS TO THE PROBLEMS OF OIL SPILL CLEARANCE

Cormack, D., and J.A. Nichols. 1978.
Chemical Dispersants for the Control of Oil Spills. L.T. McCarthy, Jr., G.P. Lindblom, and H.F. Walter (eds.). Philadelphia, American Society for Testing and Materials, 1978. p. 236-252. ASTM Special Technical Publication 659.

Pollution control, Dispersants, Equipment, UK, Contingency planning,
*Application methods

This paper outlines the rationale for a dispersant approach to spill response, and details methods of application for ships, small vessels, and aircraft. Oil treatment rates and capabilities for aircraft and ships are tabulated, and data on the amounts of dispersant and equipment held in the UK for contingency planning are presented.

79D-1190

MICROBIAL DEGRADATION OF OIL IN SURFACE SOIL HORIZONS

De Borger, R., R. Van Loocke, A. Verlinde, and W. Verstraete. 1978.
Revue d'Ecologie et de Biologie du Sol 15(4):445-452.

Biodegradation, Soil, Spill cleanup, Biological treatment, Contamination

"Investigations were carried out to evaluate the environmental circumstances under which microbial cleanup is feasible and to define a practical procedure to decontaminate microbiologically surface soils polluted with oil." Nutritional C-N-P ratio, pH, temperature and aeration were found to affect oil breakdown.

[from Chemical Abstracts 91(3):#19022j. 1979]

79D-1191

FEDERAL VIEWPOINT ON USE AND POTENTIAL OF CHEMICAL OIL DISPERSANTS

Dorrlor, J.S. 1977.
Proceedings of the Oil Spill Response Workshop. US Fish and Wildlife Service, Office of Biological Services, 1977. Report FWS/OBS/77-24. p. 95-103.

Dispersants, Spill cleanup, Pollution control, Government agencies, Regulations

"The composition and use of chemical oil dispersants are discussed in relation to federal policy."

[from Chemical Abstracts 91(3):#14831n. 1979]

B. OIL POLLUTION PREVENTION AND CONTROL

79D-1192

RESEARCH NEEDED TO DETERMINE EFFECTIVENESS OF CHEMICALS IN TREATING OIL SPILLS AND THE TOXICITY OF CHEMICALLY DISPERSED OIL - WORKSHOP PROCEEDINGS
Exxon Production Research Company. 1978.

Houston, Texas, Exxon Production Research Company, 1978. 51 p.

Spill cleanup, Dispersants, Toxicity, Acute effects, Chronic effects, Marine organisms, Habitats

A panel of 14 internationally recognized scientists participated in a workshop dealing with the two title research concerns. Participants were divided into two groups; each group was asked to consider the problem of effects or toxicity of chemically treated oil spills versus untreated ones. This report presents and summarizes the research goals and priorities that were identified by the two groups.

79D-1193

MOVING BELT TYPE OIL SKIMMER WITH PROPULSION INDUCED FLOW

Grimes, E.L., and D.W. Lerch. 1979.

Australian Patent 498,043

Spill cleanup, Skimmers, Oil-water separation, Equipment, Design-engineering, Patent

Discussed is a method for recovering oil from a water surface while separating the water and recovered oil utilizing an endless oil-water separation filter belt technique.

[from Petroleum Abstracts 19(31):#266,002. 1979]

79D-1194

OIL SPILL CLEANUP ACTIVITIES

Hann, R.W., L. Rice, M.-C. Trujillo, and H.N. Young, Jr. 1978.

The Amoco Cadiz Oil Spill, a Preliminary Scientific Report. W.N. Hess (ed.). NOAA/EPA Special Report. Washington, DC, Government Printing Office, 1978. p. 229-275.

Spill cleanup, Physical aspects, Behavior, Amoco Cadiz spill, Pollution control, France

The authors discuss the physical properties, behavior and movement of oil from the Amoco Cadiz spill and its ultimate deposition on the beaches. The organizational structure established to clean up the spill and the strategy of control are presented and evaluated with regard to their utility in other spills.

B. OIL POLLUTION PREVENTION AND CONTROL

79D-1195

SEPARATION OF OIL ON WATER

Hoketsu, H. 1979.

Japanese Patent Application 79 33,887

Spill cleanup, Oil removal, Patent

"Polar plastic coated rice hulls are spread over oil films on water, and stirred to remove the oil."

[from Chemical Abstracts 91(4):#26872q. 1979]

79D-1196

REMOVAL OF OIL AND COLORING MATTER FROM CONTAMINATED WATERS USING SHALE AS ADSORBENT

Kamiya, S., F. Hase, and S. Takeshita. 1978.

Japanese Patent 78 18,194

Spill cleanup, Wastewater treatment, Adsorption, Patent, *Powdered shale

Colored matter and oil in water are adsorbed on powdered shale and a gel is formed. The gel is separated and dried and the oil and colored matter are separated from the shale.

[from Chemical Abstracts 89(24):#203974f. 1978]

79D-1197

CHEMICAL CONTROL OF OIL SPILLS AND HAZARDS

Kaufmann, S. 1978.

Chemical Dispersants for the Control of Oil Spills. L.T. McCarthy, Jr., G.P.L. Lindblom, and H.F. Walter. (eds.). Philadelphia, American Society for Testing and Materials, 1978. p. 89-97. ASTM Special Technical Publication 659.

Spill response, Dispersants, Economics, Pollution control

Economical and practical considerations for the use of dispersants in a variety of accidental spill situations on land or water are examined. Past practices are reviewed and future directions are discussed.

79D-1198

PERFORMANCE TESTING OF THREE OFFSHORE SKIMMING DEVICES

Lichte, H.W., and M.K. Breslin. 1978.

Report HCP/P3241-01, Contract EE-77-A-28-3241. 90 p.

Spill removal, Equipment, Performance testing, Design-engineering, Skimmers

Performance testing results are presented for three commercial oil spill cleanup devices. Operating techniques based on test results are described.

[from Energy Research Abstracts 3(17):#41520. 1978]

B. OIL POLLUTION PREVENTION AND CONTROL

79D-1199

A SMALL-SCALE LABORATORY DISPERSANT EFFECTIVENESS TEST

Mackay, D., J.S. Nadeau, and C. Ng. 1978.

Chemical Dispersants for the Control of Oil Spills. L.T. McCarthy, Jr., G.P.L. Lindblom, and H.F. Walter (eds). Philadelphia, American Society for Testing and Materials, 1978. p. 35-49. ASTM Special Technical Publication 659.

Dispersants, Performance testing, Behavior, Simulations, Physical aspects

A small-scale laboratory system is described in which known quantities of oil and dispersant are introduced on a water surface at a controlled temperature, and turbulence and dispersion behavior are observed. The design and performance of the apparatus are described. Results are presented for experiments in which turbulence, oil-to-dispersant ratio, and temperature were varied. The advantages and disadvantages of the system are outlined, and the possibility of relating sea state to conditions in the system is discussed.

79D-1200

DEVELOPMENT OF AN OIL DISPERSANT SPRAYING SYSTEM

Manolio, V.P., Jr., and L.T. McCarthy, Jr. 1978.

Chemical Dispersants for the Control of Oil Spills. L.T. McCarthy, Jr., G.P.L. Lindblom, and H.F. Walter (eds.). Philadelphia, American Society for Testing and Materials, 1978. p. 81-88. ASTM Special Technical Publication 659.

Dispersants, Equipment, Design-engineering, US, USSR, Performance testing, EPA, *OHMSETT facility

A joint effort between the US, EPA and the USSR Central Scientific Research Institute was initiated to examine various oil dispersants and application methods, and to establish a uniform series of acceptance tests.

79D-1201

CHEMICAL DISPERSANTS FOR THE CONTROL OF OIL SPILLS

McCarthy, L.T., Jr., G.P. Lindblom, and H.F. Walter (eds.). 1978.

Philadelphia, American Society for Testing and Materials, 1978. 307 p. ASTM Special Technical Publication 659.

Dispersants, Toxicity, Performance testing, Simulations, Equipment, Environmental effects, Guidelines, *ASTM symposium

This book presents a collection of 22 papers on the title topic, presented at a symposium sponsored by the ASTM Committee on Spill Control Systems in Williamsburg, Virginia, 4-5 October 1977. Among the topics covered are dispersant toxicity testing, evaluation of techniques and equipment for their application, guidelines for their usage, and their environmental effects.

B. OIL POLLUTION PREVENTION AND CONTROL

79D-1202

PERFORMANCE TESTING OF THE TETRADYNE HIGH SPEED AIR JET SKIMMER

McCracken, W.E., and S.H. Schwartz. 1978.

Report EPA/600/2-78/187, Contract EPA-68-03-0490. 45 p.

Spill cleanup, Skimmers, Performance testing, Equipment, Design-engineering, EPA, *OHMSETT facility

The skimmer tested depends on an air jet impacting the water surface at an angle and deflecting rapidly moving, floating spilled material laterally into a low-current chamber. The four test fluids include No. 2 fuel oil, naphtha, and two lubricating stocks. The effects of several variables (film thickness, fluid viscosity, etc.) on skimmer performance are presented.

[from Government Reports Announcements 79(5):166. #PB-287 822. 1979]

79D-1203

OIL RECOVERY PROCESS

National Marine Service, Inc. 1977.

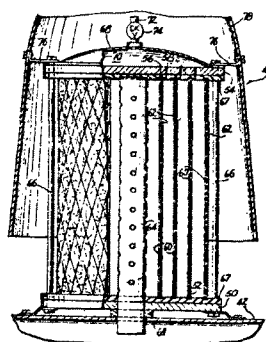
US Patent 4,053,414

Oil removal, Skimmers, Booms, Filtration, Gravity separation, Equipment, Design-engineering, Patent

A vessel is provided with a gravity separation tank, a boom and skimmer. A manifold on the inner periphery of the tank discharges skimmed oil and water into the tank. Means of filtering drawn off water are provided and filtered water is discharged. Pumps can reverse the flow of water to back-wash coalescing filters.

[from Energy Research Abstracts 3(3):625. #5972. 1978]

4,053,414
OIL RECOVERY APPARATUS
Cornelis In'tVeld, Vlaardingen, Netherlands, assignor to National Marine Service, Inc., St. Louis, Mo.
Filed Aug. 3, 1976, Ser. No. 711,215
Claims priority, application Netherlands, Nov. 26, 1975, 7513810
Int. Cl.² B01D 21/24
U.S. Cl. 210—117 9 Claims



B. OIL POLLUTION PREVENTION AND CONTROL

79D-1204

SKIMMER FOR OIL SPILLS

Nagy, C.E., and J.F. Nagy. 1979.

US Patent 4,145,290

Spill cleanup, Skimmers, Equipment, Design-engineering, Patent

The skimmer has a submersible hull within which is located a surge tank for receiving oil and water skimmer from the surface. A funnel at the top of the skimmer projects through the hull into the surge tank. Means are provided for controlling the flow through the funnel and pumping oil out of the surge tank. A coupler on the nose of the hull enables coupling of the skimmer to a towing vehicle.

[from Petroleum Abstracts 19(28):#265,131. 1979]

4,145,290

SKIMMER FOR OIL SPILLS

Charles E. Nagy, 3221 Bend Pl., Hollywood, Calif. 90068, and

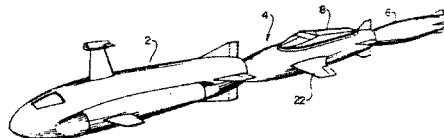
John F. Nagy, 785 W. End Ave., New York, N.Y. 10025

Filed Jul. 28, 1977, Ser. No. 819,704

Int. Cl.² E02B 15/04

U.S. Cl. 210—242 S

16 Claims



79D-1205

AERIAL APPLICATION OF DISPERSANTS IN BANTRY BAY FOLLOWING THE BETELGEUSE INCIDENT

Nichols, J.A., and I.C. White. 1979.

Marine Pollution Bulletin 10(7):193-197.

Spill cleanup, Dispersants, Ireland, *Betelgeuse spill, *Aerial application

"For the first time during a significant oil spill, aircraft were used in preference to surface vessels to apply chemical dispersants, following the tragic accident to the French registered tanker in Bantry Bay, south-west Eire. In this particular case, with an ideally situated landing strip, close to the source of the spill of fresh crude oil, the response proved to be highly effective and prevented the vast majority of the oil lost after the 6th day from reaching the nearby shorelines. The ability of the pilot of the spray aircraft to rapidly locate and to select for treatment only those slicks or parts of slick posing a significant threat also resulted in the minimum amount of dispersant being used to maximum effect."

B. OIL POLLUTION PREVENTION AND CONTROL

79D-1206

OIL ABSORBENT ON WATER

Nishihara, H. 1979.

Japanese Patent Application 79 02,287

Oil removal, Absorption, Sorbents, Patent

The oil absorbent comprises cut or powdered polypropylene filament of average diameter 15-100 μ and ≥ 10 volumes foamed polyethylene powdered to 5-20 mm mixed in 30-60:70-40 ratio.

[from Chemical Abstracts 91(2):#9333x. 1979]

79D-1207

INSTALLATION TO COLLECT OIL OR SIMILAR MATERIAL FROM A WATER SURFACE

Nylands Verksted A/S. 1978.

Netherlands Patent Application 7,802,657

Spill cleanup, Skimmers, Booms, Ships, Equipment, Design-engineering, Patent

The device consists mainly of a bag of impermeable material stretched horizontally which can be towed by a ship. A boom is positioned between the ship and the bag. The bag has an inlet facing the towed device and an outlet for dumping the collected oil.

[from Petroleum Abstracts 19(31):#265,998. 1979]

79D-1208

VESSEL AND PROCEDURE TO REMOVE AND COLLECT OIL FLOATING ON WATER

Oil Mop, Inc. 1978.

Netherlands Patent Application 7,806,198

Spill cleanup, Spill removal, Ships, Equipment, Design-engineering, Patent

The vessel has a longitudinal hull with interconnected side sections and means to propel the hull through the water. Oil-catching material is between the sections.

[from Petroleum Abstracts 19(31):#266,003. 1979]

B. OIL POLLUTION AND CONTROL

79D-1209

SYSTEM FOR COLLECTING OIL

Shyu, J.Y. 1979

US Patent 4,146,482

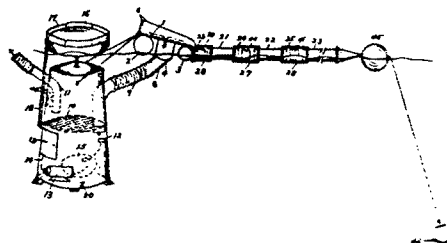
Spill cleanup, Oil-water separation, Skimmers, Sea surface, Equipment, Design-engineering, Patent

An apparatus for collecting oil floating on a sea surface is described. Waves cause oil and water to flow into a collecting panel and from there to a container, in which the oil and water can be separated and filtered and the oil pumped to a nearby ship.

[from Petroleum Abstracts 19(28):#265,132. 1979]

4,146,482
SYSTEM FOR COLLECTING OIL
Ji Yn Shyu, Kaohsiung, Taiwan, assignor to Yin-Lung Yang,
Kangshan, Taiwan
Filed Feb. 22, 1978, Ser. No. 880,073
Int. Cl.² E02B 15/04
U.S. Cl. 210—242 S

3 Claims



79D-1210

OIL SPILL REMOVAL EQUIPMENT TECHNIQUES AND EQUIPMENT. VOLUME 2, 1976-JULY 1978. (A BIBLIOGRAPHY WITH ABSTRACTS)

Smith, M.F. 1978.

Report NTIS/PS-78/0960 84 p. Report for 1976-July 1978. (Supersedes NTIS/PS-77/0750, NTIS/PS-76/0637, NTIS/PS-75/542, and COM-74-10951.)

Spill removal, Oil-water separation, Skimmers, Dispersants, Sorbents, Absorption, Flotation, Equipment, Spreading, Bibliographies

The removal processes are discussed for oil-water separators, skimmers, dispersants, absorbents, flotation and combustion. Studies are presented concerning oil spreading, droplet entrainment, prototype removal systems, and equipment and costs.

[from Government Reports Announcements 78(23):186. #NTIS/PS-78/0960. 1978]

79D-1211

TECHNIQUES FOR MIXING DISPERSANTS WITH SPILLED OIL

Smith, G.F. 1978.

Report EPA/600/2-78/128, Contract EPA-68-03-0490. 50 p. Final report.

Spill cleanup, Equipment, Design-engineering, Dispersants, *Dispersant application

B. OIL POLLUTION PREVENTION AND CONTROL

Test results are given of an EPA-sponsored project to measure the relative effectiveness of four devices for adding mixing energy to an oil slick after dispersant application. A modified five-bar gate proved to be the most effective for breaking up a 1 mm thick oil slick into droplets with the greatest overall penetration (2.4 m) at a tow speed of 2.0 m/s.

[from Government Reports Announcements 78(26):149. #PB-285 679. 1978]

79D-1212

OHMSETT 'HIGH SEAS' PERFORMANCE TESTING: MARCO CLASS V OIL SKIMMER

Smith, G.F., and W.E. McCracken. 1978.

Report EPA/600/2-78/093, Contract EPA-68-03-0490. 49 p. Final report.

Skimmers, Equipment, Design-engineering, Spill cleanup, Performance testing, *OHMSETT facility

A MARCO Class V skimmer was tested in high seas conditions. Skimmer efficiency is described at various belt speeds and induction pump rates in order to define optimum settings and to better define oil-water separator needs.

[from Government Reports Announcements 78(22):201. #PB-283 390. 1978]

79D-1213

REMOVAL OF A WATER-INSOLUBLE ORGANIC COMPOUND FROM A SURFACE

Sonnergaard, R.E. and L.A.S. Waag. 1979.

German patent application 2,846,926

Spill removal, Emulsification, Patent

"Fuel oil is recovered from seawater by emulsifying the oil with a phosphate ester of an alkoxylated alcohol, breaking the emulsion by adding a base, and separating the oil phase."

[from Chemical Abstracts 91(8):#59245r. 1979]

79D-1214

DEVICE FOR RETRIEVING FLOATING POLLUTANTS ON SURFACE WATER

Stupica, V.A. 1979.

US Patent 4,133,765

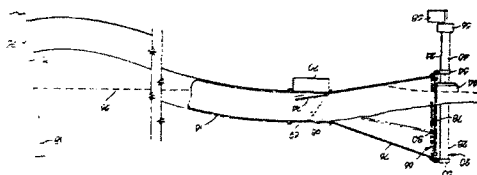
Spill cleanup, Skimmers, Equipment, Design-engineering, Patent

The apparatus employs a floating flexible barrier and has a reservoir tank coupled with the barrier so that oil is conveyed from the barrier to the tank by gravity flow.

[from Petroleum Abstracts 19(32):#266,224. 1979]

B. OIL POLLUTION PREVENTION AND CONTROL

4,133,765
DEVICE FOR RETRIEVING FLOATING POLLUTANTS
ON SURFACE WATER
Vekoslav A. Stupica, 2911 N. 73rd Pl., Kansas City, Kans. 66109
Filed Sep. 21, 1977, Ser. No. 835,041
Int. Cl.² E02B 15/04
U.S. Cl. 210—242 S 1 Claim



79D-1215

PERFORMANCE TESTS OF FOUR SELECTED OIL SPILL SKIMMERS

Urban, R.W., D.J. Graham, and S.H. Schwartz. 1978.

Report EPA/600/2-78/204, Contract EPA 68-03-0490. 84 p.

Spill cleanup, Skimmers, Equipment, Design-engineering, Performance testing, *OHMSETT facility

A series of tests are described which determined the range of best performance for each skimmer under the manufacturer's design limits. The four skimmers tested at the OHMSETT facility included the Oil Mop, the Cyclonet 050, the Clowsor skimmer, and the Bennett Mark 6E. A total of 198 individual test runs were made in an 8-week test period.

[from Government Reports Announcements 79(6):166. #PB-288 549. 1979]

79D-1216

APPLICATION OF THE PRINCIPLE OF THE INTEGRATION OF COMPATIBLE FUNCTIONS TO THE SYSTEM OF HYDROCARBON SPILL RECOVERY (THE SYSTEM, LOGISTICS AND STRUCTURE) [in French]

Vidilles, J. 1978.

Journal des Ingenieurs 27(1):21-26.

Spill cleanup, Design-engineering, Equipment, *SIRENE

A device called "SIRENE" designed for the cleanup of ocean oil spills is described.

[from Chemical Abstracts 89(22):#185627p. 1978]

79D-1217

OIL BINDING AGENT BASED ON NATURAL AND/OR SYNTHETIC RUBBER

Zwittnig, L. 1979.

Austrian Patent 348,491

Sorbents, Oil removal, Adsorption, Patent

Oil adsorbents are based on natural and/or synthetic rubber particles and contain 0.5-8 wt.% sawdust to avoid caking.

[from Chemical Abstracts 91(4):#22190t. 1979]

B. OIL POLLUTION PREVENTION AND CONTROL

3. Environmental Restoration

79D-1218

RESPONSE OF A SALT MARSH TO OIL SPILL AND CLEANUP: BIOTIC AND EROSIONAL EFFECTS IN THE HACKENSACK MEADOWLANDS, NEW JERSEY

Dibner, P.C. 1978.

Report EPA/600/7-78/109, Contract EPA-68-03-2160. 62 p. Final report.

Spill cleanup, Marshes, Restoration, Recovery, Soil, Plants, Invertebrates, Crude oil

The study assesses the response of the title marsh to a number 6 crude oil spill in May 1976. Cleanup included cutting and removal of oiled grasses of the species Spartina alterniflora. Productivity, soil composition, invertebrate communities, and erosional trends were monitored. Conclusions suggest that cutting of heavily oiled grasses saved the plants from dying of root suffocation.

[from Government Reports Announcements 78(25):188. #PB-285 211. 1978]

4. Personnel Training

[No entries.]

5. Contingency Planning

79D-1219

PROCEEDINGS OF THE NATIONAL RESPONSE TEAM OIL SPILL SCIENTIFIC RESPONSE WORKSHOP, NEW ENGLAND

Conner, W.G., and P.U. Alkon. 1978.

Report EPA/600/7-78/196, Contract EPA-68-01-3188. 480 p.

Spill response, Spill cleanup, Contingency planning, *Proceedings

The principal objective of the workshop proceedings detailed in the title report "was to identify the scientific needs and capabilities, to be incorporated into a regional response plan for assessing the ecological damage due to major oil spills."

[from Government Reports Announcements 79(8):97. #PB-289732. 1979]

B. OIL POLLUTION PREVENTION AND CONTROL

79D-1220

SOME GUIDELINES FOR OIL-SPILL CONTROL IN COASTAL ENVIRONMENTS, BASED ON FIELD STUDIES OF FOUR OIL SPILLS

Gundlach, E.R., M.O. Hayes, C.H. Ruby, L.G. Ward, et al. 1978. Chemical Dispersants for the Control of Oil Spills. L.T. McCarthy, Jr., G.P.L. Lindblom, and H.F. Walter (eds.). Philadelphia, American Society for Testing and Materials, 1978. p. 89-97. ASTM Special Technical Publication 659.

Guidelines, Dispersants, Contingency planning, Spill cleanup, Beach clean-up, Intertidal zone, Shorelines

An understanding of factors influencing the distribution, damage, and long-term persistence of oil spills is essential for adequate planning and appropriate application of cleanup techniques. Based on a study of two massive tanker spills the Metula and the Urquiola, and two smaller spills, the Bouchard 65 and the Ethel H., these factors are wind stress and water currents, beach activity and grain size, tidal stage, wave energy, oil quantity and composition, and ice effects. These factors and initial biological effects were used as the basis for a classification of coastal environments in terms of potential oil spill damage.

79D-1221

ORGANIZATIONAL STRUCTURE, CLEANUP PROCESSES AND LEVEL OF RESOURCES UTILIZED IN THE CLEANUP OF THE AMOCO CADIZ OIL SPILL

Hann, R.W. 1979.

American Association for the Advancement of Science National Meeting, 145th, Houston, Texas, 3-8 January 1979. Washington, DC, AAAS, 1979. p. 144. Abstracts.

Contingency planning, Spill cleanup, Amoco Cadiz spill, Pollution control, Coasts, France

This paper documents "the level of effort expended in dealing with the spill...so that those responsible for dealing with such a spill in the future will have good information as to the level of resources they should expect to expend to deal with such a spill, and the technologies which were chosen to be utilized under this particular set of oceanographic and meteorological conditions coupled with the high marine resource and recreational value of this important coast of France."

B. OIL POLLUTION PREVENTION AND CONTROL

79D-1222

ECOLOGICAL DAMAGE ASSESSMENT OF OIL SPILLS - THE GOVERNMENT'S RESPONSE
Lefcourt, P. 1978.

In the Wake of the Argo Merchant. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 179-181.

Contingency planning, Government agencies, Legislation, Spill response

The legal justification and authorities for the federal government's response and participation in activities relative to spills of oil and hazardous substances are briefly discussed.

79D-1223

THE ROLE OF PHYSICAL STUDIES BEFORE, DURING AND AFTER OIL SPILLS
Milgram, J.H. 1978.

In the Wake of the Argo Merchant. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 5-14.

Oil spills, Physical aspects, Spill response, Spill cleanup, Argo Merchant spill

Physical studies, among others, are required to provide the on-scene clean-up coordinator with the scientific information necessary to guide the correct choice of optimum cleanup technology and logistics. The title article discusses the means by which this objective is met by physical studies and their role in the provision of accurate information relative to naturally occurring processes such as spreading, mass transport, dispersion, evaporation, and dissolution.

79D-1224

WHEN AN OIL SPILL HITS, BEING PREPARED IS YOUR BEST DEFENSE
Noel, H.S. 1979.

National Fisherman 60(6):45.

Contingency planning, Pollution control, *Mariculture projects

For coastal or estuarine mariculture projects, careful and continually updated contingency planning appears to be the best defense against oil spills. This article summarizes advice presented by Dr. Ian White, a fisheries biologist representing the International Tanker Owners' Pollution Federation Ltd., which administers compensation for those affected by tanker spills around the world.

B. OIL POLLUTION PREVENTION AND CONTROL

79D-1225

LOGISTIC REQUIREMENTS FOR AERIAL APPLICATION OF OIL SPILL DISPERSANTS

Ross, C.W., P.B. Hildebrand, and A.A. Allen. 1978.

Chemical Dispersants for the Control of Oil Spills. L.T. McCarthy, Jr., G.P.L. Lindblom, and H.F. Walter (eds.). Philadelphia, American Society for Testing and Materials, 1978. p. 66-80. ASTM Special Technical Publication 659.

Dispersants, Simulations, Equipment, Cost analysis, *Aerial application

In the title study, selected factors involved in establishing the feasibility of aerial application of dispersants on oil spills were investigated. The approach focused on only those areas affecting operational feasibility and was based on general assumptions and mathematical formulas which could be used to evaluate other spill configurations, volumes, and locations, or other dispersant platforms.

79D-1226

SYSTEMS FOR ARCTIC SPILL RESPONSE, VOLS. 1 & 2

Schultz, L.A., P.C. Deslauriers, F.W. DeBord, and R.P. Voelker. 1978. Report 405C-3 Vol-1,2; USCG-D-44-78-Vol 1,2, Contract DOT-CG-71343-A. 327 p., 138 p. Final report.

Spill response, Contingency planning, Spill cleanup, Cold climates, Ice, USCG

An optimum arctic pollution recovery system was determined by establishing the cost and effectiveness of responses for 16 oil spill response situations, and based on these, developing six alternative Coast Guard arctic response systems. The six systems were developed for three ice conditions: Thick stable ice, dynamic hummocky ice and open water/light ice. The scenarios are detailed together with response systems.

[from Government Reports Announcements 78(25):173. #AD-A053 732,733. 1978]

79D-1227

ANTI-OIL POLLUTION STRATEGY IN SULLOM VOE

Syratt, W.J., and M.G. Richardson. 1979.

The Marine Environment at Sullom Voe and the Implications of Oil Developments, Scottish Marine Biological Association, 18-19 April 1979. Oban, Scotland, Shetland Terminal Advisory Group, 1979. p. 23. Abstract.

Oil terminals, Pollution prevention, Contingency planning, Spill cleanup, Scotland, *Sullom Voe

The focus of this paper is upon environmental considerations of an oil spill contingency plan drawn up by the Sullom Voe Oil Spill Advisory Committee. An analysis of the sea areas and coastline is discussed which defines the accessibility of certain zones and identifies a number of sensitive areas for which specific recommendations for cleanup techniques are included.

B. OIL POLLUTION PREVENTION AND CONTROL

79D-1228

THE ARGO MERCHANT OIL SPILL ON-SCENE COORDINATORS REPORT

US Coast Guard. 1977.

Report AD-A062 028. 129 p.

Spill response, Spill removal, Contingency planning, Argo Merchant spill, USCG

The title report documents the oil spill response action initiated by the Coast Guard following the grounding and foundering of the tanker Argo Merchant on 12/13/76. Discussed are the cause of the accident, organization of response, actions committed, effectiveness of response and removal actions, unique problems encountered, and recommendations of means to prevent a reoccurrence.

[from Government Reports Announcements 79(7):148. #AD-A062 028. 1979]

79D-1229

ASSESSMENT PROBLEMS OF WHETHER OR NOT TO TREAT OIL SPILLS

Wilson, M.P., Jr. 1978.

Chemical Dispersants for the Control of Oil Spills. L.T. McCarthy, Jr., G.P. Lindblom, and H.F. Walter (eds.). Philadelphia, American Society for Testing and Materials, 1978. p. 119-126. ASTM Special Technical Publication 659.

Dispersants, Environmental effects, Spill response

The decision to use dispersants on an oil spill requires a multiplicity of biological, chemical, physical and meteorological inputs. Much of the information required to conduct such an assessment is presently unavailable and must be obtained through laboratory, meso-scale, and in situ types of experiments. This paper discusses the kinds of information obtainable from each type of experiment and how these influence the assessment process.

79D-1230

SHORELINE OIL SPILL PROTECTION & CLEANUP STRATEGIES: SOUTHERN BEAUFORT SEA WORBETS, B.W. 1979.

Arctic Petroleum Operators' Association, Report of Project #136. Manual: 85 p.; Appendix:64 p.

Spill response, Contingency planning, Pollution prevention, Spill cleanup, Shorelines, Beaufort Sea, Arctic

The title manual is designed for on-scene commander's use during an oil spill, and recommends oil spill protection and cleanup strategies for identified sensitive coastal regions. The appendix discusses the process and logic that were followed to develop this work. The publications are available from the APOA Information Service, PO Box 1281, Station M, Calgary Alberta, Canada T2P 2L2.

B. OIL POLLUTION PREVENTION AND CONTROL

6. Legal and Regulatory Aspects

79D-1231

OCEAN LAW (A BIBLIOGRAPHY WITH ABSTRACTS). VOLUME 2

Brown, R.J. 1978.

Report NTIS/PS-78/1083. 122 p. Report for 1977-October 1978. (Supersedes NTIS/PS-77/0948, NTIS/PS-76/0834, NTIS/PS-75/712, and NTIS/PS-74/134.)

Legislation, Marine environment, International agreements, Pollution control, Bibliographies

Cited are national and international laws on fishing, undersea mining, shipping, dredging, territorial waters, navigation regulations, offshore minerals, government policies, and water pollution. (This updated bibliography contains 55 new entries to the previous edition.)

[from Government Reports Announcements 78(25):33. #NTIS/PS-78-1083. 1978]

79D-1232

HAZARDOUS WASTE CLEAN-UP "SUPERFUND" BILL IN CONGRESS

Gaines, S.E. 1979.

Environmental Science & Technology 13(8):917.

Legislation, US, Liability, Compensation, Spill cleanup, *Superfund

The provisions of the proposed "superfund" legislation are discussed.

79D-1233

LAWS PASSED DURING THE 1977 SESSION OF THE MISSISSIPPI LEGISLATURE AFFECTING COASTAL RESOURCE MANAGEMENT, USE AND PROTECTION

University of Mississippi Law Center. 1977.

Report MASGP-78-012, NOAA-78062701, Grant NOAA-04-7-158-44017. 16 p.

Pollution prevention, Legislation, Resource management, Mississippi

Presented in the title study are those laws passed during the 1977 session of the Mississippi Legislature that would affect the use, development and protection of the state's marine resources. Specific subjects include mineral and non-living resources, industrial resources, and environmental control. [possibly oil pollution related]

[from Government Reports Announcements 78(22):29. #PB-284 739. 1978]

B. OIL POLLUTION PREVENTION AND CONTROL

79D-1234

U.S. BILL WOULD MAKE SPILLERS PAY, HELP VICTIMS COLLECT

Studds, G.E. 1979.

National Fisherman 60(2):56.

Liability, Compensation, Legislation, Regulations, US, Fisheries

A US congressman discusses the advantages and necessity of having comprehensive oil pollution liability and compensation legislation to aid the fishing industry in case of oil spillage.

79D-1235

OIL POLLUTION CONTROL MECHANISMS - STATUTES AND REGULATIONS

University of Mississippi Law Center. 1977.

NOAA, Report MASGP-78-014, Grant #04-7-158-44017. 71 p.

Pollution control, Legislation, Regulations, Spill response, Government agencies, Law enforcement

This analysis provides a detailed picture of federal statutes, regulations, and case law related to oil spill prevention and control. Emphasis is placed on federal action taken after a spill. The document touches briefly on acts having a lesser effect on oil pollution control, including the Refuse Act, the Ports and Waterways Safety Act, the OCS Lands Act, and the Oil Pollution Act.

7. General Prevention and Control Measures

79D-1236

PRACTICAL EXPERIENCE OF DISPERSANT USAGE

Garnett, M.J., and I.C. White. 1978.

Chemical Dispersants for the Control of Oil Spills. L.T. McCarthy, Jr., G.P. Lindblom, and H.F. Walter (eds.). Philadelphia, American Society for Testing and Materials, 1978. p. 217-225. ASTM Special Technical Publication 659.

Dispersants, Spill cleanup, Pollution control, Coastal waters, Contingency planning

This papers reviews selected aspects of dispersant usage based on experience gained from oil spill incidents around the world. "Dispersants, applied correctly and after detailed consideration of the particular circumstances of the incident, have a role to play in combatting oil spillage at sea and can prevent or reduce damage to coastal resources and amenities. They should be regarded, however, only as one of the many courses of action open to cleanup controllers and not as a panacea for all ills."

B. OIL POLLUTION PREVENTION AND CONTROL

79D-1237

DISPERSANT FIELD TRIALS IN CANADIAN WATERS - USE OF HOVERCRAFT AS A DISPERSANT SPRAYING PLATFORM

Gill, S.D. 1978.

Chemical Dispersant for the Control of Oil Spills. L.T. McCarthy, Jr., G.P. Lindblom, and H.F. Walter (eds.). Philadelphia, American Society for Testing and Materials, 1978. p. 159-168. ASTM Special Technical Publication 659.

Spill removal, Performance testing, Equipment, Dispersants, Canada,
*Hovercraft spraying

"During the summer of 1977, modifications were made to the Canadian Coast Guard Voyageur hovercraft for preliminary studies to determine whether this vehicle, and possibly hovercraft in general, could be considered as potential platforms for oil spill dispersant spraying. Work to date indicates that air turbulence resulting from underskirt escape, propeller wash, and forward velocity does not represent an obstacle that would deter the use of these vehicles as dispersant spraying platforms."

79D-1238

MOPPING UP AFTER THE AMOCO CADIZ

Houck, R. 1978.

Conservation News 43(9):1-2.

Spill cleanup, Environmental effects, Amoco Cadiz spill, Coasts, Mortality, Birds, Marine organisms, Fisheries, France

Briefly reviewed are the cleanup efforts and environmental effects of the Amoco Cadiz tanker spill, which contaminated well over 120 km of the coastline of France in March 1978. The spill resulted in heavy mortality to birds, fish and other marine organisms, and shellfish fisheries were particularly hard hit.

79D-1239

OIL SPILL CONTROL CHEMICALS - A CURRENT VIEW

Lindblom, G.P. 1978.

Chemical Dispersants for the Control of Oil Spills. L.T. McCarthy, Jr., G.P. Lindblom, and H.F. Walter (eds.). Philadelphia, American Society for Testing and Materials, 1978. p. 127-140. ASTM Special Technical Publication 659.

Pollution control, Dispersants, Toxicity, Product information, *Application methods, *Spill control chemicals

This paper examines the current status of oil spill control chemicals, which herein are defined to include dispersants, collecting agents, shoreline protection agents, and post-spill cleaners. Discussed are the modes of action of the various chemicals, potential ecotoxicity, and application methods required to obtain best results. Boat and aerial application methods are described in detail with reference to their advantages and limitations.

B. OIL POLLUTION PREVENTION AND CONTROL

79D-1240

EVALUATION OF EQUIPMENT FOR AERIAL SPRAYING OF OIL DISPERSANT CHEMICALS

Lindblom, G.P., and C.D. Barker. 1978.

Chemical Dispersants for the Control of Oil Spills. L.T. McCarthy, Jr., G.P. Lindblom, and H.F. Walter (eds.). Philadelphia, American Society for Testing and Materials, 1978. p. 169-179. ASTM Special Technical Publication 659.

Performance testing, Spill removal, Equipment, Dispersants, *Aerial spraying

The feasibility of using helicopters or large aircraft for dispersant spraying was evaluated. Results of these field tests indicate that aerial spraying is feasible and potentially useful in spill response, that careful attention should be given to operating parameters and spray equipment design, and that further tests at sea should be conducted.

79D-1241

CLEANUP EFFICIENCY AND BIOLOGICAL EFFECTS OF A FUEL OIL SPILL IN COLD WEATHER: THE 1977 BOUCHARD NO. 65 OIL SPILL IN BUZZARDS BAY, MASSACHUSETTS

Schrier, E. 1978.

Report URS-7004-05-01, EPA/600/7-78/133.

Spill cleanup, Spill response, Biological effects, Fuel oil, Contingency planning, Bouchard 65 spill, Buzzards Bay, Sampling, EPA

The objectives of the title study are to evaluate cleanup techniques used, make recommendations of alternative methods for future use, evaluate EPA sampling techniques, and assess environmental damage caused by the spill.

[from Government Reports Announcements 79(1):144. #PB-286 362. 1979]

79D-1242

STILL THINKING ABOUT OIL [editorial]

Sebek, V. 1979.

Marine Pollution Bulletin 10(5):121-122.

Government agencies, Pollution control, Legislation, Liability, Compensation, UK

The author discusses several steps taken by the British Parliament in response to the recent increase in oil pollution incidents. These include the establishment of a Marine Pollution Control Unit, the publication of a report on Measures to Prevent Collisions and Strandings of Noxious Cargo Carriers in Waters around the United Kingdom, and recommendations concerning fines for pollution offenses. A report published by an interdepartmental group appointed by the government is criticized on a number of points. The report addressed the following problems with reference to oil pollution: 1) Command, control and communications; 2) resources, research and development; 3) salvage; and 4) liability and compensation. The hope is expressed that the new Marine Pollution Control Unit will provide more effective monitoring of spills and enforcement of pollution control legislation than did the Department of Trade.

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

1. Biological Aspects

79D-1243

AMOCO CADIZ DAMAGE EXTENSIVE [news brief]

Anon. 1978.

Conservation News 43(19):14.

Amoco Cadiz spill, Biological effects, Mortality, Birds, Marine organisms, Fisheries

Preliminary NOAA-sponsored research results indicate that there has never been "biological damage of this geographic extent in any previous oil spill." Of the 200,000 tons of oil spilled, significant amounts mixed into the water column as well as sinking to the ocean floor. Heavy mortality among birds and marine organisms, including commercial shellfish resources, was reported.

79D-1244

OIL AND THE SEA

American Petroleum Institute. 1979.

Washington, D.C., American Petroleum Institute, 1979. 22 p.

Biological effects, Fate, Oil spills, Chronic effects, Health hazards, Marine environment

Described in brief are overall conclusions of a series of studies conducted by the American Petroleum Institute regarding the effects of oil in the marine environment. Major research categories include oil and marine life, effects of oil spills, effects of chronic exposure, the fate of oil, and health aspects of oil spills.

79D-1245

RECRUITMENT OF BENTHIC ANIMALS AS A FUNCTION OF PETROLEUM HYDROCARBON CONCENTRATIONS IN THE SEDIMENT

Anderson, J.W., R.G. Riley, and R.M. Bean. 1977.

Report BNWL-SA-6559, CONF-7710169-1. 47 p.

Intertidal zone, Hydrocarbons, Benthos, Sediments, Depuration, Biological effects, Marine organisms, *Recruitment

Hydrocarbon depuration rates and recruitment of benthic organisms were measured in three intertidal zone installations, Sequim Bay, Washington, containing oiled and clean sediments. Hydrocarbon levels in sediments receiving surface applications of oil decreased more rapidly than in sediments mixed with oil. Recruitment of benthic organisms was not significantly inhibited in any of the installations.

[from Chemical Abstracts 91(3):#14742j. 1979]

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1246

STUDY OF THE GEOGRAPHIC EXTENT AND ORIGIN OF FISH NECROSIS IN THE MEDITERRANEAN COAST [in French]

Aubert, M. 1979.

Revue Internationale d'Océanographie Médicale 53-54:3-21.

Fish, Contamination, Health hazards, Biological effects, *Necrosis

Necrosis of fish studied along the Mediterranean coast appeared to be due to bacterial contamination and water pollution by various chemicals. [possibly oil pollution related]

[from Chemical Abstracts 91(3):#14842s. 1979]

79D-1247

SENSITIVITY OF THREE MICROALGAE TO CRUDE OILS AND FUEL OILS

Batterton, J.C., K. Winters, and C. Van Baalen. 1978.

Marine Environmental Research (1):31-41.

Crude oil, Fuel oil, Aromatic hydrocarbons, WSF, Toxicity, Algae, Microorganisms

Four crude and five fuel oils were tested for their toxicity to three microalgae and the results are presented. The data suggest that the toxicity of whole fuel oils is due to the less water-soluble compounds in the higher boiling aromatic fraction.

[from Chemical Abstracts 89(23):#191880g. 1978]

79D-1248

SENSITIVITY OF THREE MICROALGAE TO CRUDE OILS AND FUEL OILS

Batterton, J.C., K. Winters, and C. Van Baalen. 1978.

Report CONTRIB-275, NSF/IDOE-78/138, Grants NSF OCE73-9740-A01, NSF-OCE76-83913. 12 p.

Crude oil, Fuel oil, Biological effects, Algae, Microorganisms, PAH, Toxicity

Four crude and five fuel oils have been tested for toxicity with a blue green algae, a green algae, and a diatom. Four of the fuel oils inhibited photosynthesis, while paraffinic and asphaltic fractions of fuel oil were non-toxic. Classes of PAH not accountable for toxicity observed include naphthalene, methylnaphthalenes, dibenzothiophenes, phenanthrenes, and compounds with volatilities greater than methylnaphthalenes.

[from Government Reports Announcements 79(6):84. #PB-289 049. 1979]

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1249

SEABIRD POLLUTION RESEARCH HAS GONE ASTRAY [editorial]

Bourne, W.R.P. 1979.

Marine Pollution Bulletin 10(6):149-150.

Birds, Biological effects, *Research

The author argues that "research into the effects of pollution on seabirds has lost its way." The importance of sublethal biochemical effects of oil pollution, which is studied extensively in North America, is questioned relative to the direct effect of oil in killing birds. It is the author's feeling that chronic oil pollution is decreasing and that concern for its increase has distracted attention from the more insidious effects of toxic chemicals.

79D-1250

FISH PREDATION ON OIL CONTAMINATED PREY FROM THE REGION OF THE ARGO MERCHANT OIL SPILL

Bowman, R.E., and R.W. Langton. 1978.

In the Wake of the Argo Merchant. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 137-141.

Biological effects, Fish, Food web, Toxicity, Argo Merchant spill

The stomach contents of 21 species of fish and squid were analyzed to determine the potential impact of Argo Merchant oil on the fish stocks of the North Atlantic. Two potential pathways were established for the oil to have been passed on to the higher trophic levels.

79D-1251

HISTOPATHOLOGICAL ANALYSIS OF BENTHIC ORGANISMS FROM THE VICINITY OF THE ARGO MERCHANT WRECK

Brown, R.S., and K.R. Cooper. 1978.

In the Wake of the Argo Merchant. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 96-102.

Biological effects, Sublethal effects, Marine organisms, Benthos, Argo Merchant spill

A variety of benthic species were collected two months and seven months following the spill and examined histopathologically. The findings suggest that the effects of the spilled oil were, for the most part, within the physiological toleration limits of the macrobenthos, and that the overall impact of the spill was minor.

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1252

BIOASSAYS WITH A NATURAL ASSEMBLAGE OF BENTHIC MACROINVERTEBRATES

Burks, S.L., and J.L. Wilhm. 1977.

American Society for Testing and Materials, Special Technical Publication 634. p. 127-136.

Refineries, Wastewaters, Toxicity, Bioassay, Invertebrates, Benthos

A bioassay method for determining the effects of environmental contaminants on populations of benthic macroinvertebrates is described. Continuous flow exposure tests for 30 and 32 days indicated that activated sludge-treated petroleum refinery wastewater caused a greater decrease in species diversity, number of taxa, and mean density of individuals than the sequential activated sludge-dual media-activated carbon treated effluent. The procedure permitted measurement of both pollution-sensitive and tolerant organisms.

79D-1253

BIOLOGICAL EFFECTS OBSERVED ALONG THE NORTHWEST COAST OF BRITTANY AS A RESULT OF THE AMOCO CADIZ OIL SPILL

Cross, F.A. 1979.

American Association for the Advancement of Science National Meeting, 145th, Houston, Texas, 3-8 January 1979. Washington, D.C., AAAS, 1979. p. 44. Abstracts.

Amoco Cadiz spill, Biological effects, Shorelines, Mortality, Birds, Fisheries, France

Adverse biological effects of the spill were observed along about 150 km of coastline northwest of Brittany. Intertidal communities on coastlines facing in a westerly direction, the Aber-Benoit estuary, and Rulosquest Marsh were most severely impacted. More than 3200 dead birds were recovered; about 85% of these were shag cormorant, guillemot, razorbill, and puffin. The kelp-mariculture industry and the oyster fishery were among the most heavily impacted commercial fishing industries.

79D-1254

BIOLOGICAL OBSERVATIONS

Cross, F.A., W.P. Davis, D.E. Hoss, and D.A. Wolfe. 1978.

The Amoco Cadiz Oil Spill, A Preliminary Scientific Report. W.N. Hess (ed.). NOAA/EPA Special Report. Washington, D.C., Government Printing Office, 1978. p. 197-215.

Amoco Cadiz spill, Biological effects, Shorelines, Mortality, Birds, Fisheries, France

Some of the biological consequences of the Amoco Cadiz oil spill were assessed. Activities at selected sites included observations and photographs of biological effects along the coastline, visiting two bird hospitals and a marine sanctuary, and conducting interviews with representatives of various segments of the fishing industry.

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1255

ACUTE AQUATIC TOXICITY AND DISPERSING EFFECTIVENESS OF OIL SPILL DISPERSANTS: RESULTS OF A CANADIAN OIL DISPERSANT TESTING PROGRAM (1973 TO 1977) Doe, K.G., and P.G. Wells. 1978.

Chemical Dispersants for the Control of Oil Spills. L.T. McCarthy, Jr., G.P.L. Lindblom, and H.F. Walter (eds.). Philadelphia, American Society for Testing and Materials, 1978. p. 50-65. ASTM Special Technical Publication 659.

Dispersants, Acute effects, Toxicity, Performance testing, Canada

An oil spill dispersant testing program was initiated in 1973 to evaluate the toxicity and dispersing effectiveness of dispersants submitted to Fisheries and Environment, Canada for approval prior to use in Canadian waters. Of the 19 dispersants initially screened, six passed both the toxicity and effectiveness criteria and were placed on the Canadian standard list of acceptable oil spill dispersants.

79D-1256

AMERICAN-SOVIET SYMPOSIUM ON THE BIOLOGICAL EFFECTS OF POLLUTION ON MARINE ORGANISMS (1ST)

Duke, T.W., and A.I. Simonov. 1978.

Report EPA/600/09-78/007. 176 p.

Biological effects, Analytical techniques, Environmental effects, Marine organisms, *Proceedings

Discussed in this symposium report are state-of-the-art for hydrobiological analysis of basic structural components of marine ecosystems and the influence of pollutants on these components. Results of laboratory research are presented. [possibly oil pollution related]

[from Government Reports Announcements 79(1):69. #PB-285 923. 1979]

79D-1257

REDUCTION OF BLOOD PLASMA COPPER CONCENTRATIONS IN A MARINE FISH FOLLOWING A SIX MONTH EXPOSURE TO CRUDE OIL

Fletcher, G.L., J.W. Kiceniuk, M.J. King, and J.F. Payne. 1979.

Bulletin of Environmental Contamination and Toxicology 22(4/5):548-551.

Fish, Crude oil, Toxicity, *Plasma, *Copper

Total protein, Cu^{++} , Zn^{++} , Ca^{++} , and Mg^{++} concentrations were measured in plasma of cunner (*Tautogolabrus adspersus*) following a six-month exposure to a surface slick of Venezuelan crude oil. Copper concentrations were significantly lower in oil-exposed females, and possibly in males, than in controls; the other plasma components measured were not significantly different between the oiled and control groups.

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1258

CARCINOGENS FOUND IN THE PETROLEUM AND PETROCHEMICAL INDUSTRIES (CITATIONS FROM THE AMERICAN PETROLEUM INSTITUTE DATA BASE)

Harrison, E.A. 1978.

Report NTIS/PS-78/1345. 185 p.

Oil industry, Petrochemicals, Carcinogens, Health hazards, Toxicity, Regulations, Bibliographies

These worldwide citations pertain to petroleum and petrochemical-related carcinogens. Studies are included concerning health hazard evaluations, government regulations, and toxicity determinations of carcinogens. [possibly oil pollution related]

[from Government Reports Announcements 79(5):75. #NTIS/PS-78/1345. 1979]

79D-1259

SHELLFISH TECHNICAL ASSISTANCE

Hickey, J.M. 1978.

Report NOAA-8103101. 139 p. Final report.

Hydrocarbons, Biological effects, Mollusks, Resource management, Massachusetts

The last segment of the Massachusetts "Shellfish Technical Assistance" program is detailed. Major consideration in this segment (1/77-12/77) includes oil spill assessment, statewide hydrocarbon analysis, local management programs, and management of moderately contaminated areas.

[from Government Reports Announcements 7(4):94. #PB-288 933. 1979]

79D-1260

EMBRYOTOXIC AND TERATOGENIC EFFECTS OF CRUDE OIL ON MALLARD EMBRYOS ON DAY ONE OF DEVELOPMENT

Hoffman, D.J. 1979.

Bulletin of Environmental Contamination and Toxicology 22(4/5):632-637.

Birds, Crude oil, Toxicity, Development, Growth, Mortality, *Anas platyrhynchos, *Hatchability

At 24 hr of development, eggs of mallard ducks (Anas platyrhynchos) were treated externally with South Louisiana crude oil and monitored for 18 days. Sex, embryonic weights, crown-rump lengths, bill lengths, and external abnormalities were recorded in the survivors. Major declines in survival occurred between days 3 and 6 and between days 7 and 10. Survivorship and embryonic growth were lower and numbers of defects higher in oil-treated eggs than in controls. Aliphatic hydrocarbons used to treat an additional group of eggs had no effect on survival, growth, or abnormalities, indicating that the toxicity of the crude oil was not due to pore blockage and oxygen deprivation.

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1261

MESA NEW YORK BIGHT ATLAS: MARINE AND COASTAL BIRDS

Howe, M.A., R.B. Clapp, and J.S. Weske. 1978.

Report NYSSGP-AM-78-003, NOAA-78102616. 92 p. NTIS Report PB-290334.

Birds, Coastal waters, New York, Environmental effects

A review is presented on the bird inhabitants of the New York Bight region, including a discussion of effects of oil pollution.

[from Chemical Abstracts 91(7):#50371w. 1979]

79D-1262

QUANTITATIVE MAMMALIAN CELL GENETIC TOXICOLOGY: STUDY OF THE CYTO-TOXICITY AND MUTAGENICITY OF 70 INDIVIDUAL ENVIRONMENTAL AGENTS RELATED TO ENERGY TECHNOLOGIES AND 3 SUBFRACTIONS OF CRUDE SYNTHETIC OIL IN THE CHO/HGPRT SYSTEM

Hsie, A.W., J.P. O'Neill, and J.R. Sebastian. 1978.

Report CONF-780227-5, Contract W-7405-ENG-26. 37 p.

Toxicity, Mutagens, Crude oil, Chronic effects

Study results are presented which have determined the mutagenicity of a number of diversified agents including 27 polycyclic hydrocarbons. "The assay appears to be applicable to monitoring of the genetic toxicity of crude organic mixtures..."

[from Government Reports Announcements 78(19):41. #CONF-780227-5. 1978]

79D-1263

ONSHORE SURVEY OF MACROBENTHOS

Hyland, J.L. 1978.

The Amoco Cadiz Oil Spill, a Preliminary Scientific Report. W.N. Hess (ed.). NOAA/EPA Special Report. Washington, DC, Government Printing Office, 1978, p. 216-228. (Appendix, Chapter 5)

Amoco Cadiz spill, Biological effects, Benthos, Invertebrates, Onshore, Toxicity, France

A preliminary onshore survey following the Amoco Cadiz spill was conducted to evaluate the extent of the oiling of benthic macrofaunal species and the magnitude of onshore ecological impact.

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1264

AN OIL VULNERABILITY INDEX FOR MARINE ORIENTED BIRDS

King, J.G., and G.H. Sanger. 1979.

Conservation of Marine Birds of Northern North America, International Symposium held at the Seattle Hyatt House, Seattle, Washington, 13-15 May 1975. Washington, DC, Department of the Interior, Fish and Wildlife Service, 1979. p. 227-239.

Biological effects, Birds, Mortality, *Vulnerability index

"The 176 species of birds using marine habitats of the Northeast Pacific are graded on the basis of 20 factors that affect their survival." The total score is the Oil Vulnerability Index (OVI). Using this system, one can rank the avifauna of different areas according to their vulnerability to environmental hazards and aid in making management decisions.

79D-1265

EFFECT OF PETROLEUM PRODUCTS AND DISPERSANTS ON THE SURVIVAL OF ZOOPLANKTON SPECIES IN THE WHITE SEA [in Russian]

Koroleva, A.M. 1979.

Biologicheskije Nauki 1:105.

Fuel oil, Dispersants, Zooplankton, Toxicity, Mortality

Numbers of White Sea zooplankton decreased significantly following exposure to diesel fuel, motor oil and two dispersants. The degree of effect depended on the type of zooplankton and the concentration and time of exposure to the toxicants.

[from Chemical Abstracts 91(3):#14720a. 1979]

79D-1266

EFFECT OF DISSOLVED PETROLEUM PRODUCTS ON LIVER CARBOHYDRATE METABOLISM IN TWO BLACK SEA FISH SPECIES [in Russian]

Kovaleva, G.I. 1979.

Biologiya Morya, Vol. 1:66-71.

Fish, Petroleum products, Biological effects, Metabolism, *Liver, *Glucose

"Addition of dissolved petroleum products to water caused hyperglycemia, decrease in liver glycogen, and a decrease in the rate of glucose release by liver slices in Spicara smaris and Solea lascaris nasuta. Incubation of liver slices from intact fish in dissolved petroleum products stimulated glucose excretion."

[from Chemical Abstracts 91(3):#14768x. 1979]

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1267

EFFECTS OF THE WATER SOLUBLE FRACTION OF A VENEZUELAN HEAVY FUEL OIL (NO. 6) ON COD EGGS AND LARVAE

Kuhnhold, W.W. 1978.

In the Wake of the Argo Merchant. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 126-130.

Biological effects, Fuel oil, Fish, Mortality, Reproduction, Argo Merchant spill

One-half, three, and seven day old eggs, and two, four, and eight day old larvae were exposed to the WSF of Bunker C oil in static tests. Hatching success, survival times, and heartbeat rates were measured and compared with control groups. An attempt was made to extrapolate laboratory findings to field conditions which existed at the time of the Argo Merchant spill.

79D-1268

GENETIC TOXICITY TESTING FOR COMPLEX ENVIRONMENTAL EFFLUENTS

Larimer, E.W., and J.L. Epler. 1978.

Report CONF-780327-1, Contract W-7405-ENG-26. 10 p.

Biological effects, Crude oil, Bioassay, Mutagens, Toxicity

Various test systems were used to assay the mutagenic potential of crude synthetic oils and natural crude oils. Mutagenicity data on isolated or suspected organic components are given. "The results support the use of the short-term genetic tests in determining the advantages of coupling the bioassays with chemical fractionation."

[from Energy Research Abstracts 3(16):#38258. 1978]

79D-1269

PHOTOOXIDATION PRODUCTS OF A FUEL OIL AND THEIR ANTIMICROBIAL ACTIVITY

Larson, R.A., T.L. Bott, L.L. Hunt, and K. Rogenmuser. 1979.

Environmental Science & Technology 13(8):965-969.

Fuel oil, Oxidation, GC/MS, Microorganisms, Toxicity, *Photooxidation

"Molecular identification and antimicrobial activity are reported for some constituents of the acidic fraction of no. 2 fuel oil photoproducts."

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1270

A LITERATURE REVIEW - PROBLEM DEFINITION STUDIES ON SELECTED TOXIC CHEMICALS. VOLUME 8. ENVIRONMENTAL ASPECTS OF DIESEL FUEL AND FOG OILS SGF NUMBER 1 AND SGF NUMBER 2 AND SMOKE SCREENS GENERATED FROM THEM
Liss-Suter, D. 1978.

Report AD-A056 021, Contract DAMD17-77-C-7020. 131 p. Final report.

Biological effects, Toxicity, Marine organisms, Birds, Fish, Mollusks, Zooplankton, Bibliographies, *Diesel fuel

Topics investigated in the title study include the effects of petroleum fuels and lubricants on waterfowl, birds, insects, plants, nematodes, fish, marine worms, mollusks, crustaceans, and other marine organisms, phytoplankton, microorganisms, and zooplankton.

[from Government Reports Announcements 78(21):94. #AD-A056 021. 1978]

79D-1271

FIELD AND LABORATORY MEASUREMENTS OF STRESS RESPONSES AT THE CHROMOSOME AND CELL LEVELS IN PLANKTONIC FISH EGGS AND THE OIL PROBLEM

Longwell, A.C. 1978.

In the Wake of the Argo Merchant. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 116-125.

Biological effects, Fish, Reproduction, Mortality, Growth, Argo Merchant spill, *Cytogenetics

Results are discussed of the post Argo Merchant spill examination of dissected embryos of 79 cod and 162 pollock eggs to detect abnormalities in chromosome makeup at the early embryo stage. It is believed that a reliable, recently developed methodology for conducting cytological and cytogenetic studies on fish eggs can be used as one of the most sensitive practical indicators of the sublethal effects of marine pollutants on reproduction in fish.

79D-1272

DISPOSITION AND METABOLISM OF AROMATIC HYDROCARBONS IN MARINE ORGANISMS
Malins, D.C., T.K. Collier, and H.R. Sanborn. 1979.

American Chemical Society Symposium Series 1979, 79 (Pesticide and Xenobiotic Metabolism in Aquatic Organisms):57-75.

PAH, Marine organisms, Metabolism, Behavior

"A review with 48 references." [possibly oil pollution related]

[from Chemical Abstracts 91(5):#33584a. 1979]

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1273

A BIOLOGIST LOOKS AT OIL IN THE SEA

Mann, K.H. 1978.

Shore & Beach 46(4):27-29.

Ecosystems, Biological effects, Plants, Animals, Arctic

In assessing biological effects of oil spills, three basic biological principles must be taken into consideration: The built-in variability in the response of plant and animal populations to pollution; the productivity and vulnerability of the nearshore environment; and the reduction in number of species as a response to stress in a biotic community. The author discusses these three principles in light of Arctic ecosystems which would be far more severely impacted by oil pollution than ecosystems in temperate waters.

79D-1274

OCCURRENCE OF OILY FISH AND FOOD CHAIN OF PETROLEUM COMPOUNDS. II. TRANSFER OF N-PARAFFINS IN PETROLEUM AND OIL DISPERSER TO SHELLFISH [in Japanese]

Miyake, Y. 1978.

Okayama Igakkai Zasshi 90(5-6):613-622.

Crude oil, Hydrocarbons, Mollusks, Uptake, Depuration, Food web

During an 8-day exposure of the clam Venerupis amygdala japonica to a crude oil suspension, the C₁₃-C₂₀ compounds of an n-paraffin series were taken up by the clam. Concentration factors of 40-176 for C₁₂-C₂₄ n-paraffins were observed in the clams in 5 days. The C₁₃-C₁₅ compounds were released sooner than the C₁₆-C₂₀ compounds in seawater.

[from Chemical Abstracts 89(25):#209963y. 1978]

79D-1275

CHEMICAL CARCINOGENESIS: POLYCYCLIC AROMATIC HYDROCARBONS AND RELATED COMPOUNDS

National Cancer Institute. 1979.

Report NTISUB/E/356. ___ p. Cancergram CK07.

PAH, Carcinogens, Health hazards, Biological effects, Chronic effects

The title cancergram deals with the carcinogenicity of PAHs and certain related nitrogen heterocyclic analogs having similar mechanisms of carcinogenesis. It covers activation and metabolism, macromolecular binding, cellular effects and lesions, mutagenicity and in vitro testing, and analytical methods for the compounds and their derivatives. This report excludes studies in which PAH's have been used simply as a tool to induce experimental tumors for other studies. [possibly oil pollution related]

[from Government Reports Announcements 79(5):85. #NTISUB/E/356. 1979]

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1276

TOXICITY TESTING IN THE UNITED KINGDOM FOR THE EVALUATION OF OIL SLICK DISPERSANTS

Norton, M.G., F.L. Franklin, and R.A.A. Blackman. 1978.
Chemical Dispersants for the Control of Oil Spills. L.T. McCarthy, Jr., G.P.L. Lindblom, and H.F. Walter (eds.). Philadelphia, American Society for Testing and Materials, 1978. p. 18-34. ASTM Special Technical Publication 659.

Dispersants, Toxicity, Bioassay, Beaches, Marine organisms

Following passage of the 1974 Dumping at Sea Act, dispersant evaluation methods in UK waters were reviewed and dispersants are now licensed for offshore or beach use, based on two tests to assess the environmental effect of dispersant use. Both the "sea" test and the "beach" test compare the effects of a dispersant with a control designed to simulate the situation where the dispersant is not used. The UK criteria for licensing products on the basis of these test results are discussed.

79D-1277

EFFECT OF SOME PETROLEUM PRODUCTS AND DISPERSANTS ON THE POPULATION AND PRODUCTIVITY OF BACTERIOPLANKTON IN THE WHITE SEA

Ogarkova, O.A., and V.N. Maksimov. 1978.
Biologicheskie Nauki 6:140.

Fuel oil, Dispersants, Toxicity, Bacteria, Microorganisms, *Bacterioplankton, *White Sea

Diesel fuel and motor oil had a favorable effect on bacterioplankton while the dispersant Diproxamine 57 had an inhibitory effect within two days of exposure of the microorganisms to 10 mg/L.

[from Chemical Abstracts 89(25):#209886a. 1978]

79D-1278

TRANSFER OF PETROLEUM POLYCYCLIC AROMATIC HYDROCARBONS TO SHELLFISH

Ogata, M., and Y. Yamasaki. 1978.
Igaku to Seibutsugaku 96(5):379-383.

Mollusks, PAH, Concentrations, Uptake, Chemical analysis, *Clams

"Short-necked clams were reared for 8 days in seawater containing 50 ppm petroleum in which 3,4-benzopyrene was dissolved, and then reared for another 8 days in clean seawater." Analysis of the edible part of the clam by liquid chromatography showed that PAH concentration was increased day by day, with an accumulation coefficient on the eighth day of 136. The subsequent PAH half-life was 5 days.

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1279

FURTHER STUDIES ON THE EFFECT OF PETROLEUM HYDROCARBONS ON MIXED-FUNCTION OXIDASES IN MARINE ORGANISMS

Payne, J.F., and N. May. 1979.

American Chemical Society Symposium Series 1979, 99 (Pesticide Xenobiotic Metabolism Aquatic Organisms):339-347.

Biological effects, Chemical effects, Fish, Invertebrates, Hydrocarbons, *Mixed-function oxidase activity

In contrast to various invertebrate species exposed to high concentrations of petroleum, fish showed induction of mixed function oxidase.

However, when fish were exposed to pure hydrocarbons, no induction of aromatic hydrocarbon hydroxylase was noted. Oil dispersants had little effect on enhancing the inducing effect of oil spills.

[from Chemical Abstracts 91(7):#50611z. 1979]

79D-1280

OBSERVATIONS ON ARGO MERCHANT OIL IN ZOOPLANKTON OF NANTUCKET SHOALS

Polak, R., A. Filion, S. Fortier, J. Lanier, and K. Cooper. 1978.

In the Wake of the Argo Merchant. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 109-115.

Biological effects, Zooplankton, Crustaceans, Analytical techniques, Argo Merchant spill, *Spectrofluorometry

Zooplankton samples taken on Nantucket shoals were subjected to ultra-violet spectrofluorometric analysis to establish relative levels of contamination. Analysis revealed the presence of an oil-like material in the gut of some crustacean zooplankton. Spectrofluorometric analysis was proven to be of use in the definition of the geographic extent of oil in the water column and the persistence of oil residues following an oil spill.

79D-1281

EFFECT OF THE ARGO MERCHANT OIL SPILL ON BIRD POPULATIONS OFF THE NEW ENGLAND COAST 15 DECEMBER 1976 - JANUARY 1977

Powers, K.D., and W.T. Ramage. 1978.

In the Wake of the Argo Merchant. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 142-148.

Biological effects, Birds, Mortality, Toxicity, Argo Merchant spill

The title article documents the result of bird mortality studies in December 1976. During the study 1120 birds of 13 species were sighted, 92 percent of which were gulls. Approximately 59 and 41 percent of the total number

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

of herring and great black-backed gulls were oiled. Examination of fifteen specimens of five species of beached birds indicated that lungs and kidneys were the most seriously affected vital organs. Data indicate that the overall impact of the spill on coastal bird populations was minimal.

79D-1282

INTERACTIONS BETWEEN PETROLEUM AND BENTHIC FAUNA AT THE ARGO MERCHANT SPILL SITE

Pratt, S.D. 1978.

In the Wake of the Argo Merchant. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 131-136.

Biological effects, Marine organisms, Benthos, Argo Merchant spill

Visual inspection of samples and partial identification of benthos in 14 samples provide the basis for the conclusions in the title report. The channel bottom fauna had a high standing crop of both sessile and motile species. There was a slight increase in density and diversity of interstitial benthos at the bow of the wreck in July 1977 in an oil concentration of 0.2-0.6 ppm compared to a concentration of 4-122 ppm at the same site in February 1977.

79D-1283

AVIAN RADIOECOLOGY ON A NUCLEAR POWER STATION SITE. OCCURRENCE AND EFFECTS OF CHRONIC LOW-LEVEL OIL CONTAMINATION IN A POPULATION OF SOOTY TERNS (STERNA FUSCATA)

Robertson, M.J. 1978.

Report C00-2308-006. 48 p.

Birds, Contamination, Chronic effects, Sublethal effects, *Sterna fuscata

The title population was monitored from 1962 to 1977 for the occurrence of oil on plumage and effects of chronic, low-level contamination. Occurrence of oiled plumage ranged from 0.2% to 12% with increasing incidence from the 1960's to the 1970's. Oiling had no effect on bird weight or nesting. Sooty terns were less susceptible to oil pollution than other sea birds because of their mode of food capture.

[from Chemical Abstracts 91(3):#14743k. 1979]

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1284

AFTERMATH OF HUGE AMOCO CADIZ SPILL PROVES EFFECTS OF OIL ON MARINE LIFE
Russell, J. 1979.

National Fisherman 60(4):52-53.

Marine organisms, Fisheries, Environmental effects, Mortality, Amoco Cadiz spill, France

This article recounts the Amoco Cadiz tanker grounding off the coast of Brittany in March 1978 and discusses the impacts on shellfish and commercial fisheries. About 40,000 to 50,000 tons of the spilled oil are now resting on the nearshore sea floor, and the long-term effects of this remaining oil are as yet unclear.

79D-1285

MICROSCOPIC OBSERVATIONS ON VERTEBRATES AND INVERTEBRATES COLLECTED NEAR THE ARGO MERCHANT OIL SPILL

Sawyer, T.K. 1978.

In the Wake of the Argo Merchant. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 93-95.

Biological effects, Baseline studies, Fish, Mollusks, Crustaceans, Argo Merchant spill, *Histopathology

Fish, mollusks, crustaceans, sea urchins, and starfish were collected near the wreck site. Histopathological findings that could be directly attributed to the exposure to petroleum were not seen in any of the tissues examined. This report summarizes observations made on this diverse group of vertebrate and invertebrate species.

79D-1286

THE ARGO MERCHANT SPILL AND THE FISHERIES

Sherman, K., and D. Busch. 1978.

In the Wake of the Argo Merchant. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 149-165.

Biological effects, Fish, Mortality, Zooplankton, Toxicity, Argo Merchant spill

Results of the title study indicate that the impact of oil spilled from the Argo Merchant on fish stocks has not been catastrophic. No evidence of large-scale mortalities of juvenile or adult fish was observed in the 12 months following the spill. There was evidence of oil contamination in fish, shellfish, and zooplankton populations in the area of the spill. A more significant problem in the long run concerns the chronic background levels of petroleum hydrocarbons present in the surface waters inhabited by fish eggs and larvae.

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1287

MIXED FUNCTION OXYGENASE ACTIVITY IN BLUE CRAB, CALLINECTES SAPIDUS:
TISSUE DISTRIBUTION AND CORRELATION WITH CHANGES DURING MOLTING AND
DEVELOPMENT

Singer, S.C., and R.L. Lee. 1977.

Report NSF/IDOE-77/212, Grant NSF-OCE 76-84108. 11 p.

PAH, Metabolism, Biological effects, Growth, *Callinectes sapidus

A group of microsomal enzymes, referred to as mixed-function oxygenases, are responsible for the metabolic modification of many foreign compounds in animals. Arylhydrocarbon oxygenase is involved in the hydroxylation of the aromatic ring. The occurrence of this activity in tissues of the blue crab is discussed.

[from Government Reports Announcements 79(2):66. #PB-287 074. 1979]

79D-1288

EFFECTS OF KUWAIT OILS ON FEEDING RATES OF COPEPODS

Spooner, M.F., and C.J. Corkett. 1979.

Marine Pollution Bulletin 10(7):197-202.

Crude oil, WSF, Dispersants, Toxicity, Sublethal effects, Crustaceans,
*Copepods

"Sublethal toxicity and recovery tests were made on feeding rates of 4 species of copepods using Kuwait oils kept in suspension on a slowly rotating wheel. Counts of faecal pellets from individuals fed on standard algal suspension were made after 20 h at 12° C. This exposure produced only marginal effects at 1 and 2 ppm, but 10 ppm produced definite effects on planktonic species. Recoveries were generally quite good from 'weathered' oil treatments. Oils emulsified alone did not produce significantly different effects in these experiments from oils emulsified with dispersants."

79D-1289

BUNKER C FUEL OIL REDUCES MALLARD EGG HATCHABILITY

Szaro, R.C. 1979.

Bulletin of Environmental Contamination and Toxicology 22(6):731-732.

Fuel oil, Toxicity, Birds, Mortality, *Anas platyrhynchos, *Hatchability

Bunker C fuel oil was applied to the surface of mallard duck (Anas platyrhynchos) eggs in amounts of 5, 10, 20, and 50 µl on the eighth day of incubation. Hatching success and survival up to six days after treatment were significantly reduced in all oil-treated groups when compared to controls.

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1290

SOME PHYSIOLOGICAL EFFECTS OF THE ARGO MERCHANT OIL SPILL ON SEVERAL TELEOSTS AND BIVALVE MOLLUSKS

Thurberg, F.P., E. Gould, and M.A. Dawson. 1978.

In the Wake of the Argo Merchant. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 103-108.

Biological effects, Mollusks, Fish, Sublethal effects, Argo Merchant spill

Blood samples were taken from a variety of teleost species and bivalves and subjected to physiological and biochemical tests. Disruption of serum ions appeared in winter flounder, yellowtail flounder and haddock. Gill tissue oxygen consumption appeared in first samples of ocean scallops and horse mussels, whereas malic dehydrogenase activity was significantly decreased in scallop muscles. Other findings are discussed and compared to samples taken outside of the impacted areas.

79D-1291

EVALUATION OF MARINE INVERTEBRATE SPECIES DIVERSITY AS AN OIL TOXICITY INDICATOR FROM LABORATORY STUDIES

Vanderhorst, J.R., and P. Wilkinson. 1978.

Canada, Fisheries and Marine Service, Technical Report 818:134-152.

Fuel oil, Bioindicators, Toxicity, Analytical techniques, Algae, Invertebrates, *Species diversity

Artificial substrates colonized by marine algae and invertebrates were exposed to seawater contaminated with No. 2 fuel oil for six months. Results indicated a depression in species diversity and species richness for oil-treated colonies and a depression in species diversity for artificially-lighted colonies as compared to controls. Major compositional shifts occurred in both treated and control colonies during the course of the experiment indicating shortcomings in the use of species diversity as a toxicity indicator.

[from Chemical Abstracts 91(1):#880r. 1979]

79D-1292

DAPHNIA FOR SUPERIOR SUBLETHAL TESTING

Westlake, G.F., D.W. Rowe, J.B. Sprague, T.A. Heming, and I.T. Brown. 1978. Canada, Fisheries and Marine Service, Technical Report 818:20-30.

Refineries, Wastewaters, Sublethal effects, Toxicity, Monitoring, Bio-indicators, *Daphnia

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

A study conducted to develop a sublethal toxicity test and document the toxicity of an oil refinery effluent meeting federal standards found Daphnia pulex to be the most sensitive and easily used organism on which to carry out the tests.

[from Chemical Abstracts 91(1):#878w. 1979]

79D-1293

CHEMICAL IMMOBILIZATION, BASELINE HEMATOLOGICAL PARAMETERS AND OIL CONTAMINATION IN THE SEA OTTER

Williams, T.D. 1978.

Report MMC-77/06, Contract MM7AD094. 33 p. Final report.

Animals, Biological effects, Toxicity, Contamination, Marine mammals,
*Sea otter

The focus of this study was to compare techniques of chemical immobilization, investigate blood parameters, and explore the effects of oil contamination upon the sea otter, Enhydra laris. A contaminated otter was cleaned and released with a telemetry transmitter. Initial studies of three intra-muscular anesthetics indicated that Entorphone and C1744 have potential for safe field use with otters.

[from Government Reports Announcements 78(23):92. #PB-283 969. 1978]

2. Physical and Chemical Aspects

79D-1294

EXPERIMENT FOR TYPING FRESH GROUND WATER IN THE PEOPLE'S REPUBLIC OF BULGARIA ACCORDING TO THE DEGREE OF VULNERABILITY FOR POLLUTION [English summary]

Antonov, Kh., and B. Raikova. 1978.

Khidrologiya i Meteorologiya 27(6):12-20.

Groundwater, Soil, *Vulnerability, *Bulgaria

The relation between soil structure and degree of fresh groundwater pollution is discussed. [possibly oil pollution related]

[from Chemical Abstracts 91(4):#26965x. 1979]

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1295

WEATHERING EFFECTS ON THE CHEMICAL COMPOSITION OF THE AMOCO CADIZ OIL

Calder, J.A. 1979.

American Association for the Advancement of Science National Meeting, 145th, Houston, TX, 3-8 Jan. 1979. Washington, DC, AAAS, 1979. p. 43-44. Abstracts.

Amoco Cadiz spill, Weathering, Chemical effects, Emulsions, Aromatic hydrocarbons, France

The Amoco Cadiz cargo was transformed into a water-in-oil emulsion (mousse) almost immediately after release from the tanker or even prior to release; floating mousse adjacent to the ship contained 40-60% water, while beach mousse contained up to 75% water. Major effects of weathering included significant loss of n-alkanes through C_{14} and aromatic hydrocarbons through C_3 naphthalenes, increase in the proportion of polar material, and some reduction in alkane/isoprenoid ratios.

79D-1296

CHEMICAL COMPOSITION OF SELECTED ENVIRONMENTAL AND PETROLEUM SAMPLES FROM THE AMOCO CADIZ OIL SPILL

Calder, J.A., J. Lake, and J. Laseter. 1978.

The Amoco Cadiz Oil Spill, a Preliminary Scientific Report. W.N. Hess (ed.). NOAA/EPA Special Report. Washington, DC, Government Printing Office, 1978. p. 21-83.

Amoco Cadiz spill, Weathering, Chemical effects, Aromatic hydrocarbons, France

The title study investigated the nature and composition of the initial petroleum entering the environment and the transformation of the oil during the weathering process.

79D-1297

SOME OBSERVATIONS ON THE MECHANISM AND CHEMISTRY ASPECTS OF CHEMICAL DISPERSION

Canevari, G.P. 1978.

Chemical Dispersants for the Control of Oil Spills. L.T. McCarthy, Jr., G.P.L. Lindblom, and H.F. Walter (eds.). Philadelphia, American Society for Testing and Materials, 1978. p. 5-17. ASTM Special Technical Publication 659.

Surfactants, Dispersion, Behavior, Physical aspects, Chemical effects

The methodology and role of the surface active agent in the generation of finely dispersed oil droplets are reviewed. The incentives, concerns, and current status of chemical dispersion are discussed.

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1298

PROTECTION OF THE SOIL, WATER, SEWERS AND CLARIFICATION PLANTS FROM THE USE OF MINERAL OILS [in German]

Eiling, R. 1978.

Schmierungstechnik 9(5):148-152.

Fate, Environmental effects, Toxicity, Groundwater, Soil

Various properties of mineral oils are described, including their penetration powers on different constituents of the environment and their toxic, noxious, corrosive and explosive properties.

[from Chemical Abstracts 89(24):#203530h. 1978]

79D-1299

INVESTIGATIONS OF PHYSICAL PROCESSES

Galt, J.A. 1978.

The Amoco Cadiz Oil Spill, a Preliminary Scientific Report. W.N. Hess (ed.). NOAA/EPA Special Report. Washington, DC, Government Printing Office, 1978. p. 7-20.

Physical aspects, Physical effects, Amoco Cadiz spill, Crude oil, Movement, Distribution, France

The physical processes that affect the behavior of oil in the marine environment include those processes that control the movement and mixing of ocean waters and those processes that affect the oil and its distribution as it floats in the water. The data collected at the Amoco Cadiz spill site will prove useful in the development of conceptual algorithms to describe fundamental processes of oil movement and will contribute to the further development of oil spill forecasting models.

79D-1300

INVESTIGATIONS OF BEACH PROCESSES

Gundlach, E.R., and M.O. Hayes. 1978.

The Amoco Cadiz Oil Spill, a Preliminary Scientific Report. W.N. Hess (ed.). NOAA/EPA Special Report. Washington, DC, Government Printing Office, 1978. p. 85-196.

Amoco Cadiz spill, Shorelines, Beaches, Sediments, Crude oil, Distribution, Physical aspects, France

Coastal processes and geomorphology played a major role in the dispersal and accumulation of the Amoco Cadiz oil once it came ashore. The details of oil erosion and burial were determined by resurveying 19 permanent beach profiles which were established during the first few days of the spill.

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1301

BEACH PROCESSES AND OIL SEDIMENT INTERACTIONS AT THE AMOCO CADIZ OIL SPILL SITE

Hayes, M.O., and E.R. Gundlach. 1979.

American Association for the Advancement of Science National Meeting, 145th, Houston, Texas, 3-8 January 1979. Washington, DC, AAAS, 1979. p. 43. Abstracts.

Amoco Cadiz spill, Shorelines, Sediments, Crude oil, Distribution, Physical effects, France

Coastal processes and geomorphology played a major role in the dispersal and accumulation of oil spilled from the Amoco Cadiz once it came ashore. The details of oil erosion and burial were determined by surveying 19 permanent beach profiles on three separate occasions. Results of the findings are presented.

3. Social and Economic Aspects

79D-1302

PUBLIC KNOWLEDGE AND PERCEPTIONS OF THE EFFECTS OF THE ARGO MERCHANT OIL SPILL

Fricke, P., and J. Maiolo. 1978.

In the Wake of the Argo Merchant. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 169-175.

Oil spills, Socioeconomic effects, Argo Merchant spill

The title paper explores the perceptions that residents of Cape Cod, Martha's Vineyard and Nantucket have of the nature of effects of oil spills that occurred in the area in December 1976 and January 1977. It is believed that knowledge of these perceptions "needs to be incorporated into any efforts to inform the public and into any planning for the prevention of or response to oil spills."

79D-1303

TEN YEARS AFTER. WHAT "THE SPILL" REALLY DID TO ECOLOGY AND SANTA BARBARA

Hayes, S. 1979.

Pacific Oil World 72(1):76-78.

Santa Barbara Channel, Oil spills, Socioeconomic effects, Oil industry, *Tourism

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

The impact of the 28 January 1969 blowout in the Santa Barbara Channel on the ecology movement and its consequences to the oil industry are examined from an industry perspective. The incident is claimed to have had little impact on tourism in Santa Barbara.

[from Petroleum Abstracts 19(33):#266,505. 1979]

79D-1304

ALASKA OCS SOCIOECONOMIC STUDIES PROGRAM. FIRST ANNUAL REPORT: SYNTHESIS OF FINDINGS

Peat, Marwick, Mitchell and Co. 1978.

Report BLM-MM-78-04, Control DI-AA550-CT6-61. 160 p.

OCS, Development, Socioeconomic effects, Oil industry

This report "conveys the major theoretical, methodological, and substantive findings which have emerged from the first twelve months of the Alaska OCS Socioeconomic Studies program." Findings presented contributed to the second year program design and are described in brief. [possibly oil pollution related]

[from Government Reports Announcements 78(18):236. #PB-281 536. 1978]

79D-1305

TEXAS GULF SHRIMPS AWAIT IMPACT OF LARGEST OIL SPILL

Sullivan, T. 1979.

National Fisherman 60(6):3, 118.

Ixtoc I blowout, Fisheries, Economic effects, Contamination, Texas,
*Shrimp industry

Possible economic impacts of the Ixtoc I well blowout and oil spill on the Texas shrimp industry are discussed. Tainting of the shrimp catch and the resultant devastation of the shrimp market is the area of greatest concern among shrimp fisheries.

79D-1306

POLLUTION: BIBLIOGRAPHY OF ENVIRONMENTAL ECONOMICS, VOL. 2

Turner, R.K., D.W. Pierce, and B.O. Pettman (eds.). 1977.

Bradford, England, MCB Books, 1977. ___ p.

Economics, Economic effects, Cost analysis, Bibliographies, Book review

The title bibliography contains citations of numerous environmental problems including water and marine pollution and economic costs associated with various control strategies.

[from Environmental Pollution 18(2):171. 1978]

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

4. Environmental Response and Recovery

[No entries.]

5. Baseline and Environmental Impact Studies

79D-1307

POLLUTION RESEARCH IN ARCTIC WATERS

Anon. 1979.

Northern Offshore 8(1):11-12.

Baseline studies, Offshore, Development, Alaska, Prudhoe Bay

Scientific investigations of Prudhoe Bay and the waters north of Alaska "will form the basis for a debate on the condition of these waters prior to petroleum activity."

[from Petroleum Abstracts 19(31):#266,006. 1979]

79D-1308

POLYNUCLEAR AROMATIC HYDROCARBONS IN BALTIMORE CANYON FISH

Brown, R.A., and R.J. Pancirov. 1979.

Environmental Science & Technology 13(7):878-879.

Baseline studies, PAH, Fish, OCS, Offshore, Development, Atlantic coast

A baseline study on the present levels of PAHs in fish of the Baltimore Canyon area off the east coast of the US was conducted in anticipation of future oil and gas activities. The results are tabulated and discussed.

79D-1309

WASHINGTON STATE REFINERIES: PETROLEUM, PETROLEUM DERIVATIVES AND WASTE-WATER EFFLUENT CHARACTERISTICS

Pizzo, T.T., T.L. Johnson, and G.W. Harskman. 1978.

Report EPA/600/7-78/040, Contract NOAA-03-6-022-35189. 186 p. Final report.

Environmental effects, Oil industry, Crude oil, Refining, Petroleum products, Wastewaters, Washington, Puget Sound

The title study describes in detail the types of petroleum and petroleum derivatives which could potentially reach the waters of Puget Sound through disposition of crude oils, refined products and wastewater effluent associated with the six Puget Sound refineries. Refining and waste treatment processes are described in detail.

[from Government Reports Announcements 78(22):130. #PB-283-401. 1978]

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1310

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. FINAL REPORTS OF PRINCIPAL INVESTIGATORS. VOLUMES 1, 2, 3. BIOLOGICAL STUDIES.

US National Oceanic and Atmospheric Administration. 1978.

Reports NOAA-78110701,2,3. Vol. 1, 494 p.; Vol. 2, 960 p.; Vol. 3, 623 p. Final reports.

OCS, Development, Baseline studies, Aquatic environment, Marine organisms, Alaska

Three volumes of final reports include eleven baseline studies of aquatic fauna and flora which will be used to determine potential effects of petroleum development on the Alaskan OCS.

[from Government Reports Announcements 79(4): 94. #PB-289-154,5,6. 1979]

79D-1311

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. PRINCIPAL INVESTIGATORS' REPORTS, OCTOBER-DECEMBER 1977. VOLS. I & II.

US National Oceanic and Atmospheric Administration. 1978.

Report NOAA-78053001, 2.Vol. I, 486 p.; Vol. II, 607 p. Quarterly report.

Baseline studies, OCS, Environmental effects, Development, Oil transport

Reports containing baseline studies are compiled in this quarterly report. This baseline data will be used to assess the potential environmental impact that might result from development of Alaska's OCS petroleum resources and from transport of crude oil.

[from Government Reports Announcements 78(20):217. #PB-283 679,680. 1978]

79D-1312

GUIDELINES FOR THE DESIGN AND CONDUCT OF OCS OIL AND GAS DEVELOPMENT BASELINE STUDIES

US Outer Continental Shelf Environmental Studies Advisory Committee. 1976.

Baseline studies, OCS, Development, Environmental effects

This report is intended to provide a set of guidelines for the design of OCS baseline studies for use by government agencies or private organizations.

[from Marine Geology 24(4):338. 1977]

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1313

MARINE BIOLOGICAL EFFECTS OF OCS PETROLEUM DEVELOPMENT

Wolfe, D.A. 1978.

Report NOAA-TM-ERL-OCSEAP-1, NOAA-78102601. Technical memo.

OCS, Development, Biological effects, NOAA, *OCSEAP, *Proceedings

The title document contains the proceedings of the first formal scientific review of the Biological Effects Studies managed by NOAA's OCS Environmental Assessment program, (OCSEAP).

[from Government Reports Announcements 79(4):94. #PB-288 935. 1979]

6. Legal and Regulatory Aspects

79D-1314

A FEE COLLECTION MECHANISM FOR THE OIL POLLUTION LIABILITY AND COMPENSATION LEGISLATION

Christensen, M.W., and M.V. Froehlich. 1978.

Report CG-WEP-78-1, Contract 11 234 6981. 67 p. Final report.

Liability, Regulations, Legislation, *Superfund

The title report presents a study of the fee collection mechanism for the comprehensive oil pollution fund. This proposed \$200 million "superfund" to cover cleanup and compensation costs will be sustained by a fee not to exceed \$.03/bbl of all oil domestically produced or imported. Separate collection schemes are proposed for domestic crude oil, imported crude oil and products, and exported crude oil.

[from Government Reports Announcements 79(6):161. #AD-A061 403. 1979]

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

7. General Aspects

79D-1315

HOW MUCH ENVIRONMENTAL DAMAGE WAS CAUSED BY THE OIL SPILL THAT RESULTED WHEN THE SUPERTANKER AMOCO CADIZ RAN AGROUND OFF THE COAST OF BRITTANY ON MARCH 16, 1978?

Anon. 1979.

Sea Secrets 23(1):2.

Oil spills, Environmental effects, Contamination, Spill removal, Amoco Cadiz spill, France

A concise and non-technical summary of the major effects of the Amoco Cadiz spill is given including amount of oil removed, environmental effects, climatic influences, and details about the ship itself.

79D-1316

PROCEEDINGS OF THE FIRST AND SECOND USA-USSR SYMPOSIA ON THE EFFECTS OF POLLUTANTS UPON AQUATIC ECOSYSTEMS. VOLUME I. DULUTH, MINNESOTA, USA SYMPOSIUM, OCTOBER 21-23, 1975. VOLUME II. BOROK, JAROSLAVL OBLAST, USSR SYMPOSIUM, JUNE 22-26, 1976

Akademiya Nauk, SSSR, and Environmental Research Lab, Duluth. 1978.

Report EPA/600/3-78/076. 413 p.

Biological effects, Biodegradation, Fate, Movement, Aquatic environment

The papers in these proceedings focus upon methodology, historical aspects, microbial and abiotic degradation processes, effects of toxicants, trace metal problems, proposed species indices and studies on the fate and transport of pollutants. [possibly oil pollution related]

[from Government Reports Announcements 79(02):72. #PB-287 219. 1979]

79D-1317

THE CRISTOS BITAS AFFAIR

Bourne, W.R.P. 1979.

Marine Pollution Bulletin 10(5):122-123.

Oil spills, Biological effects, Birds, Spill response, *Cristos Bitas spill

The events following the October 1978 wreck of the Cristos Bitas are briefly outlined, and the contents of a report entitled Oil Pollution of West Wales by the Cristos Bitas, 21 October-20 November 1978 are summarized. The report describes the effects of the spill on the bird and grey seal populations and the action taken on their behalf. Recommendations are made for future action regarding response to oil spills.

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1318

IN THE WAKE OF THE ARGO MERCHANT, PROCEEDINGS OF A SYMPOSIUM HELD JANUARY 11-13, 1978

Center for Ocean Management Studies. 1978.

Kingston, Rhode Island, University of Rhode Island, Center for Ocean Management Studies, 1978. 181 p.

Oil spills, Biological effects, Chemical effects, Physical effects, Socioeconomic effects, *Proceedings, Argo Merchant spill

The title Proceedings presents 25 articles dealing with physical, chemical, biological, socioeconomic, and response studies carried out following the wreck of the Argo Merchant in December 1976. The purpose of the document is "to serve as a historic document and assist various individuals and agencies in responding to future spills."

79D-1319

A SMALL OIL SPILL AT WEST FALMOUTH

Conner, W. 1979.

Report EPA 600/9-79-007. 28 p. Energy/Environment R & D Decision Series.

Florida spill, Fate, Environmental effects, Biological effects, Benthos, Intertidal zone, Marshes, Marine organisms, Massachusetts

This report on oil and its fate and effects in coastal environments focuses on the Florida tanker spill which occurred at West Falmouth, Massachusetts in September 1969. Long-term studies by H. Sanders and M. Blumer of Woods Hole Oceanographic Institution comprise "probably the most rigorous and comprehensive investigation ever made of a single spill event." The spill resulted in heavy contamination of biologically sensitive subtidal areas, tidal flats, and salt marshes, and the sublethal effects of chronic oil pollution were apparent for at least seven years after the spill.

79D-1320

ECOLOGICAL EFFECTS OF DISPERSANTS IN THE UNITED KINGDOM

Cowell, E.B. 1978.

Chemical Dispersants for the Control of Oil Spills. L.T. McCarthy, Jr., G.P. Lindblom, and H.F. Walter (eds.). Philadelphia, American Society for Testing and Materials, 1978. p. 277-292. ASTM Special Technical Publication 659.

Dispersants, Toxicity, Environmental effects, Torrey Canyon spill, UK, Marshes, Rivers, Lakes

Toxicity problems associated with dispersant use in the Torrey Canyon spill are reviewed, as are subsequent developments to reduce toxicity and to increase the safe application of dispersants. Although newly developed dispersant formulations are environmentally much safer, even these materials should not be used in salt marsh and mangrove areas, or in freshwater rivers and lakes unless they are very large.

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1321

MARINE POLLUTION AND PROPERTIES OF THE BAY OF ELEUSIS [in Greek]

Friligos, N. 1978.

Chemika Chronika, Genike Ekdosis 43(2):45-47.

Bays, Industries, Petroleum products, Pollution control, *Greece

"Pollution of the Bay of Eleusis (Greece) by sewage and industrial wastes was discussed. Heavy metals, petroleum products, and insecticides were the main pollutants. Six proposals for the correction of the situation were made."

[from Chemical Abstracts 91(4):#26989h. 1979]

79D-1322

PETROLEUM AND PETROCHEMICALS

Haakansson, H., and A. Jernelov. 1977.

Report IVL-B-346. 36 p. (NTIS Report PC A03/MF A01)

Crude oil, Petrochemicals, Biological effects, Environmental effects, Health hazards, *Bioaccumulation

"The review covers biological, ecological, and medical effects of crude oil and petrochemicals." Special attention is given to the accumulation of oil in different organisms and consideration of the resulting effects on biological populations and the ecosystem.

[from Chemical Abstracts 89(18):#151933v. 1978]

79D-1323

PROGRAM REVIEW PROCEEDINGS OF: ENVIRONMENTAL EFFECTS OF ENERGY RELATED ACTIVITIES ON MARINE/ESTUARINE ECOSYSTEMS

Hall, C., and W. Preston. 1977.

Report EPA/600/7-77/111. 303 p.

Environmental effects, Movement, Monitoring, Marine environment, Estuaries, *Proceedings

An integrated environmental science research program was suggested for five major areas: Pollution characterization and monitoring; environmental transport processes; health effects, ecological effects; and integrated assessment. This report is a compilation of proceedings from the review session. [possibly oil pollution related]

[from Government Reports Announcements 78(23):128. #PB-284 296. 1978]

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1324

THE AMOCO CADIZ OIL SPILL, A PRELIMINARY SCIENTIFIC REPORT

Hess, W.N. (ed.). 1978.

NOAA/EPA Special Report. Washington, DC, US Government Printing Office, 1978. vi + 281 p.

Amoco Cadiz spill, Spill cleanup, Remote sensing, Beaches, Distribution, Chemical effects, Biological effects, France

This document provides a preliminary account of the US scientific efforts in response to the Amoco Cadiz oil spill during the period from 19 March to 15 May 1978. Observational objectives established by the US team were: Aerial photographic mapping and ground surveys of impacted beaches; statistical mapping of the distribution of oil on the water; surveys of the concentration of oil in subsurface water; evaluation of the effect of weathering on the composition of surface oil; evaluation of the long-term effects of weathering on the composition of oil in sediments from tidal flats and beaches; evaluation of the biological consequences of the spill; and observation and assessment of cleanup techniques. Individual papers are abstracted separately in this issue OPA.

79D-1325

THE U.S. STUDIES OF THE AMOCO CADIZ WRECK

Hess, W.N. 1979.

American Association for the Advancement of Science National Meeting, 145th, Houston, Texas, 3-8 January 1979. Washington, DC, AAAS, 1979. p. 43. Abstracts.

Amoco Cadiz spill, Spill cleanup, Distribution, Chemical effects, Biological effects, NOAA, EPA, France

An overview of the Amoco Cadiz spill and US scientific involvement is given. Scientists from NOAA, EPA, and several universities have worked with French scientists to map the distribution of oil on the water, in the sediments, and on the beach; to study the changing chemistry of the oil; to study the biological effects of the oil; and to study the cleanup procedures used by the French authorities.

79D-1326

EXPERIMENTAL ECOSYSTEMS AS A MEANS OF EVALUATING THE FATE AND EFFECT OF CONTAMINANTS IN AQUATIC ECOSYSTEMS

Hodson, P.V., and E.S. Millard. 1978.

Canada, Fisheries and Marine Service, Technical Report 818:65-87.

Aquatic environment, Contamination, Fate, Biological effects, Ecosystems

"A review with 18 references." [possibly oil pollution related]

[from Chemical Abstracts 91(1):#841d. 1979]

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1327

AIR AND WATER POLLUTION - ANNUAL REPORT FY 74-76

Kirchoff, W.H., and E. Myers. 1978.

Report NBS-TN-963. 390 p.

Analytical techniques, Concentrations, Detection, Sediments, Hydrocarbons

Oil pollution related subjects presented include development of Standard Reference Materials for evaluation of instrument accuracy, methods for measuring the concentration of pollutants in water and sediments, and measurement evaluation and compilation of physical and chemical properties of known pollutants.

[from Government Reports Announcements 79(4):61. #PB-287 493. 1979]

79D-1328

A LITERATURE REVIEW - PROBLEM DEFINITION STUDIES ON SELECTED TOXIC CHEMICALS. VOLUME 1. OCCUPATIONAL HEALTH AND SAFETY ASPECTS OF DIESEL FUEL AND WHITE SMOKE GENERATED FROM IT

Liss-Suter, D., and R. Mason. 1978.

Report AD-A056 018, Contract DAMD17-77-C-7020/ 64 p. Final report.

Health hazards, Safety, Toxicity, Bibliographies, *Diesel fuel

Literature is reviewed covering diesel fuel analysis, physical and chemical properties, human and animal toxicology, mammalian pharmacokinetics, industrial standards, and occupational hazards and white smoke. [possibly oil pollution related]

[from Government Reports Announcements 78(21):93. #AD-A056 018. 1978]

79D-1329

EFFECTS OF PETROLEUM ON ARCTIC AND SUBARCTIC ORGANISMS. V. 1: NATURE AND FATE OF PETROLEUM. V. 2: BIOLOGICAL EFFECTS

Malins, D.C. (ed.). 1977.

New York, San Francisco, London, Academic Press, 1977. V. 1:xvii + 321 p. V. 2:xx + 500 p.

Biological effects, Fate, Weathering, Birds, Fish, Biodegradation, Arctic, Cold climates, Book review, *Transport

The purpose of these two volumes is "to compile and evaluate current knowledge on the effects of petroleum on arctic and subarctic marine environments." Subjects include transport, weathering, biodegradation, and various biological effects on birds, fish, and other marine organisms.

[from Limnology and Oceanography 24(1):199. 1979]

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1330

THE EFFECTS OF OIL ON MARINE LIFE

Mertens, E.W., and J.R. Gould. 1979.

Erdoel, Kohle, Erdgas, Petrochemie 32(4):162-164.

Environmental effects, Offshore, Production, Marine organisms

"A review with 29 references."

[from Chemical Abstracts 91(5):#33569z. 1979]

79D-1331

GENERAL REPORT ON WATER POLLUTION IN SETO INLAND SEA [in Japanese]

Nakanishi, H. 1976.

Yamaguchi Sangyo Igaku Nempo 22:16-33.

Oil industry, Petrochemicals, Environmental effects, Fisheries, Japan,
*Seto Inland Sea

A ten-fold increase in industrial effluents occurred between 1955 and 1973 from various industries including the petroleum and petrochemicals industries. The fishing industry has been the most affected by pollution.

[from Chemical Abstracts 89(22):#185659q. 1978]

79D-1332

EFFECTS OF DISPERSANT USE ON SHORE LIFE

Nelson-Smith, A. 1978.

Chemical Dispersants for the Control of Oil Spills. L.T. McCarthy, Jr., G.P. Lindblom, and H.F. Walter (eds.). Philadelphia, American Society for Testing and Materials, 1978. p. 253-265. ASTM Special Technical Publication 659.

Dispersants, Spill cleanup, Environmental effects, Shorelines, Marine organisms, Toxicity, UK, Guidelines, Torrey Canyon spill

Damage to seashore life that resulted from the Torrey Canyon spill is not representative of dispersant use, as shown by recent examples of dispersant application around Great Britain. This paper discusses newer, less toxic dispersants and their ecological effects and presents general guidelines for dispersant use limitations in certain coastal environments.

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

79D-1333

SOME DATA ON THE CARCINOGENIC POLYCYCLIC AROMATIC HYDROCARBONS OF THE ENVIRONMENT [English summary]

Shabad, L.M. 1979.

Magyar Onkologia 23(1):3-11.

PAH, Distribution, Soil, Freshwater, Seawater, Plants

"A review with no references on carcinogenic aromatic hydrocarbons in the soil, natural waters, seeds, etc." [possibly oil pollution related]

[from Chemical Abstracts 91(7):#50356v. 1979]

79D-1334

ECOLOGICAL CONSEQUENCES OF CHOICES IN THE FIELD OF ENERGY

Zorzoli, G.B. 1978.

Acqua Aria 1:13-16.

Fossil fuels, Industries, Environmental effects

"A review with no references on the impact on the environment of the use of fossil fuels and atomic energy in power generation." [possibly oil pollution related]

[from Chemical Abstracts 89(26):#219923z. 1979]

D. FATE OF OIL IN THE ENVIRONMENT

1. Biodegradation

79D-1335

STUDY OF FACTORS AFFECTING PETROLEUM BIODEGRADATION IN SOIL [in Russian]

Andreson, R.K., and L.A. Propadushchaya. 1979.

Korroziya i Zashchita v Neftegazovoi Promyshlennosti 3:30-32.

Biodegradation, Microorganisms, Soil

Small doses of EPN-5 stimulated the growth of spore-forming microorganisms and enhanced petroleum biodegradation whereas larger doses decreased their numbers and those of bacteria. Superphosphate (10 mg P_{2O_5} /100 g soil) also increased the count of petroleum degrading microorganisms. The mechanism of microbial action is discussed.

[from Chemical Abstracts 91(1):#2694g. 1979]

79D-1336

BIOLOGICAL DEGRADATION OF PETROLEUMS [in Russian]

Aref'ev, O.A., M.N. Zabrodina, I.K. Norenkova, M.N. Karpenko, et al. 1978.

Izvestiya Akademii Nauk SSSR, Seriya Geologicheskaya 9:134-139.

Biodegradation, Crude oil, Concentrations, Hydrocarbons, Chemical analysis

The composition of petroleum before and after bacterial degradation was examined using gas-liquid chromatography and mass spectroscopy. The concentrations of n-alkanes, isoprenoids, and isoparaffins decreased after degradation due to transformation into paraffins-naphthenes and naphthenes.

[from Chemical Abstracts 89(26):#217615b. 1978]

79D-1337

AROMATIC HYDROCARBONS: DEGRADATION BY BACTERIA AND FUNGI

Cerniglia, C.E., and D.T. Gibson. 1978.

Oil and Oil Shale Chemistry, Proceedings of the Symposium. O.P. Strausz and E.M. Lown (eds.). New York; Verlag Chemie International, 1978. p. 191-210.

Biodegradation, Aromatic hydrocarbons, Bacteria, Fungi

"A review with 52 references."

[from Chemical Abstracts 91(3):#14623w. 1979]

D. FATE OF OIL IN THE ENVIRONMENT

79D-1338

PRELIMINARY RESEARCH ON THE MARINE DISTRIBUTION OF HYDROCARBON-OXIDIZING MICROORGANISMS [English summary]

De Domenico, M. 1977.

Bolletino di Pesca Piscicoltura e Idrobiologia 30():157-176.

Biodegradation, Bacteria, Distribution, Hydrocarbons, Italy

The results of a study on the occurrence of hydrocarbon-oxidizing bacteria in water and sewer lines in several places around Italy are presented, and the literature on the subject is reviewed.

[from Biological Abstracts 67(1):#189. 1979]

79D-1339

BIODETERIORATION OF OIL SPILLS (A BIBLIOGRAPHY WITH ABSTRACTS)

Harrison, E.A. 1979.

Report NTIS/PS-79/0009. 131 p. Report for 1964-Jan. 79. (Supersedes NTIS/PS-78/0043, NTIS/PS-77/0046, NTIS/PS-76/0032, and NTIS/PS-75/152.)

Biodegradation, Oil spills, Bacteria, Algae, Spill cleanup, Bibliographies

Citation and abstract topics include algae, bacteria, hydrocarbons, petroleum degradation, oil spills, beach cleanup, and microbial degradation as related to biodeterioration of oil spills. This issue contains 124 abstracts, 6 of which are new.

[from Government Reports Announcements 79(7):76. #NTIS/PS-79/0009. 1979]

79D-1340

DEGRADATION OF CRUDE OIL BY USING MARINE MICROORGANISMS. EFFECT OF VITAMINS [in Japanese]

Hirayama, M., S. Nagata, and G. Kondo. 1978.

Mizu Shori Gijutsu 19(10):919-921.

Biodegradation, Crude oil, Microorganisms, *Vitamins

Addition of B-vitamins, biotin, and α -lipoic acid were tested for their effects on biodegradation of crude oil by marine microorganisms. The addition of B-vitamins increased degradation rates for n-alkanes; the other additives had no effect.

[from Chemical Abstracts 91(6):#44211c. 1979]

D. FATE OF OIL IN THE ENVIRONMENT

79D-1341

INTERACTION OF AEROBIC AND ANAEROBIC BACTERIA IN PETROLEUM BIODEGRADATION
Jobson, A.M., F.D. Cook, and D.W.S. Westlake. 1979.
Chemical Geology 24(3-4):355-365.

Biodegradation, Bacteria, Metabolism

The relations between aerobic petroleum-degrading and anaerobic sulfate-reducing bacteria in oil degradation are presented. The results support the hypothesis that sulfate-reducing bacteria cannot initiate oil degradation but rather grow on the residues produced by aerobic degradation.

[from Chemical Abstracts 91(4):#23494g. 1979]

79D-1342

METHOD FOR CONDITIONING FRESH AND SEA WATERS FROM OIL
Marconi, W., N. Oddo, and L. Degen. 1977.
US Patent 4,042,495

Biodegradation, Oil removal, Microorganisms, Spill cleanup, Patent

Hydrocarbons are removed from surface waters by scattering a nutrient salt containing nitrogen and phosphorus on the contaminated area in a form readily assimilable by microorganisms capable of metabolizing hydrocarbons. The nutrient particles are made buoyant by means of a surface treatment with paraffin.

[from Energy Research Abstracts 3(3):625.#5975. 1978]

79D-1343

THE DEGRADATION OF HYDROCARBONS BY MUTANT MICROORGANISM
Rogers, J. 1977.

Genesis of Petroleum and Microbiological Means for Its Recovery. Papers Presented at the Microbiology Group Symposium, 1976. London, Institute of Petroleum, 1977. p. 76-82.

Biodegradation, Petroleum products, Microorganisms, Hydrocarbons,
*Mutant bacteria

"The hydrocarbon-degrading bacterial products are composed of a mixture of complementary strains of mutant adapted microorganisms which will degrade oil, oil products, and residues including tar balls in a permanent, nontoxic manner. The Petrobac I system eliminates crude oil from soil and beaches by emulsification and solubilization. Petrobac II system contains an absorbent which sorbs both slick and microorganisms and sinks below the surface where degradation is complete."

[from Chemical Abstracts 89(24):#203628. 1978]

D. FATE OF OIL IN THE ENVIRONMENT

79D-1344

EFFECT OF A CHEMICAL DISPERSANT ON MICROBIAL UTILIZATION OF PETROLEUM HYDROCARBONS

Traxler, R.W., and L.S. Bhattacharya. 1978.

Chemical Dispersants for the Control of Oil Spills. L.T. McCarthy, Jr., G.P. Lindblom, and H.F. Walter (eds.). Philadelphia, American Society for Testing and Materials, 1978. p. 180-188. ASTM Special Technical Publication 659.

Biodegradation, Dispersants, Microorganisms, Crude oil, Hydrocarbons

Unless mechanically or chemically dispersed in the water column, hydrocarbons or crude oils are not oxidized by the natural seawater microbial populations. Results of experiments are presented which show that the dispersant Corexit 9527 enhances bacterial metabolism of crude oils and pure hydrocarbons in nonagitated seawater systems, by dispersing the oil and hydrocarbon droplets into the water column as discrete droplets that can be attacked by bacteria.

79D-1345

MICROBIAL DEGRADATION OF PETROLEUM HYDROCARBONS

Westlake, D.W.S., F.D. Cook, and A.M. Johnson. 1978.

Report EPA/600/7-78/148. 79 p.

Biodegradation, Hydrocarbons, Shorelines, Sediments, Bacteria, Puget Sound

Microbial population response to Prudhoe Bay oil were investigated.

Samples were tested from the water column, beach, and sediments representing the diverse marine shoreline environments found in northern Puget Sound and the straits of San Juan de Fuca. All sites studied yielded psychotropic bacterial populations which, in the presence of added nitrogen and phosphorus, were able to bring about changes in the n-alkane components of Prudhoe Bay oil.

[from Government Reports Announcements 79(5):75.#PB-288 406. 1979]

D. FATE OF OIL IN THE ENVIRONMENT

2. Physical and Chemical Processes

79D-1346

NEAR-BOTTOM TRANSPORT IN THE VICINITY OF THE ARGO MERCHANT: A SEABED DRIFTER STUDY

Collins, B.P., C.A. Griscom, and E.J. Hoffman. 1978.

In the Wake of the Argo Merchant. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies. 1978. p. 34-36.

Movement, Drift, Spill trajectories, Monitoring, Argo Merchant spill,
*Near-bottom transport

Methods and results are described of experiments designed to determine the transport of Argo Merchant oil by near-bottom currents. Based on a 12% return of seabed drifters, it appeared that a near-bottom drift component existed to the northwest. The results corroborate the findings of earlier research in the area tested.

79D-1347

STUDIES ON DECAY OF SPILT CRUDE OILS. V. CHANGES OF SULFUR AND NITROGEN CONTENTS AND ULTRAVIOLET SPECTRA [in Japanese]

Higashi, K., and K. Hagiwara. 1978.

Mizu Shori Gijutsu 19(6):513-516.

Crude oil, Weathering, Chemical analysis, Source identification

Changes were investigated in eight crude oils floating on artificial seawater over a 360-day period. Some of the oils could be identified by the title analyses.

[from Chemical Abstracts 89(24):#199920r. 1978]

79D-1348

DISTRIBUTION OF HYDROCARBONS IN NARRAGANSETT BAY SEDIMENT CORES

Hurt, A.C., and J.G. Quinn. 1979.

Environmental Science & Technology 13(7):829-836.

Hydrocarbons, Distribution, Fate, Sedimentation, Narragansett Bay

Sediment cores from Narragansett Bay indicated a decrease in surface sediment hydrocarbons from the Providence River to the mouth of the bay and a decrease with depth to about 20-25 cm. This depth is probably related to increased petroleum utilization at the end of the 19th century. The Providence River is the major source of anthropogenic hydrocarbons in bay sediments.

D. FATE OF OIL IN THE ENVIRONMENT

79D-1349

THE FATE OF STRANDED PELAGIC TAR ON A BERMUDA BEACH

Iliffe, T.M., and A.H. Knap. 1979.

Marine Pollution Bulletin 10(7):203-205.

Tar, Beaches, Fate, Distribution, Sediments, Physical aspects

"The major process involved in the removal of stranded petroleum residues or 'tar lumps' from sandy high energy beaches is the adsorption of sand and shell particles to the residues effecting a density change. This results in transport off the beach, sinking, and sometimes burial of tar in sublittoral sediments."

79D-1350

DROP SIZE DISTRIBUTIONS IN A TREATED OIL-WATER SYSTEM

Jasper, W.L., T.J. Kim, and M.P. Wilson. 1978.

Chemical Dispersants for the Control of Oil Spills. L.T. McCarthy, Jr., G.P. Lindblom, and H.F. Walter (eds.). Philadelphia, American Society for Testing and Materials, 1978. p. 203-216. ASTM Special Technical Publication 659.

Dispersion, Behavior, Dispersants, Physical aspects

An experimental study of the title topic used two dispersants, Surfrow-OW-1 and Corexit 9527, and incorporated the effects of input energy and shear rate. Peak values of the drop size distribution curve were found to decrease inversely with energy input; the oil-water interfacial area increased with the energy input; and Corexit 9527, the self mixing dispersant, had finer and better dispersion.

79D-1351

PHYSICAL AND CHEMICAL BEHAVIOR OF SMALL CRUDE OIL SLICKS ON THE OCEAN

Johnson, J.C., D.C. McAuliffe, and R.A. Brown. 1978.

Chemical Dispersants for the Control of Oil Spills. L.T. McCarthy, Jr., G.P. Lindblom, and H.F. Walter (eds.). Philadelphia, American Society for Testing and Materials, 1978. p. 141-158. ASTM Special Technical Publication 659.

Oil slicks, Physical aspects, Behavior, Hydrocarbons, Dispersants, Atlantic Ocean

Described are the results of four small (under 1.7 m^3 volume) test spills in the North Atlantic, which were conducted to determine their physical behavior, and to obtain chemical data on specific hydrocarbon fractions of fresh slicks. The tests were conducted to develop data for understanding the effects of dispersants on future experimental slicks.

D. FATE OF OIL IN THE ENVIRONMENT

79D-1352

THE FATE OF SPILLED OIL

Leinonen, P.J. 1977.

University of Toronto, Ph.D. Dissertation. ___ p.

Oil slicks, Hydrocarbons, Evaporation, Dispersion, Models, Physical aspects

The processes of evaporation and dissolution of an oil slick were studied experimentally and using computer models. "A technique was developed to study equilibrium multicomponent hydrocarbon-water-air systems. The compositions of the vapor, hydrocarbon, and aqueous phases were measured simultaneously and the fugacities of each hydrocarbon component in all 3 phases were calculated. The hydrocarbon and aqueous phase activity coefficients of the hydrocarbons also were determined."

[from Petroleum Abstracts 19(33):#266,506. 1979]

79D-1353

A STUDY TO CONDUCT EXPERIMENTS CONCERNING TURBULENT DISPERSION OF OIL SLICKS

Lin, J-T., M. Gad-el-Hak, and H-T. Liu. 1978.

Report FRC-112, USCG-D-54-78, Contract DOT-CG-6188-A. 108 p. Final report, October '76-April '78.

Oil slicks, Behavior, Dispersion, Sea surface, Models

Laboratory experiments were conducted to study the turbulent characteristics in the water boundary layers under the action of wind and waves and to study the action of breaking waves. For field application, empirical formulas were derived from the laboratory results.

[from Government Reports Announcements 78(25):128.#AD-A058 802. 1978]

79D-1354

DETERMINATION OF AIR-WATER HENRY'S LAW CONSTANTS FOR HYDROPHOBIC POLLUTANTS

Mackay, D., W.Y. Shiu, and R.P. Sutherland. 1979.

Environmental Science and Technology 13(3):333-337.

Hydrocarbons, Physical aspects, Solubility, Evaporation, *Air-water interface, *Henry's law

A system for the title determination involves measuring the pollutant concentration in only the water phase while the compound is being stripped isothermally from solution at a known gas flow rate. Determinations of H made for several hydrocarbons agree with available literature data. "The method may be suitable for elucidating the extent of sorption of volatilizing compounds in aqueous environments and quantifying the role of sorption in reducing volatilization rates."

[from Chemical Abstracts 91(4):#26962u. 1979]

D. FATE OF OIL IN THE ENVIRONMENT

79D-1355

SURFACE CIRCULATION AND THE DISTRIBUTION OF PELAGIC TAR AND PLASTIC

Shaw, D.G., and G.A. Mapes. 1979.

Marine Pollution Bulletin 10(6):160-162.

Tar, Distribution, Drift, Pacific Ocean

"Pelagic tar and plastic have been measured along 158° W in the North Pacific. Maxima in the abundance of tar are associated with convergent meso scale and with small scale surface circulation features observed at the same time. There is no significant correlation between abundance of tar and that of plastic. It appears that this difference in distributions is the result of different input patterns or residence times."

79D-1356

THE METHODS FOR INVESTIGATING OIL AND HYDROCARBON OXIDATION IN SEA WATER

Tsyban, A.V. 1977.

Ambio Special Report, Vol. 5:263-267.

Oxidation, Crude oil, Hydrocarbons, Chemical analysis, Seawater

"A review with 29 references is presented."

[from Chemical Abstracts 89(16):#135314p. 1978]

79D-1357

AN EXPERIMENT FOR WATER SURFACE CONTAMINATION

Unno, H., and I. Inoue. 1978.

Chemical Engineering Science 33(11):1425-1428.

Oil slicks, Spreading, Behavior, Contamination

The effect of surface contamination on the spreading behavior of oil spilled on water was investigated. Three phases in the spreading pattern were noted; the degree of surface contamination had little effect on the spreading patterns during the first and second phases, but had great influence during the final phase.

[from Petroleum Abstracts 19(27):#264,929. 1979]

79D-1358

OIL LUMPS IN THE SEA [in German]

Walden, H. 1978.

Seewarte 39(3):128-130.

Tar, Marine environment, Sea surface, Weathering, Atlantic Ocean,
*Sargasso Sea

This article summarizes research conducted by B.F. Morris, et al., as previously published in the book Marine Pollution Transfer [H.L. Windom, and R.A. Duce (eds.), Lexington, Massachusetts, Lexington Books, D.C.

D. FATE OF OIL IN THE ENVIRONMENT

Heath and Company, 1976]. At present, the Sargasso Sea contains some of the greatest concentrations of residual, tarry lumps, either floating or dispersed in the upper part of the water column, and the residence time of such particles ranges from months to years.

79D-1359

POLYCYCLIC AROMATIC HYDROCARBONS IN GULF OF MAINE SEDIMENTS AND NOVA SCOTIA SOILS

Windsor, J.G., Jr., and R.A. Hites. 1979.

Geochimica et Cosmochimica Acta 43(1):27-33.

PAH, Concentrations, Distribution, Fate, Soil, Sediments, *Pollutant transport

The title samples were analyzed for 10 PAHs using GC/MS. Total hydrocarbons ranged from 18 ppb for deep-ocean sediments to 120,000 ppb for Charles River sediments. Wide variations in soil PAHs were due to differences in soil porosity, lipophilic surface cover, and humic substance content. Two competitive transport mechanisms for the hydrocarbons are proposed.

[from Chemical Abstracts 91(4):#24312h. 1979]

3. Models, Simulations, and Predictions

79D-1360

POLLUTION BY PETROLEUM PRODUCTS. TRANSFER OF HYDROCARBONS IN WATER AND MIGRATION OF THE CONTAMINANTS IN THE AQUIFER [in French]

Bastien, F., P. Muntzer, and L. Zilliox. 1977.

Protection des Eaux Souterraines Captees pour l'Alimentation Humaine, Communications, Colloque National, Vol. 2:1-19.

Models, Petroleum products, Contamination, Movement, Groundwater

"A model is given for determining the speed and direction of migration of petroleum spills in an aquifer."

[from Chemical Abstracts 89(14):#117351u. 1978]

D. FATE OF OIL IN THE ENVIRONMENT

79D-1361

A MODEL SYSTEM FOR THE STUDY OF SUBLETHAL POLLUTION EFFECTS ON MARINE ORGANISMS

Ducklow, H.W., and R. Mitchell. 1978.

Report TR-8, Contract N00014-76-C-0262. Interim report.

Models, Crude oil, Coral reefs, Biological effects, Sublethal effects, Bacteria

A microbial ecosystem consisting of coral and its associated bacteria can be used as a model for studying the effects of sublethal concentrations of pollution on microbial activities. An experimental flowing water system is described in which a Red Sea soft coral, Heteroxenia fuscens is exposed to sublethal concentrations of crude oil. Such exposures resulted in a significant increase in the coral's mucous bacteria population levels.

[from Government Reports Announcements 79(7):83.#AD-A061 716. 1979]

79D-1362

THE BEHAVIOR OF FLOATING OIL FROM THE ARGO MERCHANT

Grose, P.L. 1978.

In the Wake of the Argo Merchant. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 19-21.

Models, Oil spills, Behavior, Movement, Drift, Predictions, Sea surface, Argo Merchant spill

The actual formation and drift of Argo Merchant oil are compared with those expected from predictive models. Measured differential velocities of the pancakes and surface waters were found to be consistent with a wave/oil interaction model that predicts oil velocities at twice the surface Stokes drift. The thicknesses of the oil pancakes were not consistent with a model that predicted only static forces.

79D-1363

CAN OIL SPILL MOVEMENT BE PREDICTED?

Lissauer, I., and P. Welsh. 1978.

In the Wake of the Argo Merchant. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 22-27.

Models, Predictions, Movement, Drift, Sea surface, Argo Merchant spill

The title article provides a description of the forecasts given to the Coast Guard's Marine Safety Office (MSO) in Boston following the 15 December 1976 grounding of the Argo Merchant. Oil movement was predicted by use of a simple vector addition of the tidal velocity and 3.5% of the wind speed on an hourly basis. The lateral spread was determined from the tidal velocities. A series of 16 maps with supporting tables illustrates the model.

D. FATE OF OIL IN THE ENVIRONMENT

79D-1364

AN OIL SPILL RISK ANALYSIS FOR THE SOUTHERN CALIFORNIA (PROPOSED SALE 48) OUTER CONTINENTAL SHELF LEASE AREA

Slack, J.R., T. Wyant, and K.J. Lanfear. 1978.

US Geological Survey, Water Resources Investigations 78-80. vi + 93 p.

Predictions, Risk analysis, Models, Spill trajectories, Oil-gas leasing, Santa Barbara Channel, California

The title study analyzed the probability of spill occurrence, likely paths of the spilled oil and locations in space and time of biological and recreational resources likely to be vulnerable. The study concludes that the leasing of the proposed tracks will increase the expected number of spills by about 50-55% over that expected from existing federal leases. The probability that land will be contacted by a spill is increased by less than 17%.

79D-1365

SURFACE AND SUBSURFACE SPILL TRAJECTORY FORECASTING: APPLICATION TO THE ARGO MERCHANT SPILL

Spaulding, M.L. 1978.

In the Wake of the Argo Merchant. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies, 1978. p. 37-42.

Movement, Spill trajectories, Drift, Predictions, Spill response, Argo Merchant spill

Two models were constructed for predicting surface and subsurface trajectories of the Argo Merchant spill in order to provide the Coastal Zone Management and University of Rhode Island response teams with adequate data. A simple surface drift model was constructed to predict surface movement while a simple advective model was used to estimate subsurface trajectories. Surface and subsurface predictions were close to the actual spill motion.

79D-1366

RISK FORECASTING FOR THE ARGO MERCHANT SPILL

Wyant, T., and R.A. Smith. 1978.

In the Wake of the Argo Merchant. Proceedings of a Symposium, Kingston, Rhode Island, 11-13 January 1978. University of Rhode Island, Center for Ocean Management Studies. 1978. p. 28-33.

Risk analysis, Models, Environmental effects, Predictions, Onshore impacts, Argo Merchant spill

D. FATE OF OIL IN THE ENVIRONMENT

An oil spill trajectory model developed for OCS environmental impact assessment is described as applied to the Argo Merchant spill. The model accurately predicted a low risk to various shoreline and marine resources over the long term. Differences between this "long term" risk model and short-term movement models are discussed.

79D-1367

AN EXPERIMENTAL STUDY OF DISPERSIVE SPREADING

Zimmerman, K.A., and R.W. Miksad. 1978.

Austin, Texas, Atmospheric Science Group, University of Texas, 1978.

iv + 80 p. (Report No. 46.)

Oil slicks, Spreading, Dispersion, Simulations, Predictions

An oscillating grid water tank was used to study the dispersive spreading of oil spills. A comparison of data generated from the laboratory experiments with actual oceanic measurements indicates that the water tank simulates on a small scale the ocean's turbulent surface layer. It is shown that the relative diffusion theory can be used to predict the dispersion of oil patches relative to their collective center of mass.

4. General Fate of Oil

79D-1368

SEASONAL DISTRIBUTION, TRAJECTORY STUDIES, AND SORPTION CHARACTERISTICS OF SUSPENDED PARTICULATE MATTER IN THE NORTHERN PUGET SOUND AREA

Baker, E.T., J.D. Cline, R.A. Feely, and J. Quan. 1978.

Report EPA/600/7-78/126. 156 p.

Crude oil, Distribution, Movement, Adsorption, Simulations, Sediments, Puget Sound

The title study focuses on the spatial and seasonal distributions of suspended particulate matter and its adsorption characteristics relative to Alaskan crude oils. The composition and abundance of hydrocarbons associated with suspended matter was evaluated at five locations. Laboratory measurements were also performed under simulated natural conditions to investigate short-term interaction between Prudhoe Bay crude and two local riverine sediments.

[from Government Reports Announcements 79(7):97.#PB-288 791. 1979]

D. FATE OF OIL IN THE ENVIRONMENT

79D-1369

NATURALLY OCCURRING HYDROCARBON SEEPS IN THE GULF OF MEXICO AND THE CARIBBEAN SEA

Geyer, R.A. 1978.

College Station, Texas, Texas A&M University, Department of Oceanography, 1978. 19 p.

Natural seepage, Biological effects, Fate, Hydrocarbons, Texas, Gulf of Mexico, Caribbean Sea

This booklet summarizes historical and contemporary evidence for the presence of major natural oil and gas seeps along the Texas Gulf Coast. Results of Texas A&M University biological and geological investigations are briefly summarized. These indicate that "persistent introduction of hydrocarbons over thousands of years into an ecosystem has not been deleterious to the marine environment."

79D-1370

FATE OF POLYCYCLIC AROMATIC HYDROCARBONS IN CONTROLLED ECOSYSTEM ENCLOSURES

Lee, R.F., W.S. Gardner, J.W. Anderson, J.W. Blaylock, and J. Barwell Clarke. 1978.

Report NSF/IDOE-78/109, Grants NSF-GX-39149, NSF-OCE76-84108. 8 p.

PAH, Fate, Biodegradation, Weathering, Zooplankton, Uptake, Sediments, Ecosystems, Cold climates

The title report describes findings on the effects of Prudhoe crude oil enriched with a number of PAH's on an ecosystem enclosure suspended in Saanich Inlet, Canada. Concentrations of various aromatics were determined in water, zooplankton, oysters, and sediments. Only naphthalenes were significantly degraded by microbes, up to 5% per day. Sedimentation and photochemical oxidation were responsible for the decrease in concentrations of the higher weight aromatics.

[from Government Reports Announcements 79(6):174. #PB-289 060. 1979]

79D-1371

THE USE OF FATE OF LUBRICANTS, OILS, GREASES, AND HYDRAULIC FLUIDS IN THE IRON AND STEEL INDUSTRY

Serne, J.C., and K. Wilson. 1978.

Report EPA/600/2-78/101, Contract EPA 68-02-1405. 344 p. Final task report, May 76-April 78.

Petroleum products, Fate, Disposal, Industries, Water quality, Solid wastes

Results of the title investigation indicate that for a typical 4 million ton/yr integrated plant, 1.2 million lb/mo (545,000 kg/mo) of oils, greases, and hydraulic fluids are used of which 10% enters the environment as air pollution, 9% as water pollution, and 44% as solid waste.

[from Government Reports Announcements 78(25):182. #PB-284 973. 1978]

E. POLLUTION ASPECTS OF OIL EXPLORATION, DEVELOPMENT, AND PRODUCTION

1. Biological Aspects

79D-1372

SEALS IN SHETLAND WATERS

Anderson, S.S. 1979.

The Marine Environment of Sullom Voe and the Implications of Oil Developments, Scottish Marine Biological Association, 18-19 April 1979. Oban, Scotland, Shetland Oil Terminal Advisory Group, 1979. p. 14. Abstract.

Development, Oil spills, Marine mammals, Biological effects, Scotland, *Sullom Voe, *Seals

"The actual and potential effects on Grey and Common Seals of oil pollution and disturbance from the development and running of the Shetland oil industry are assessed."

79D-1373

EFFECT OF SOME CHEMICAL AGENTS USED IN THE DRILLING OF OIL WELLS ON CASPIAN SEA FAUNA [in Russian]

Gulidaze, M.P., A.G. Kasymov, K.V. Shakhbazbekov, and R.Kh. Nadzhafova. 1978. Izvestiya Vysshikh Uchebnykh Zavedenii, Neft i Gaz 21(9):99-102.

Drilling, Toxicity, Invertebrates, Fish, *Drilling fluids

Several chemical agents tested had toxic effects on invertebrates and fish.

[from Chemical Abstracts 91(4):#26983b. 1979]

79D-1374

THE IMPLICATION OF NORTH SEA OIL ON THE SEABIRD POPULATIONS OF SHETLAND

Johnston, J.Z., and P.K. Kinneir. 1979.

The Marine Environment of Sullom Voe and the Implications of Oil Developments, Scottish Marine Biological Association, 18-19 April 1979. Oban, Scotland, Shetland Oil Terminal Advisory Group, 1979. p. 12. Abstract.

Development, Biological effects, Birds, Statistics, Contingency planning, North Sea, Scotland, *Sullom Voe

The key species at risk are identified together with the likely sources of threat, and the possible biological implications of oil developments in Shetland and surrounding waters. The practicalities of existing oil spill contingency measures for seabirds are assessed. Statistics on bird populations and details on species susceptibility are presented.

E. POLLUTION ASPECTS OF OIL EXPLORATION, DEVELOPMENT, AND PRODUCTION

79D-1375

BALANCED PROGRAM PLAN: ANALYSIS FOR BIOMEDICAL AND ENVIRONMENTAL RESEARCH.
VOLUME 5, OIL SHALE TECHNOLOGY

US Energy Research and Development Administration. 1976.
Contract W-7405-ENG-38. 42 p.

Oil Shale, Environmental effects, Health hazards, Development

Twenty-three research projects are described as to scope, milestones, technology time frame, program unit priority, and cost. Definition of research programs includes: Pollutants, physical and chemical processes and effects, health effects, ecological processes and effects, and integrated assessment.

[from Energy Research Abstracts 3(4):847.#8043. 1978]

2. Physical and Chemical Aspects

79D-1376

GEOCHEMICAL POLLUTION OF THE ENVIRONMENT IN THE AREAS OF OIL-GAS PRODUCTION AND UNDERGROUND GAS HOLDERS

Lukashev, K.I., and A.V. Kudelskii. 1978.

Gas Industry and the Environment, Proceedings of a Symposium of the Committee on Gas, Economic Commission for Europe, 1977. Oxford, England, Pergamon Press, 1978. p. 145-149.

Production, Oil industry, Environmental effects, Groundwater

"A review with no references." [possibly oil pollution related]

[from Chemical Abstracts 89(24):#203133f. 1978]

3. Social and Economic Aspects

[No entries.]

E. POLLUTION ASPECTS OF OIL EXPLORATION, DEVELOPMENT, AND PRODUCTION

4. Legal and Regulatory Aspects

79D-1377

MUD, BRINE MAY BE CLASSIFIED HAZARDOUS WASTES

Pitts, J.P. 1979.

Drill Bit 28(4):23-24.

Oil fields, Drilling, Production, Oil industry, EPA, Regulations,

*Drilling muds

The effects on the oil industry of proposed EPA regulations which would classify oil field mud and brine as hazardous wastes are discussed. Measures bring taken by the industry in response to the proposed regulations are outlined.

[from Petroleum Abstracts 19(30):#265,672. 1979]

5. General Aspects

79D-1378

OIL EXPLORATION EXPECTED OFF OREGON BY EARLY 1980'S

Anon. 1979.

Western Fisheries 98(1):32, 63-64.

Offshore, Development, Oil-gas leasing, Baseline studies, Oregon

Offshore exploration may be expected off Oregon by the early 1980's. Before granting leases, the BLM guarantees that such development will be environmentally compatible by providing for regional baseline studies and environmental impact assessments, and removing environmentally sensitive areas from leasable tracts.

79D-7379

OFFSHORE DRILLING. VOLUME 2. (A BIBLIOGRAPHY WITH ABSTRACTS)

Habercom, G.E., Jr. 1978.

Report NTIS/PS-78/0749, 118 p. Report for 1976-June 1978. (Supersedes NTIS/PS-77/0703, NTIS/PS-76/0627, NTIS/PS-75/540, and NTIS/PS-74/103.)

Offshore, Drilling, Oil wells, Environmental effects, Equipment, Legislation, Bibliographies

Drilling procedures, equipment, environmental aspects, and legal implications involved in oceanic mineral resources recovery are covered. This updated bibliography contains 111 abstracts, 55 of which are new entries. [possibly oil pollution related]

[from Government Reports Announcements 78(20):144.#NTIS/PS-78/0749. 1978]

E. POLLUTION ASPECTS OF OIL EXPLORATION, DEVELOPMENT, AND PRODUCTION

79D-1380

ENVIRONMENTAL ASSESSMENT OF AN ACTIVE OIL FIELD IN THE NORTHWESTERN GULF OF MEXICO, 1976-1977

Jackson, W.B. 1977.

Report PB-283 890. 756 p. Annual report.

Oil fields, Crude oil, Environmental effects, Concentrations, Marine environment, Development

Of particular interest in this report comparing an active oil field with an unaltered area are the comparison of pollutant concentrations in the sediments and biota, and identification of those changes associated with oil and gas exploration and production. Topics include hydrocarbon pathways in major components of the marine ecosystem, and total organic carbon and carbon isotopes in sediments.

[from Government Reports Announcements 78(23):191.#PB-283 890. 1978]

79D-1381

REVIEW AND ANALYSIS OF OIL SHALE TECHNOLOGIES. VOLUME IV. ABOVE GROUND OR SURFACE TECHNOLOGY

Jee, C.K., J.D. White, S.K. Bhatia, and D. Nicholson. 1977.

Report FE-2343-6 (Vol. 4). 173 p.

Environmental effects, Oil shale, *Surface technology

"A review, with unknown references, of 6 processes." [possibly oil pollution related]

[from Chemical Abstracts 91(8):#59658c. 1979]

79D-1382

MANAGING OIL AND GAS ACTIVITIES IN COASTAL ENVIRONMENTS

Longly, W.L., R. Jackson, and B. Snyder. 1978.

Report FWS/OBS-78/54, Contract DI-14-16-0008-2152.75 p.

Environmental effects, Resource management, Coasts, Oil industry

Suggestions are offered to developers for mitigation of environmental disruption. Coastal ecosystems are categorized, characteristic vegetation is described, and management practices are discussed. Impacts from a wide variety of industry-related activities are presented.

[from Governmental Reports Announcements 78(23):151.#PB-283 677. 1978]

E. POLLUTION ASPECTS OF OIL EXPLORATION, DEVELOPMENT, AND PRODUCTION

79D-1383

OIL IN WASHINGTON: APPLICABILITY OF MODELS TO MARINE ENVIRONMENTAL
MANAGEMENT QUESTIONS AND ECOLOGICAL IMPACTS

Oceanographic Institute of Washington. 1976.

Seattle, Washington, Oceanographic Institute of Washington, 1976. Vol. I.

Models, Oil spills, Socioeconomic effects, Resource management, Risk
analysis, Puget Sound, Oil industry, Environmental effects

An assessment is given of the use of models to solve state and local
governmental management questions which could arise from alternative
developments of the petroleum industry in Puget Sound through 1985. The
socio-economic impacts of potential oil spills are considered of primary
importance. Risk, transport, and ecological models are developed and
conclusions and recommendations are made.

79D-1384

THE GREENWICH FORUM

Sibthorp, M.M. 1979.

Marine Pollution Bulletin 10(7):186-188.

Offshore, Development, North Sea, Pollution prevention, IMCO, Oil
transport, Legislation, Law enforcement, Fisheries

A summary of the proceedings of the conference in May 1979 entitled,
"Europe and the Sea: The Case For and Against a New International
Regime for the North Sea and Its Approaches" is presented. Topics
covered include Energy, Environmental Aspects, Technological Co-
operation, Fisheries, Shipping, Surveillance, Enforcement and Defense,
and Alternative Legal Regimes. [possibly oil pollution related]

79D-1385

AN OILSPILL RISK ANALYSIS FOR THE MID-ATLANTIC (PROPOSED SALE 49) OUTER
CONTINENTAL SHELF LEASE AREA

Slack, J.R., and T. Wyant. 1978.

Report USGS/WRD/WRI-78/085, USGS/WRI-78-56. 79 p. Final report.

Oil spills, Risk analysis, OCS, Development, Atlantic Ocean

The relative environmental risks for developing different North Atlantic
regions for oil are examined. Conclusions indicate that, assuming re-
coverable amounts of petroleum are found, the proposed development of
tract 49 will increase the number of spills by about 20-25% over those
expected from existing leases (sale 40).

[from Government Reports Announcements 79(5):179.#PB-288 401. 1979]

E. POLLUTION ASPECTS OF OIL EXPLORATION, DEVELOPMENT, AND PRODUCTION

79D-1386

BENEFITS DERIVED FROM THE OUTER CONTINENTAL SHELF ENVIRONMENTAL STUDIES PROGRAM ARE QUESTIONABLE

US General Accounting Office. 1978.

Report CED-78-93. 33 p.

OCS, Development, Production, Contingency planning

The Outer Continental Shelf Environmental Studies Program is costly and may do little toward minimizing environmental damage during oil and gas exploration, development and production in the OCS. Recommendations to improve effectiveness are presented, including how data might best be used in decision-making, what information is needed, and the type of plans necessary.

[from Government Reports Announcements 78(18):167.#PB-281 782. 1978]

F. POLLUTION ASPECTS OF OIL TRANSPORT, TRANSFER, AND STORAGE

1. Tankers and Ships

79D-1387

OIL-SPILL SHIP/COASTAL TANKER IS MODEL TESTED

Anon. 1979.

Ocean Industry 14(7):59-60.

Tankers, Skimmers, Equipment, Design-engineering, Spill cleanup, Models

A novel wide-jaw vessel to clean up oil spills is described. The ship consists of a twin hull, connected aft by a hinge to form a tanker during normal operations, and a skimming vessel for spill cleanup operations. Model tests indicate that the craft will be operable as a skimmer under North Sea wave conditions.

79D-1388

TANK BARGE OIL POLLUTION STUDY

Bender, A., G.G. Brown, Jr., and J.M. Rosenbusch. 1978.

Report USCG-CG-M-2-78, Contract DOT-CG-71603-A. 69 p. Final report.

Oil transport, Oil spills, Pollution prevention, *Barges

This study determined and categorized the causes of tank barge oil spill incidents and the extent of the resulting pollution. Operational and causal patterns were identified, present pollution prevention efforts were examined, and means of reducing spill volumes and number of incidents were investigated.

[from Government Reports Announcements 79(1):129.#AD-A059 116. 1979]

79D-1389

REPORT OF THE CALIFORNIA INTERAGENCY TANKER TASK FORCE

California Resources Agency. 1978.

Sacramento, California Resources Agency, 1978. xvii + 82 p.

Oil transport, Oil transfer, Tankers, Ports, Oil terminals, Liability, Spill cleanup, Pollution prevention, Regulations

This report presents findings and recommendations of the California Interagency Task Force, relating to safe and pollution-free tanker operations, terminal, and port operations, and oil spill cleanup and liability provisions.

F. POLLUTION ASPECTS OF OIL TRANSPORT, TRANSFER, AND STORAGE

79D-1390

OPERATION BOHLEN

Cessou, M. 1978.

Petroleum Technology, N. 256:9-18.

Tankers, Oil transfer, Pollution prevention, *Hot water extraction

A new hot water extraction method was successfully applied to the recovery of oil from the shipwrecked East German tanker Bohlen, which sank on 14 October 1976. Recovery operations were completed within 5 months.

[from Petroleum Abstracts 19(30):#265,673. 1979]

79D-1391

SUPERTANKERS AND SUPERPORTS (CITATIONS FROM THE ENGINEERING INDEX DATA BASE)

Habercom, J.E. 1978.

Report NTIS/PS-78/0815. 116 p. Report for 1970-June 1978. (Supersedes NTIS/PS-77/0701, and NTIS/PS-76/0592.)

Tankers, Ports, Development, Environmental effects, Offshore, Bibliographies

Construction and operation of supertankers and requirements for port facilities are reviewed in these reports gathered from international literature. Environmental aspects, offshore mooring sites, and harbor preparations are among the topics investigated. There are 110 abstracts in the report, 4 of which are new entries.

[from Government Reports Announcements 78(20):229.#NTIS/PS-78/0815. 1978]

79D-1392

TANKER OPERATIONS: A HANDBOOK FOR THE SHIP'S OFFICER

Marton, G.S. 1978.

Cambridge, Maryland, Cornell Maritime Press, 1978. 195 p.

Tankers, Pollution prevention, Equipment, Oil transport, Oil transfer, Manuals

The title book deals with several key aspects of tanker operations and contains the latest information on such subjects as pollution prevention, gas inerting systems, and special loading and unloading systems.

[from Marine Technology Society Journal 12(5):42. 1979]

F. POLLUTION ASPECTS OF OIL TRANSPORT, TRANSFER, AND STORAGE

79D-1393

SPILL RISK ANALYSIS PROGRAM: METHODOLOGY DEVELOPMENT AND DEMONSTRATION - VOLUME 1

Stoehr, L.A., C.H. Morgan, F.J. Reiffler, and P.M. Tullier. 1977.
Report CG-D-21-77, Contract DOT-CG-31571-A, 1977. Final report.

Models, Tankers, Ships, Oil Spills, Risk analysis, USCG, Information systems, *PIRS

This report is an assessment of recently enacted and implemented merchant marine safety regulations. The methodology includes analytical modeling of collisions primarily in terms of physical parameters (vessel size, speed, maneuverability), and logical modeling of casualties using as a data base the USCG marine casualty reports. A preliminary analysis of the Coast Guard Pollution Reporting System (PIRS) is also included.

79D-1394

REPORT OF STUDY OF TANKER SAFETY AND POLLUTION PREVENTION REQUIREMENTS FOR US TANKERS IN DOMESTIC TRADE

US Coast Guard. 1978.

Report USCG-M-5-78. ___ p.

Tankers, Safety, Pollution prevention, Risk analysis, Oil spills, Environmental effects, Segregated ballast, USCG

Risks are examined that are associated with the marine transportation of oil by US tank vessels, including vessel movements, and potential hazards to people, property, and the marine environment. Preventative actions and recommendations are presented including suggested discharge control measures, segregated ballast tanks, and tank cleaning procedures.

[from Government Reports Announcements 78(23):209.#AD-A057 607. 1978]

79D-1395

MARINE ACCIDENT REPORT - GROUNDING OF M/V DAUNTLESS COLOCOTRONIS IN MISSISSIPPI RIVER NEAR NEW ORLEANS, LOUISIANA ON JULY 22, 1977

US National Transportation Safety Board. 1978.

Report MA-GEN-370-78061, Contract MA-7-38020. 236 p.

Tankers, Oil spills, Mississippi River, *Accident report

A chronology of events leading to the title accident is presented. The probable cause was a fracturing of the vessel's bottom as it dragged over a sunken barge which had been declared a hazard to navigation but had not been marked by the owner nor removed by the Coast Guard.

[from Government Reports Announcements 78(24):199.#PB-284 333. 1978]

F. POLLUTION ASPECTS OF OIL TRANSPORT, TRANSFER, AND STORAGE

79D-1396

MARINE ACCIDENT REPORT. SINKING OF THE M/V CHESTER A. POLING NEAR CAPE ANN, MASSACHUSETTS, JANUARY 10, 1977
US National Transportation Safety Board. 1978.
Report NTSB-MAR-78-7. 28 p.

Oil spills, Tankers, Massachusetts, *M/V Chester A. Poling

A summary of findings presented of the sinking of the title coastal tanker. Hull failure during a severe storm was caused by fracturing of a horizontal hull stiffener due to high stresses of heavy seas and improper distribution of ballast water.

[from Government Reports Announcements 79(01):159.#PB-286 549. 1979]

79D-1397

SPILLS WORSEN PROBLEMS IN GLOBAL OIL MOVEMENTS
Vielvoye, R. 1979.
Oil and Gas Journal 77(26):35-39.

Tankers, Oil spills, Statistics, Ballast, Oil discharges, Pollution prevention, International conventions

"Accidental oil spills during the past 18 months are listed and discussed. While statistically tankers are spilling less and less oil into the sea each year, the continuing spill incidents demonstrate that international conventions, enforced regulations, tanker equipment improvements, and navigational aids cannot entirely eliminate such spills....Some solutions to containing oil-spill pollution from both wreckage and ballast discharge are offered, including provisions of the international proposal for a Convention of Civil Liability for Oil Pollution Damage."

[from Petroleum Abstracts 19(27):#264,928. 1978]

2. Pipelines

79D-1398

OFFSHORE PIPELINE FACILITY SAFETY PRACTICES. VOLUME I - EXECUTIVE SUMMARY, VOLUME II - MAIN TEXT
Funge, W.J., K.S. Chang, and D.I. Juran. 1977.
Report DOT/MTB/OPSO-77/14, Contract DOT-05-60103. Vol. 1, 68 p.; Vol. 2, 563 p.

Pipelines, Offshore, Safety, Pollution prevention, Regulations

F. POLLUTION ASPECTS OF OIL TRANSPORT, TRANSFER, AND STORAGE

This report presents an evaluation of the state-of-the-art in the design, construction, operation, and maintenance of offshore pipeline facilities, an identification of potential hazards to operation, and a review of selected pipeline safety regulations. It includes an appraisal of existing foreign and domestic practices, a determination of their adequacy, an analysis of the need for additional research and development, and the need for regulatory changes.

[from Government Reports Announcements 78(19):114.#PB281 865,867. 1978]

79D-1399

SAFE SERVICE LIFE FOR LIQUID PETROLEUM PIPELINES

US National Transportation Safety Board. 1978.

Report NTSB-PSS-78-1. 43 p. Special Study.

Pipelines, Safety, Models, Pollution prevention

The title analysis revealed that insufficient data is available to support development of a model for determining when a pipeline has become so hazardous that its operation should be modified or terminated. Recommendations include improvement of DOT data gathering and analysis, strengthened federal pipeline regulations concerning LPG pipelines, and promotion of statewide "one-call" systems.

3. Loading and Offloading Facilities

79D-1400

THE FLOTTA OIL TERMINAL AND ITS EFFECTS ON THE MARINE ENVIRONMENT

Johnson, C.S. 1979.

The Marine Environment of Sullom Voe and the Implications of Oil Developments, Scottish Marine Biological Association, 18-19 April 1979. Oban, Scotland, Shetland Oil Terminal Advisory Group, 1979. p. 25. Abstract.

Oil terminals, Biological effects, Tankers, Oil transfer, Scotland,
*Sullom Voe

The title paper concentrates on five major aspects of the Flotta Terminal: Risks from tanker movements and loading procedures; oily-water treatment systems; effluent discharge; general environmental philosophy; and "interpretation of exemption conditions from the Prevention of Oil Pollution Act of 1971 and the ongoing monitoring programme in the Flotta environs."

F. POLLUTION ASPECTS OF OIL TRANSPORT, TRANSFER, AND STORAGE

79D-1401

STUDY OF DEEPWATER PORT OIL TRANSFER CONTROL SYSTEMS

Robson, I.C., and W. Scherkenbach. 1978.

Report USCG-D-58-78, Contract DOT-CG-64503-A. 377 p. Final report.

Deepwater ports, Oil transfer, Pollution prevention, Tankers, *Transfer control systems

The title report deals with the description, reliability, and rating of oil transfer control systems. A numerical rating is presented which enables a comparison to be made between a proposed control system and a benchmark system. An equipment staging diagram, fault trees, and a failure mode and effects analysis are presented for the defined control system. [possibly oil pollution related]

[from Government Reports Announcements 78(3):124.#AD-A060 144. 1979]

4. Storage Facilities

79D-1402

STRATEGIC PETROLEUM RESERVE PLAN. EXPANSION OF THE STRATEGIC PETROLEUM RESERVE: AMENDMENT NO. 2, ENERGY ACTION DOE NO. 1

US Department of Energy. 1978.

Report DOE/RA-0032/2. 66 p.

Storage, Strategic Petroleum Reserve, Cost analysis, Environmental effects, Louisiana

Provisions are discussed of amendments which could double the present 500 million bbl reserve, and which would provide for the storage of 250 million bbl petroleum products for the U.S. Coast Guard. Implementation activities and a benefit/cost analysis are presented. [possibly oil pollution related]

[from Energy Research Abstracts 3(16):#36854. 1978]

79D-1403

STRATEGIC PETROLEUM RESERVE. SEAWAY GROUP SALT DOMES, BRAZORIA COUNTY, TEXAS. FINAL ENVIRONMENTAL IMPACT STATEMENT. VOLUMES 1, 2, 3

US Department of Energy. 1978.

Report DOE/EIS-0021 (Vol. 1,2,3). Vol. 1, 403 p.; Vol. 2, 357 p.; Vol. 3, 614 p.

Storage, Strategic Petroleum Reserve, EIS, Texas

The title final EIS discusses the environmental impacts of developing and operating a 100 million barrel crude oil storage facility at one or more of five candidate sites in the Seaway Group.

[from Energy Research Abstracts 3(20):48,746. 1978]

F. POLLUTION ASPECTS OF OIL TRANSPORT, TRANSFER, AND STORAGE

79D-1404

STRATEGIC PETROLEUM RESERVE, SULPHUR MINES SALT DOME, CALCASIEU PARISH, LOUISIANA. FINAL ENVIRONMENTAL IMPACT STATEMENT

US Department of Energy. 1978.

Report DOE/EIS-0010. 622 p.

Storage, Strategic Petroleum Reserve, Oil transport, EIS, Louisiana

"This site specific EIS has identified particularly sensitive environmental parameters that have been investigated in detail for for Sulphur Mines, Louisiana site....A total of 453 barrels of oil are projected to be spilled during the project lifetime in transporting the crude oil."

[from Energy Research Abstracts 3(16):#36853. 1978]

79D-1405

FINAL ENVIRONMENTAL IMPACT STATEMENT. STRATEGIC PETROLEUM RESERVE. CAPLINE GROUP SALT DOMES, IBERIA, IBERVILLE, AND LAFOURCHE PARISHES, LOUISIANA. VOLUMES 1-4

US Federal Energy Administration. 1978.

Report DOE/EIS/0024 (V. 1,2,3,4). 1825 p.

Storage, Strategic Petroleum Reserve, EIS, Louisiana

A site-specific EIS is presented in four volumes for five candidate sites comprising the Capline Group of salt domes located in the Gulf Coast region of south central Louisiana.

[from Engery Research Abstracts 3(22):#51969-51972. 1978]

79D-1406

QUESTIONABLE SUITABILITY OF CERTAIN SALT CAVERNS AND MINES FOR THE STRATEGIC PETROLEUM RESERVE

US General Accounting Office. 1978.

Report EMD-78-65. 48 p.

Storage, Strategic Petroleum Reserve, Risk analysis, DOE

The title report discusses actions taken by DOE without adequate analysis to assure that risks of using certain salt caverns and mines for the strategic petroleum reserve were minimized. Possible ramifications of these actions and alternatives available are presented.

[from Government Reports Announcements 78(23):134.#PB-284 662. 1978]

F. POLLUTION ASPECTS OF OIL TRANSPORT, TRANSFER, AND STORAGE

5. Legal and Regulatory Aspects

79D-1407

AN INTERVIEW WITH IMCO

Bartlett, T. 1977.

Dock and Harbour Authority 58(680):113-114.

IMCO, International conventions, Tankers, Oil terminals, Pollution control, Law enforcement, Spill cleanup

The text of an interview with the head of IMCO's Marine Environment Division, Mr. Yoshiosasamura, is presented. Topics of discussion include various provisions of the 1973 IMCO Convention, enforcement of the provisions, and the Regional Oil Combatting Centre at Malta.

6. General Aspects

79D-1408

BLACK YEAR FOR UK OIL POLLUTION

Anon. 1979.

Marine Pollution Bulletin 10(7):182-184.

Oil spills, Tankers, Statistics, Legislation, Biological effects, UK

The contents of the Advisory Committee on Oil Pollution of the Seas (ACOPS) Annual Report for 1978 are outlined. Statistics for spill incidents around the coasts of Britain and Ireland and legislative developments during 1978 are reviewed.

79D-1409

AD HOC STUDY OF CERTAIN SAFETY RELATED ASPECTS OF DOUBLE-BOTTOM TANKERS

Ervin R.D., P.S. Fancher, T.D. Gillespie, C.B. Winkler, and A. Wolfe. 1978. Report UM-HSRI-78-18-1,2. Vol. 1, 79 p.; Vol. 2, 185 p. Final report.

Oil transport, Petroleum products, Safety, Design-engineering, *Tank trucks

The title two-volume study deals with inherent stability problems shown by "double-bottom" tank trucks, or those with multiple trailers. The study concludes that the double bottom "is a uniquely hazardous vehicle" and recommended that use of multiple trailers of present design be discontinued in Michigan. A modified version is suggested using existing technology. [possibly oil pollution related]

[from Government Reports Announcements 78(19):129.#PB-282 080,081. 1978]

F. POLLUTION ASPECTS OF OIL TRANSPORT, TRANSFER, AND STORAGE

79D-1410

DEEPWATER PORTS INSPECTION METHODS AND PROCEDURES

Mastandrea, J.R., K.J. Gilbert, J.A. Simmons, and P.B. Kimball. 1978. Report USCG-D-31-78, Contract DOT-CG-60670-A. 591 p. Final report.

Deepwater ports, Regulations, Pollution prevention, *Oil Transfer System

The title study provides information for future regulations dealing with pollution. It identifies and assesses inspection methods and procedures for the Oil Transfer System (OTS) of deep water ports. Recommendations are made for inspection methods and procedures that would provide an effective means of minimizing accidental oil spills from the OTS of deep-water ports in US waters.

[from Government Reports Announcements 78(20):199.#AD-A055 727. 1978]

79D-1411

OIL SPILLS AND TAR POLLUTION ALONG THE COAST OF KUWAIT

Oostdam, B.L., and V. Anderlini. 1978.

Safat, Kuwait, Kuwait Institute of Scientific Research, 1978. 54 p.

Statistics, Oil transport, Tankers, Tar, Oil spills, Coasts, Ballast, Pollution control, Kuwait

This report summarizes statistics on oil movement and oil pollution incidents in Kuwait waters, and presents the results of a tarball sampling and analysis program along Kuwait City beaches. Among the conclusions are that the number of oil spills in Kuwait is generally decreasing, that the average amount of oil spilled to oil transported is in a ratio of 1.5 ppm, well below the world average of 72 ppm, and that present monitoring and enforcement measures are inadequate, as are the facilities for tanker deballasting and slop disposal.

G. PETROLEUM AND PETROCHEMICAL INDUSTRY WASTE TREATMENT AND DISPOSAL

1. Waste Treatment and Disposal Methods

79D-1412

PRELIMINARY EXAMINATION OF WASTE WATERS PRODUCED DURING AN IN SITU RETORTING OF TAR SANDS

Barbour, F.A., F.D. Guffey, and S.M. Dorrence. 1977.

Canadian Institute of Mining and Metallurgy Special Vol., No. 17. p. 743-748.

Wastewaters, Tar sands, Oil shale

The title study was conducted on a tar sand deposit in Utah. Organic constituents identified using GC/MS included carboxylic acids, particularly acetic acid, phenols, and lactones. Inorganic components were also identified. The results are compared with those from a similar analysis on product water from in situ recovery of oil shale.

[from Petroleum Abstracts 19(32):#266,226. 1979]

79D-1413

AUTOMATIC SYSTEM FOR TRAPPING AND REMOVING WASTE HYDROCARBONS FROM WASTEWATER

Bereskin, F.P., and J.J. Borowczyk. 1979.

US Patent 4,145,286

Wastewater treatment, Oil-water separation, Equipment, Design-engineering, Patent

Wastewater enters a chamber where oil, grease and other hydrocarbons are allowed to separate from the water. The separated water is discharged and new wastewater entering the chamber forces the hydrocarbon layer upward and through an outlet into a storage vessel.

[from Chemical Abstracts 91(4):#26849n. 1979]

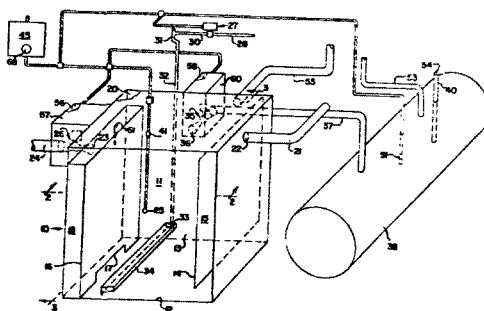
4,145,286
AUTOMATIC SYSTEM FOR TRAPPING AND
REMOVING WASTE HYDROCARBONS FROM WATER
Fred P. Bereskin, 117 Red Oak La., Highland Park, Ill. 60035,
and Joseph J. Borowczyk, 116 West Central Blvd., Villa Park,
Ill. 60181

Filed Aug. 1, 1977, Ser. No. 820,553

Int. Cl.² B01D 21/24; B03D 3/00

U.S. Cl. 210-104

7 Claims



G. PETROLEUM AND PETROCHEMICAL INDUSTRY WASTE TREATMENT AND DISPOSAL

79D-1414

DEPHENOLIZATION OF INDUSTRIAL WASTE WATER ON THE MACROPOROUS ADSORBENT AMBERLITE XAD-4

Bogdaniak, S.W. 1978.

Environmental Protection Engineering 4(3):201-209.

Wastewater treatment, Adsorption, Oil industry, *Phenol removal

Testing equipment for the title process is described, consisting of gravel and sorption columns connected in series. The process is suitable for oil industry and petrochemical wastewaters.

[from Chemical Abstracts 91(6):#44040w. 1979]

79D-1415

BIOLOGICAL EVALUATION OF BEST PRACTICABLE AND BEST AVAILABLE TREATMENT CONTROL TECHNOLOGY FOR PETROLEUM REFINERY WASTEWATERS

Burks, S.Z., and J.L. Wilhm. 1977.

Report PB-272281. 139 p.

Wastewater treatment, Oil industry, Filtration, Toxicity, Biological effects

Treatment systems were tested for the production of non-toxic effluents from petroleum refining wastewaters. Toxic effects of the test effluents were measured on fathead minnows and by benthic macroinvertebrate bio-assay. BATEA, a sequential treatment process involving dual media filtration with activated charcoal absorption, improved final effluents. BPTC, a system without activated charcoal, did not significantly improve final effluent quality. A waste stabilization lagoon system produced a final effluent of comparable quality to that of BATEA.

[from Chemical Abstracts 88(20):#141,226g. 1978]

79D-1416

WASTE PROCESSING AND POLLUTION IN THE CHEMICAL AND PETROCHEMICAL INDUSTRIES. VOLUME 3. (A BIBLIOGRAPHY WITH ABSTRACTS)

Cavagnaro, D. 1978.

Report NTIS/PS-78/0826. 242 p. Report for 1977-July 1978. (Supersedes NTIS/PS-76/0607, NTIS/PS-75/541, and NTIS/PS-74/118.)

Wastewater treatment, Petrochemicals, Oil industry, Pollution prevention, Economics, Bibliographies

These citations cover a variety of topics including economics, control processes, pollution effects and abatement strategies of the chemical and petrochemical industries. Of the 235 entries, 123 are new.

[from Government Reports Announcements 78(21):97.#NTIS/PS-78/0826. 1978]

G. PETROLEUM AND PETROCHEMICAL INDUSTRY WASTE TREATMENT AND DISPOSAL

79D-1417

BIODEGRADATION OF HIGH-LEVEL OIL-IN-WATER EMULSIONS

Davis, R.M. 1978.

Report CONF-780549-1, Contract W-7405-ENG-26. 18 p.

Biodegradation, Emulsions, Disposal, Wastewater treatment

A process is discussed for disposing of high-level oil-in-water emulsions used as coolants in metal machining operations. An aerobic stirred-bed reactor is used for the biodegradation of organic wastes and has demonstrated organic carbon removal efficiencies of 98%.

[from Energy Research Abstracts 3(20):#48257. 1978]

79D-1418

DEMULSIFIER FOR REMOVING EMULSIFIED PETROLEUM PRODUCTS AND VEGETABLE OILS FROM WATER

Gol'denfon, A.K., A.B. Stepanov, L.V. Shcherbakova, G.N. Semenov, et al. 1979. USSR Patent 648,527

Wastewater treatment, Oil removal, Demulsification, Patent

Propylene oxide-ethylene oxide block copolymer was used for oil removal.

[from Chemical Abstracts 91(2):#9162r. 1979]

79D-1419

PRIMARY WASTEWATER TREATMENT AND OIL RECOVERY IN THE REFINING INDUSTRY

Gruett, J.L. 1978.

National Petroleum Refiners Association, Technical paper AM-78-43. 23 p.

Wastewater treatment, Oil removal, Oil-water separation, Refineries

"A review with no references."

[from Chemical Abstracts 89(24):#203465r. 1978]

79D-1420

HIGH RATE FILTRATION OF REFINERY OILY WASTEWATER EMULSIONS

Humenick, M.J., and B.J. Davis. 1978.

Journal Water Pollution Control Federation 50(8):1953-1964.

Wastewater treatment, Filtration, Emulsions, Refineries

The effectiveness of filtration of solids-stabilized oil-in-water emulsions with a dual-media-filter of anthracite and sand under a variety of conditions is assessed.

[from Chemical Abstracts 89(26):#220360v. 1978]

G. PETROLEUM AND PETROCHEMICAL INDUSTRY WASTE TREATMENT AND DISPOSAL

79D-1421

STATUS OF OIL SHALE CONVERSION PROCESS TECHNOLOGY AND RESIDUALS MANAGEMENT

Hutchins, J. 1976.

Symposium on Management of Residuals from Synthetic Fuels Production,
(first), Denver, Colorado, 25 May 1976.

Oil shale, Extraction, Disposal, Environmental effects, Solid wastes

Oil shale deposits of the west and some retorting processes are described. The waste and saleable products are discussed. "It is felt that most of the money spent on environmental studies is just wasted, and a personal view of priorities is offered." [possibly oil pollution related]

[from Energy Research Abstracts 3(5):1025. 1978]

79D-1422

THERMODYNAMIC ANALYSIS OF AN OIL RECLAMATION PROCESS

Jhavar, K.R., E.D. Grossman, H.L. Brown, and B.B. Hamel. 1977.

Report NTIS PC A09/MF A01. 200 p.

Waste oil treatment, Reclamation, Industries

"This study provides quantitative methodology for characterizing the energy utilization efficiency of waste oil reclamation processes."

[from Energy Research Abstracts 3(4):842.#7995. 1978]

79D-1423

DUAL MEDIA FILTRATION FOR TREATMENT OF REFINERY WASTE WATER

Kempling, J.C., T.E. Michniewicz, and J. Eng. 1976.

Water Pollution Research in Canada 11:57-61.

Wastewater treatment, Refineries, Filtration, Oil removal

Anthracite and sand were used to treat a refinery wastewater. The data were used to construct a dual-media filter capable of treating waste at a rate of 22,800 L/min (6,000 gal/min). Removal of oil and suspended solids were 79% and 55%, respectively.

[from Chemical Abstracts 89(26):#220366b. 1978]

G. PETROLEUM AND PETROCHEMICAL INDUSTRY WASTE TREATMENT AND DISPOSAL

79D-1424

OIL REMOVAL FROM WASTEWATER OR SEWAGE

Kobiyama, S., and T. Kishi. 1978.
Japanese Patent Application 78 50,056

Wastewater treatment, Oil removal, Patent

Wastewater is treated in an apparatus containing a cylindrical deflector and a solvent, either petroleum ether, petroleum benzene, PhMe or gasoline. The wastewater is deflected by the deflector, which has a solvent inlet and retrieving outlet, and is discharged through the top of the apparatus.

[from Chemical Abstracts 89(22):#185527f. 1978]

79D-1425

WASTEWATER TREATMENT

Komiyama, Y., and C. Hidaka. 1978.
Japanese Patent Application 78 97,256

Wastewater treatment, Oil removal, Flocculation, Patent

Pollutant-containing wastewaters are stirred with $Al(OH)_3$ and the resulting coagulated materials are separated and burned to obtain Al_2O_3 . The method is applicable to oil removal.

[from Chemical Abstracts 89(22):#185584x. 1978]

79D-1426

TECHNIQUES FOR REMOVING OIL AND GREASE FROM INDUSTRIAL WASTEWATER

Kulowiec, J.J. 1979.
Pollution Engineering 11(2):39-43.

Wastewater treatment, Gravity separation, Flotation, Biological treatment, Sludge, Disposal

Alternative methods are outlined for oily wastewater treatment and removal. Differing concentrations from various industrial sources are given and brief discussions of the following topics are presented: Gravity separation, dissolved air flotation, gas flotation, free-floating oil and emulsions, membrane removal processes, biological treatment, physical-chemical treatment, and disposal of waste oil and sludges.

G. PETROLEUM AND PETROCHEMICAL INDUSTRY WASTE TREATMENT AND DISPOSAL

79D-1427

TREATMENT OF OIL CONTAMINATED WASTE WATERS BY FOAM FRACTIONATION

Mathews, A., P.R. Bishnoi, and W.Y. Svrcek. 1979.

Water Research 13(4):385-391.

Wastewater treatment, Oil removal, Adsorption, Performance testing,

*Foam separation

The application of a foam separation process to the removal of organic pollutants from wastewater was studied. The effects of air flow rate, surfactant flow rate, pressure, pH, and solid adsorbent concentration were examined for different feed streams. Foam separation alone achieved 98% removal of emulsified oil from a waste stream. The 3-phase fluidized bed adsorption processes resulted in 98% reduction of organics from two waste waters tested. The results of study establishing the cost feasibility of using a similar process on an industrial scale are presented.

[from Petroleum Abstracts 19(33):#266,510. 1979]

79D-1428

TREATMENT OF PETROLEUM REFINERY, PETROCHEMICAL AND COMBINED INDUSTRIAL-MUNICIPAL WASTEWATERS WITH ACTIVATED CARBON - LITERATURE REVIEW

Matthews, J.E. 1978.

Report EPA/600/2-78/200. 98 p.

Wastewater treatment, Refineries, Petrochemicals, Adsorption, Bibliographies,

*Activated carbon

A review is presented of the literature available on activated carbon adsorption treatment for various wastewaters. Over 240 references are cited.

[from Government Reports Announcements 79(5):175.#PB-288 211. 1979]

79D-1429

REMOVAL OF EMULSIFIED OILS FROM EFFLUENTS BY ELECTROCOAGULATION [English summary]

Mejbaum, Z., and J. Stasch. 1978.

Przemysl Chemiczny 57(8):407-410.

Wastewater treatment, Oil removal, Emulsions, *Electrocoagulation

Conditions required for effective oil removal by electrocoagulation are described.

[from Chemical Abstracts 89(26):#220405p. 1978]

G. PETROLEUM AND PETROCHEMICAL INDUSTRY WASTE TREATMENT AND DISPOSAL

79D-1430

APPLICABILITY OF ANALYTICAL METHODS FOR DETERMINING PETROLEUM PRODUCTS IN STUDIES ON BIOCHEMICAL SEWAGE PURIFICATION [in Polish]

Miksch, K., 1978.

Nafta 34(6):201-205.

Waste oil treatment, Analytical techniques, Petroleum products, Biodegradation

"A review is given...of the efficiency of sewage biological purification and the biodegradability of petroleum products."

[from Chemical Abstracts 89(24):#203493y. 1978]

79D-1431

MIXED CULTURE OF MYCOTORULA JAPONICA AND PSEUDOMONAS OLEOVORANS ON TWO HYDROCARBONS

Miura, Y., K. Sugiura, M. Yoh, H. Tanaka, et al. 1978.

Journal of Fermentation Technology 56(4):339-344.

Waste oil treatment, Biodegradation, Microorganisms, Hydrocarbons, Models, *Mycotorula, *Pseudomonas

The title culture system was developed on two carbon sources, n-tetradecane and PhOH, as a model for the treatment of petroleum sewage. Characteristics of the system are described.

[from Chemical Abstracts 89(22):#185448f. 1978]

79D-1432

THE OTHER OIL CRISIS: WHAT TO DO WITH "WASTE" OIL

Morris, R. 1978.

Conservation News 43(7):2-5.

Waste oil, Crankcase oil, Disposal, Recycling

This article examines current practices of waste crankcase oil handling and disposal. Currently only about one tenth of this used oil is re-refined for lubrication purposes, and one-third of all the waste oil is unaccounted for, largely dumped into the environment by the do-it-yourselfers who change their own oil.

G. PETROLEUM AND PETROCHEMICAL INDUSTRY WASTE TREATMENT AND DISPOSAL

79D-1433

PURIFYING DRILLING WASTEWATER FROM MECHANICAL IMPURITIES ON A HYDROCLONE INSTALLATION [in Russian]

Mustafaev, A.M., B.M. Gutman, M.A. Karaev, and V.P. Ershov. 1977.
Izvestiya Yysshikh Uchebnykh Zavedenii, Neft i Gaz No. 2, 37-39.

Wastewater treatment, Drilling, Pollution prevention, *Hydrocyclone

Problems involved in the purification of drilling wastewaters to prevent pollution are discussed. The possibility of using hydrocyclones for removal of impurities is studied. "As a result of experiments, a method is worked out and optimum parameters of purification on a hydrocyclone plant with the efficiency of 90-93% by means of recirculation are determined."

[from Energy Research Abstracts 3(4):843.#7997. 1978]

79D-1434

REMOVAL OF SUSPENDED SOLIDS AND OIL FROM WASTEWATER

Nakano, S., and T. Naka. 1979.

Japanese Patent Application 79 30,659

Wastewater treatment, Oil removal, Solid wastes, Filtration, Patent

"Wastewater is filtered with hydrophobic fiber filter, then treated with a composite prepared from polymer fiber and \leq oxides or hydroxides of Mg, Zn, Pb, Fe, Co, Ni, or Cu to remove suspended solids and oils."

[from Chemical Abstracts 91(4):#26833c. 1979]

79D-1435

OIL-ADSORPTIVE MATERIAL FOR TREATMENT OF WASTEWATERS

Nakano, S., and H. Nakatsui. 1979.

Japanese patent application 79 37,070

Wastewater treatment, Adsorption, Sorbents, Patent

Polyethylene and polypropylene fibers, 3-50 mm long, are dispersed in water, then sheared with a sharp edged device to form fibrillar surfaces for improved adsorption of oil. In a test, emulsified wastewater containing 1000 ppm of heavy oil was reduced to 10 ppm oil content.

[from Chemical Abstracts 91(6):#44182u. 1979]

G. PETROLEUM AND PETROCHEMICAL INDUSTRY WASTE TREATMENT AND DISPOSAL

79D-1436

EFFLUENT TREATMENT PROCESS

Oldham, G.F. 1977.

US Patent 4,032,439

Wastewater treatment, Design-engineering, Oil removal, Gravity separation, Filtration, Patent

"A method for treating effluent water containing suspended oil from a gravity separator, comprises passing the effluent through a sand filter so as to remove suspended oil and produce water suitable for effective passage through a biological percolating filter, periodically stopping the flow...and backwashing the sand filter with water to remove suspended oil therefrom."

[from ERDA Energy Research Abstracts 2(22):5601.#53909. 1977]

4,032,439

EFFLUENT TREATMENT PROCESS

Guy Franklin Oldham, London, England, assignor to The British Petroleum Company Limited, London, England
Continuation of Ser. No. 535,181, Dec. 23, 1974, abandoned.

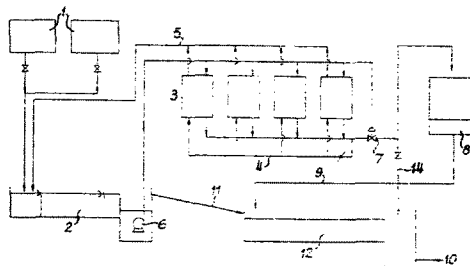
This application Mar. 18, 1976, Ser. No. 668,078

Claims priority, application United Kingdom, Jan. 3, 1974, 00264/74

Int. Cl.² C02C 5/10

U.S. Cl. 210-17

6 Claims



79D-1437

TREATMENT OF EFFLUENT

Oldham, G.F. 1978.

British Patent 1,535,848

Wastewater treatment, Oil removal, Gravity separation, Filtration, Patent

Oily wastewaters are treated by gravity separation to give an oily fraction an aqueous fraction with reduced oil content, and an oily sludge. The oily fraction and sludge are combined, heated, and pressure filtered to retain solids; the aqueous fraction is recycled to the gravity separator for further treatment.

[from Chemical Abstracts 91(6):#44148. 1979]

G. PETROLEUM AND PETROCHEMICAL INDUSTRY WASTE TREATMENT AND DISPOSAL

79D-1438

PROCEEDINGS OF THE OPEN FORUM ON MANAGEMENT OF PETROLEUM WASTEWATER (2ND)

Pfeffer, F.M. and F.S. Manning. 1978.

Report EPA/600/2-78-058, Grant EPA-R-804968. 564 p. Final report.

Wastewater treatment, Oil industry, Environmental effects

Summary not available.

[from Government Reports Announcements 78(23):106.#PB-284 247. 1978]

79D-1439

SEPARATION OF SPENT OIL EMULSIONS, OIL-CONTAINING WASHING WATERS AND COOLANTS USING CHEMO-FLotation CF. [in German]

Poepel, F., and S. Mangold. 1979.

Umweltschutz-Gesundheitstechnik 13(2):31-32.

Emulsions, Wastewaters, Disposal, Flotation, Oil-water separation

The title method provides an economical way of reducing the hydrocarbon content of wastewaters for permissible disposal.

[from Chemical Abstracts 91(2):#9117e. 1979]

79D-1440

TRACE ORGANICS VARIATION ACROSS THE WASTEWATER SYSTEM OF A CLASS-B REFINERY AND ESTIMATE OF REMOVAL OF REFRACTORY ORGANICS BY ADD-ON MIXED MEDIA FILTRATION AND GRANULAR ACTIVATED CARBON AT PILOT SCALE

Raphaelian, L.A., and W. Harrison. 1978.

Report ANL/WR-78-2, EPA/600/7-78-125. 178 p.

Wastewater treatment, Filtration, Refineries

The efficiency of the title wastewater filtration system that met BPT (best practicable technology) criteria is evaluated. Effluents from the full-scale system and an add-on pilot scale unit were sampled for analysis of common wastewater parameters and trace organic compounds. Common wastewater parameters are also presented for comparison to specific organics concentration data.

[from Government Reports Announcements 78(26):148.#PB-285 596. 1978]

G. PETROLEUM AND PETROCHEMICAL INDUSTRY WASTE TREATMENT AND DISPOSAL

79D-1441

PURIFICATION OF CONDENSED WASTEWATER CONTAINING ORGANIC SUBSTANCES

Sano, K., Y. Yamada, and S. Kurihara. 1979.

Japanese Patent Application 79 10,561

Wastewater treatment, Activated sludge, Patent

"The title wastewater is adjusted with seawater to contain >50 mg/L NaCl, then treated with an activated sludge to decompose organic substances." [possibly oil pollution related]

[from Chemical Abstracts 91(4):#26807x. 1979]

79D-1442

OIL-ABSORBING MATERIAL FOR TREATING OIL-CONTAINING WATER

Sato, H., M. Nakatani, and N. Mochida. 1978.

German Patent Application 2,806,851

Wastewater treatment, Oil removal, Adsorption, Patent

An oil-adsorbing material containing an inorganic filler and a cross-linkable polymer is described.

[from Chemical Abstracts 89(26):#220501s. 1978]

79D-1443

DISPOSAL OF WASTE OIL RE-REFINING RESIDUES BY LAND FARMING

Snyder, H.J., Jr., G.B. Rice, and J.J. Skujins. 1976.

Report EPA-600/9-76-015. 15 p.

Waste oil, Disposal, Land farming, Sludge

Factors surrounding the selection and design of sites for the disposal of residues from a waste oil re-refining plant are discussed. The sludge emulsions were spread on a plot and supplemental fertilizer applied. After one year, oil degradation on fertilized lots was ~80%.

[from Chemical Abstracts 88(12):#78544s. 1978]

79D-1444

WATER POLISHING MEANS FOR REMOVING OIL AND OTHER FLOTSAM FROM WATER

Stebbins, G.B., and J.F. Stebbins. 1977.

US Patent 4,049,553

Wastewater treatment, Oil removal, Equipment, Design-engineering, Patent

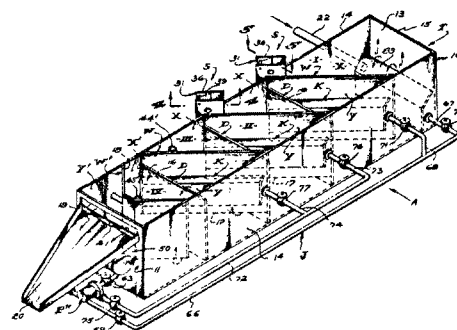
The title apparatus includes an elongate tank, an inlet and a plurality of spaced vertical dams extending transversely across the tank. A vertical weir is provided in each dam zone with its upper portion above the mean fluid level. A pump means and downstream pipes are provided to

G. PETROLEUM AND PETROCHEMICAL INDUSTRY WASTE TREATMENT AND DISPOSAL

cause a mixture of fluid, flotsam, and air to be drawn into the open end of the pipe eventually to be dispersed after passing through the apparatus.

[from Energy Research Abstracts 3(4):843.#8004. 1978]

4,049,553
WATER POLISHING MEANS FOR REMOVING OIL AND
OTHER FLOTSAM FROM WATER
George B. Stebbins, 938 Fairbrook Lane, and James F. Stebbins,
2910 Shakespeare Drive, both of San Marino, Calif. 91108
Filed Apr. 12, 1976, Ser. No. 675,733
Int. Cl.² B03D 1/26
U.S. Cl. 210—195 R 6 Claims



79D-1445

ORGANIC CONSTITUENTS OF OIL SANDS EXTRACTION PLANT WASTEWATERS

Strosher, M.T., and E. Peake. 1977.

Canadian Institute of Mining and Metallurgy Special Vol. No. 17. p. 749-758.

Wastewaters, Tar sands, Oil discharges, Rivers

The organic constituents of wastewaters from the Athabasca oil sand extraction plant were characterized and quantified on samples taken in 1975.

The findings indicate that a daily average of 198 kg (435 lbs) of organic carbon were discharged to the Athabasca river from the tailings pond dike filter system and 1,460 kg (3,245 lbs) from the upgrading plant effluent.

[from Petroleum Abstracts 19(32):#266,227. 1979]

79D-1446

AMINO-DEMULSIFIER FOR OIL-EMULSIFIED WASTEWATER

Suzuki, H., T. Ono, and M. Yamaguchi. 1979.

Japanese Patent Application 79 18,152

Wastewater treatment, Demulsification, Patent

The demulsifier is composed of 0.01-0.5 mole C₆₋₆₀ amino compound per mole metal oxide and/or hydroxide and is "carried on a support."

[from Chemical Abstracts 91(4):#26818b. 1979]

G. PETROLEUM AND PETROCHEMICAL INDUSTRY WASTE TREATMENT AND DISPOSAL

79D-1447

REMOVAL OF OIL FROM WASTEWATERS

Takenishi, S., and T. Sato. 1978.

Japanese Patent Application 78 54,176

Oil removal, Wastewater treatment, Patent

Wastewaters containing oils are purified by passing through poly(vinylpyrrolidone)-containing cellulose-fiber fabrics.

[from Chemical Abstracts 89(22):#185525d. 1978]

79D-1448

WASTEWATER MANAGEMENT: A GUIDE TO INFORMATION SOURCES

Tchobanoglous, G. 1976.

Gale Research Company, 1976. 202 p. Man and the Environment Guide Series, Vol. 2.

Wastewaters, Information systems, Manuals

Summary not available.

[from Environmental Management 3(2):163. 1979]

79D-1449

WASTE OIL IN ALASKA. AN EVALUATION OF WASTE OIL GENERAL [sic] AND DISPOSAL, AND RECOMMENDATIONS FOR USE AND CONVERSION. TASK A REPORT: WASTE OIL GENERATION AND DISPOSAL

Thyck, Nyman and Hayes. 1977.

Report PB-287 568. 117 p.

Waste oil treatment, Environmental effects, Disposal, Alaska

Data and an analysis of current waste oil disposal practices are given. Environmental impacts of waste oil, Juneau's waste oil disposal program, and a bibliography of past studies, reports, and documents are presented.

[from Government Reports Announcements 79(3):120.#PB-287 568. 1979]

G. PETROLEUM AND PETROCHEMICAL INDUSTRY WASTE TREATMENT AND DISPOSAL

2. Oil-Water Separation

79D-1450

PROCESSES AND PLANTS FOR BREAKING UP EMULSIONS AND SEPARATING OILS AND GREASES [in German]

Bradke, H.J. 1979.

Metall (Berlin) 33(3):267-272.

Oil-water separation, Emulsions, Regulations

Processes for treatment of oily emulsions are described. Mechanical, physical, chemical, and thermal methods and their combinations are described, and applicable laws and regulations are covered.

[from Chemical Abstracts 91(8):#59778s. 1979]

79D-1451

THE DESIGN APPLICATION OF TILTED PLATE SEPARATOR OIL INTERCEPTORS

Iggleden, G.J. 1978.

Chemistry and Industry, No. 21:826-831.

Oil-water separation, Gravity separation, Wastewater treatment, Design-engineering, Equipment

The design and operating principles of the title apparatus are described "Separation is achieved within gravity differential types of oil-water interceptors by the effect of specific gravity differences between the oil particles and water. The rising velocity of a particle with diameter is governed by Stokes' Law."

[from Petroleum Abstracts 19(27):#264,930. 1979]

79D-1452

POLYURETHANE FOAMS WITH HIGH CAPABILITY OF OIL ABSORPTION

Jarre, W., M. Marx, and R. Wurmb. 1979.

Angewandte Makromolekulare Chemie, Vol. 78:67-74.

Oil-water separation, Absorption, *Sorbent foam

"Ultralight, open-cell polyurethane foams capable of absorbing 100 times their weight of oil from oil-water mixtures were developed by chemical modification of the matrix and adjustment of the foam structure."

[from Chemical Abstracts 91(6):#41622b. 1979]

G. PETROLEUM AND PETROCHEMICAL INDUSTRY WASTE TREATMENT AND DISPOSAL

79D-1453

SEPARATION OF OIL FROM WATER [in Japanese]

Mori, M. 1976.

Nisseki Rebyu 18(4):206-212.

Oil-water separation, Equipment, Wastewater treatment

"A review is given with 21 references of various separation methods, including mechanical, physiochemical, electromagnetic and biological."

[from Chemical Abstracts 91(6):#44003m. 1979]

79D-1454

SEPARATION OF WATER AND OILY SUBSTANCES

Ohta, M. 1979.

Japanese Patent Application 79 06,498

Oil-water separation, Filtration, Patent

Filters prepared from cellulose regenerated fibers were used to separate oil and water.

[from Chemical Abstracts 91(2):#6377d. 1979]

79D-1455

METHOD FOR SEPARATING A BINARY LIQUID MIXTURE INTO ITS COMPONENT LIQUIDS

Seo, M. 1978.

British Patent 1,535,606

Oil-water separation, Equipment, Coalescence, Filtration, Patent

Oil-water mixtures are separated by passage through a coiled pipe that contains a number of parallel small-diameter tubes. As the mixture flows laminarily through the coil, oil coalesces on the copper surfaces of the flow passages and moves upward to a collection and filtration area.

[from Chemical Abstracts 91(6):#41252f. 1979]

79D-1456

OIL WATER SEPARATORS (CITATIONS FROM THE NTIS DATA BASE)

Smith, M.F. 1978.

Report NTIS/PS-78/1256. 154 p. Report for 1964-Dec.1978 (Supersedes NTIS/PS-78/1004, NTIS/PS-76/0863, and NTIS/PS-75/710.

Oil-water separation, Equipment, Spill removal, Ballast, Pollution control, Bibliographies

G. PETROLEUM AND PETROCHEMICAL INDUSTRY WASTE TREATMENT AND DISPOSAL

Federally sponsored research on the title equipment is cited in 146 abstracts (6 new to previous editions). Operation, testing and performance reports are given for these devices which include centrifuge separators, coalescers, filters, and skimmers. Oil recovery from oil spills and separation from ballast and bilge water are also covered.

[from Government Reports Announcements 79(02):111.#NTIS/PS-78/1256. 1979]

79D-1457

TREATMENT OF WATER CONTAINING OIL

Takahashi, T., and M. Honma. 1979.

Japanese patent application 79 18,840

Oil-water separation, Wastewater treatment, Patent

"Water containing oil is combined with a water soluble N-acylamino acid salt, then with acid, and then separated."

[from Chemical Abstracts 91(6):#44373g. 1979]

79D-1458

WATER-OIL SEPARATOR

Takamatsu, A. 1977.

Japanese Patent 77 42,738

Oil-water separation, Wastewater treatment, Flotation, Patent

A feedwater containing oil is mixed tangentially with a powder and introduced into a powder flotation separator from which the powder is recovered and recycled.

[from Chemical Abstracts 89(22):#185483p. 1978]

79D-1459

OIL/WATER SEPARATION TECHNOLOGY: THE OPTIONS AVAILABLE. PART I.

Tebakin, R.B., R. Trattner, and P.N. Cheremisinoff. 1978.

Water and Sewage Works 125(7):74-77.

Oil-water separation, Wastewater treatment, Equipment, Design-engineering

"A review with 19 references of separation of oil and water in wastes."

[from Chemical Abstracts 89(24):#203469v. 1978]

G. PETROLEUM AND PETROCHEMICAL INDUSTRY WASTE TREATMENT AND DISPOSAL

79D-1460

GREASE AND WATER SEPARATING APPARATUS

Walker, H.L., and D.B. David. 1979.

US Patent 4,145,287

Oil-water separation, Wastewater treatment, Equipment, Design-engineering. Patent, *Grease

Wastewater is passed into a separator tank where water and grease are allowed to separate. Means are provided for drawing off the lower water layer. Wastewater is treated in this manner before entering the sewage system.

[from Chemical Abstracts 91(2):#9172u. 1979]

4,145,287

GREASE AND WATER SEPARATING APPARATUS

Harold L. Walker, 1204 E. 95th St., Tacoma, Wash. 98445, and

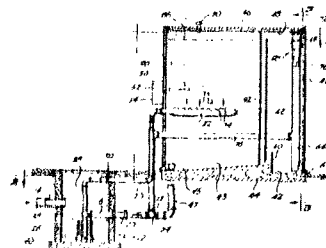
Don B. David, 33412 28th Pl. SW., Federal Way, Wash. 98003

Filed Jan. 17, 1977, Ser. No. 760,095

Int. Cl.² B01D 21/24

U.S. Cl. 210-104

6 Claims



3. Waste Oil Reclamation and Reuse

79D-1461

STUDY AND DEVELOPMENT OF THE EXTRACTION OF PETROLEUM AND PETROLEUM PRODUCTS FROM GEL ON THE COLUMN VIBRATION EXTRACTOR EKV-50 [in Russian]

Birshtein, I.A. 1978.

Azerbaidzhanskoe Neftyanoe Khozyaistvo, Vol. 7:44-48.

Reuse, Waste oil treatment, Recycling, Equipment, Gasoline, Extraction

Extraction by gasoline of petroleum and petroleum products adsorbed on silica gel after treatment of stratal waters and industrial wastewaters was studied in the title apparatus. The extraction rate was 87-97%.

[from Chemical Abstracts 91(4):#26657y. 1979]

G. PETROLEUM AND PETROCHEMICAL INDUSTRY WASTE TREATMENT AND DISPOSAL

79D-1462

METHOD OF REREFINING OIL WITH RECOVERY OF USEFUL ORGANIC ADDITIVES

Forsberg, J.W. 1979.

US Patent 4,028,226

Reuse, Waste oil, Reclamation, Refining, Patent

The waste oil is diluted with a water-soluble polar diluent and insoluble impurities are removed from the resulting solution; water is added to produce a two-phase system, separating the organic phase and recovering the polar diluent therefrom. In this manner it is possible to recover useful oil.

[from ERDA Energy Research Abstracts 2(23):5791.#55790. 1977]

79D-1463

METHOD OF REREFINING OIL BY DISTILLATION AND EXTRACTION

Habiby, E.N., and R.W. Jahnke. 1977.

US Patent 4,021,333

Reuse, Lubricating oil, Waste oil, Reclamation, Refining, Patent

Used oil is reclaimed by distillation to remove a volatile fraction, followed by a fraction of lubricating viscosity; the latter is then separated with an immiscible liquid extractant which removes impurities.

[from ERDA Energy Research Abstracts 2(19):4656.#44988. 1977]

79D-1464

USED OIL: COMPARATIVE LEGISLATIVE CONTROLS OF COLLECTING, RECYCLING, AND DISPOSAL

Irwin, W.A. 1978.

Ecology Law Quarterly 6(4):699-754.

Reuse, Reclamation, Recycling, Waste oil, Crankcase oil, Legislation, Europe, US, Government agencies

Legislative and regulatory approaches to oil recycling are described and evaluated, and several European programs for the collection and recycling of used oil under carefully controlled conditions are highlighted. Until recently, federal and state laws in the US have discouraged oil recycling; however, this situation is rapidly changing, as new legislation, such as the FEA-sponsored Model Used Oil Recycling Act and state programs, are proposed.

G. PETROLEUM AND PETROCHEMICAL INDUSTRY WASTE TREATMENT AND DISPOSAL

79D-1465

METHOD FOR RECLAIMING WASTE OIL BY DISTILLATION AND EXTRACTION

O'Blasny, R.H. 1978.

US Patent 4,071,438

Reuse, Waste oil, Refining, Reclamation, Patent

A method for reclaiming or re-refining additive supplemented waste oils is provided. Substantial purification at relatively low cost without creation of disposal problems appears to be the major benefit of the process.

[from Energy Research Abstracts 3(20):#48260. 1978]

79D-1466

SEPARATION OF OILS FROM DEGREASING SOLUTIONS

Ohyagi, T., A. Fukuda, K. Ando, and K. Goto. 1979.

Japanese Patent Application 79 09,450

Reuse, Waste oil treatment, Patent

Degreasing solutions containing 3-200 ml/L oil were mixed with 5-50 g/L builder, heated at 40-90° to separate the oil by salting out, and recycled.

[from Chemical Abstracts 91(4):#22849q. 1979]

79D-1467

LAND AS A WASTE MANAGEMENT ALTERNATIVE [BOOK REVIEW]

Ross, S.S. 1978.

Ann Arbor, Michigan, Ann Arbor Science Publishers, 1978. 811 p.

Reuse, Wastewater treatment, Land farming, Disposal, Pollution prevention, Book review

Reclamation of oil from a rolling mill's wastewater has totalled 600,000 gal in a pre-treatment process from 1972-1976, while some 36 million gal of oily wastes have been sprayed on a 14.6 acre field. Results of this and two dozen other case studies are presented and discussed.

[from Chemical Engineering 85(2):14,16. 1979]

79D-1468

USED OIL RECYCLING KIT

US Department of Energy. 1978.

Report ERDA/02800, ERDA/320321. 46 p.

Reuse, Waste oil, Recycling, Guidelines, Manuals

"Basic facts, ideas, and sample tools necessary to start a communitywide used oil recycling program are provided."

[from Energy Research Abstracts 3(17):#39103. 1978]

G. PETROLEUM AND PETROCHEMICAL INDUSTRY WASTE TREATMENT AND DISPOSAL

4. Legal and Regulatory Aspects

[No entries.]

H. MISCELLANEOUS

79D-1469

OHMSETT ACHIEVEMENTS

Farlow, J.S. 1979.

US Environmental Protection Agency, Office of Research and Development.
20 p. Summary report.

Pollution control, Equipment, Design-engineering, Performance testing,
EPA, *OHMSETT facility

This brochure describes the many programs completed through December 1978 and illustrates some of the wide ranging capabilities of the test facility, the operating staff, and the EPA's Oil and Hazardous Materials Spills Branch.

79D-1470

OHMSETT CAPABILITY

Farlow, J.S. 1979.

US Environmental Protection Agency, Office of Research and Development,
20 p. Summary report.

Performance testing, Equipment, Design-engineering, EPA, *OHMSETT facility

The US EPA's Oil and Hazardous Materials Simulated Test Tank (OHMSETT) is the world's largest test facility specifically designed to test the performance of spill control equipment under environmentally safe conditions. This publication summarizes the OHMSETT technical capabilities for performance evaluation of spill control systems and is available from John S. Farlow, Project Officer, US Environmental Protection Agency, Research and Development - IERL-Ci, Edison, NJ 08817.

SECTION II

CURRENT RESEARCH PROJECTS

Title, contract information, and a summary of project objectives are provided in each entry. Sources of project information include: The Smithsonian Science Information Exchange (SSIE); API Environmental Research Annual Status Report; Maritime Research Information Service Abstracts; Scientific and Technical Aerospace Reports; Department of Environment, Canada, Spill Technology Newsletter; Northwest and Alaska Fisheries Center Monthly Report; and written inquiries to organizations and researchers. Current status information and publications resulting from the projects are presented when such information is available from the principal investigators or performing organizations. The source of status information is given at the end of each entry.

Entries are grouped according to subject and then ordered sequentially with a citation number 79D-R---. Some of the projects listed in previous Oil Pollution Abstracts were recently renewed. These projects are relisted with a current serial number, followed by the original number in parentheses. To locate the original entry, refer to the following list:

<u>Citation Numbers</u>	<u>Dates Covered</u>	<u>Report Number</u>
R-001-74 to R-165-74	July 74 - Oct. 74	EPA-670/2-75-003
R-166-74 to R-244-74	Nov. 74 - Feb. 75	EPA-670/2-75-044
R-245-74 to R-268-74	Feb. 75 - Apr. 75	EPA-670/2-75-059
R-269-74 to R-342-74	May 75 - July 75	EPA-600/2-76-129
R-269-75 to R-304-75	Aug. 75 - Oct. 75	EPA-600/2-76-113
R-001-76 to R-035-76	Nov. 75 - Jan. 76	EPA-600/2-76-185
R-036-76 to R-063-76	Feb. 76 - Apr. 76	EPA-600/2-76-215
R-064-76 to R 123-76	May 76 - July 76	EPA-600/2-76-266
R-124-76 to R-175-76	Aug. 76 - Oct. 76	EPA-600/2-77-037
R-001-77 to R-022-77	Nov. 76 - Jan. 77	EPA-600/2-77-075
R-023-77 to R-039-77	Feb. 77 - Apr. 77	EPA-600/2-77-111
R-040-77 to R-075-77	May 77 - July 77	EPA-600/2-77-243
R-076-77 to R-096-77	Aug. 77 - Oct. 77	EPA-600/2-78-005
R-001-78 to R-020-78	5(1) Nov. 77 - Jan. 78	EPA-600/2-78-071
R-021-78 to R-057-78	5(2) Feb. 78 - May 78	EPA-600/7-78-160
R-058-78 to R-150-78	5(3) Jun. 78 - Sep. 78	EPA-600/7-78-218
R-151-78 to R-200-78	5(4) Oct. 78 - Dec. 78	EPA-600/7-79-040
79A-R001 to 79A-R009	6(1) Jan. 79 - Mar. 79	EPA-600/7-79-160
79B-R010 to 79B-R069	6(2) Apr. 79 - June 79	EPA-600/
79C-R070 to 79C-R085	6(3) July 79 - Sep. 79	EPA-600/

CURRENT RESEARCH PROJECTS

A. OIL POLLUTION DETECTION AND EVALUATION

1. Detection and Monitoring

79D-R086 (R-057-77)

DETECTION AND CARCINOGENICITY OF OILS IN SEA WATER - USE OF HYBRID FISH AND FOOD CHAINS

Principal Investigator: Humm, D.G.

Performing Organization: University of North Carolina, Dept. of Zoology,
Chapel Hill, NC 27514

Supporting Organization: US Environmental Protection Agency, Office of
Research & Development, Gulf Breeze Environ-
mental Research Lab., Sabine Island, Gulf Breeze,
FL 32561

Period: 8/76 - 8/79

Funds: \$1,500 FY 79

Carcinogens, Bioindicators, Detection, Fish

Hybrid fish with a high incidence of neoplasia are being used to develop genetically modified fish to serve as quick-screen indicators of carcinogens.

Status: Preliminary results indicate that such crosses are possible and may have validity as a quick-screen tool.

[from SSIE No. GMA-5603]

79D-R087

SPECIFICATIONS FOR AUTOMATIC SAMPLING AND MONITORING INSTRUMENTATION TO ENFORCE STANDARDS FOR EFFLUENTS AND DRINKING WATER

Principal Investigators: Mentink, A.F., R.H. O'Herron, P.C. Lin,
J.P. Donnelly, and W.J. Averett

Performing Organization: US Environmental Protection Agency, Office of
Research & Development, Environmental Monitoring
& Support Lab., 26 W St. Clair St., Cincinnati,
OH 45268

Supporting Organization: Same

Period: 7/61 - 9/79

Funds: \$273,000 FY 79

Wastewaters, Monitoring, Sampling, Equipment, Detection, Water quality

Field instruments will be provided for automatic collection and measurement of pollution parameters such as oil in water, organic carbon, chlorine, sample pretreatment, suspended solids, data handling systems, and other discharge parameters of municipal and industrial effluents.

Status: Manufacturers equipment designs have been improved upon based on a series of EMSL-CI reports.

[from SSIE No. ZMA-1534-1]

CURRENT RESEARCH PROJECTS

79D-R088

DEVELOPMENT OF OIL-IN-WATER MONITOR

Principal Investigator: Silvus, H.S.

Performing Organization: Southwest Research Institute, 8500 Culebra Rd.,
San Antonio, TX 78228

Supporting Organization: US Environmental Protection Agency, Office of
Research & Development, Environmental Monitoring
& Support Lab., 26 W. St. Clair St., Cincinnati,
OH 45268

Period: 5/78 - 5/80

Funds: \$59,990 FY 78

Monitoring, Equipment, Wastewaters, Oil industry, Chromatography

An oil-in-water monitoring device is to be developed which will provide monitoring of wastewaters from petroleum refineries, shale oil extraction plants and coal liquefaction. The device will make use of reverse phase liquid chromatography, optical fiber technology and a suitable optical sensor, and will monitor 75 ppm or greater of oil in water. A prototype instrument will be designed, fabricated and tested.

Status: The concept has been demonstrated as feasible, as reported at a symposium in March 1978.

[from SSIE No. GMA-5089-1]

2. Sampling and Analysis

79D-R089

OIL POLLUTION CONTROL AT MILITARY INSTALLATIONS

Principal Investigator: Fileccia, R.J.

Performing Organization: US Dept. of Defense, Army, Corps of Engineers,
Construction Engineering Research Lab., PO Box
4005, Champaign, IL 61820

Supporting Organization: Same

Period: 10/77 - 9/81

Funds: NA

Chemical analysis, Oil discharges, Wastewaters, Analytical techniques,
Pollution control

Several Class I installations will be surveyed to determine the causes, magnitude and nature of oily waste discharges from facility operations. Methods for determining pollutants in water will be evaluated. The results will be used in the preparation of an engineer technical letter for distribution to the field.

[from SSIE No. ZQA-198126-2]

CURRENT RESEARCH PROJECTS

79D-R090

TECHNICAL SERVICES TO SUPPORT THE QUALITY ASSURANCE PROGRAM

Principal Investigator: Kowalski, V.

Performing Organization: Bionetics Inc., PO Box 19070, Cincinnati, OH 45219

Supporting Organization: US Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Support Lab., 26 W. St. Clair St., Cincinnati, OH 45268

Period: 1/77 - 9/79

Funds: \$176,200 FY 79

Water quality, Chemical analysis, Equipment, EPA, Sampling

The primary objective of the title experiment is to provide the Quality Assurance Branch, EMSL-Cincinnati with technical support services.

Status: Quality control samples were developed for oil and grease, turbidity, nonfilterable residue, and volatile residue samples. The sampling and sample preservation manual was revised and 20,000 quality control samples were distributed.

[from SSIE No. GMA 4948-1]

79D-R091

OIL SPILL RESPONSE RESEARCH, NORTH ATLANTIC COAST (NORFOLK, VIRGINIA TO EASTPORT, MAINE)

Principal Investigator: Payne, R.R.

Performing Organization: US Environmental Protection Agency, Office of Research & Development, Environmental Research Lab., S. Ferry Rd., Narragansett, RI 02882

Supporting Organization: Same

Period: 5/79 - 9/81

Funds: \$75,000 FY 79

Sampling, Oil spills, Coasts, Habitats, Benthos, Marine organisms, Spill response, Statistical analysis

Response research will include sampling and measuring regimes for different coastal habitats, evaluation of short- and long-term effects of spilled oil on selected organisms, ecological studies on benthic organisms, sampling and analysis of petroleum in the water column, sediments, and pelagic and benthic organisms and statistical analysis of sampling and measuring methods.

[from SSIE No. ZMA-1501-1]

CURRENT RESEARCH PROJECTS

79D-R092

CAPILLARY COLUMNS IN GC/MS ANALYSIS

Principal Investigator: Shackelford, W.M.

Performing Organization: US Environmental Protection Agency, Office of Research & Development, Environmental Research Lab., College Station Rd., Athens, GA 30605

Supporting Organization: Same

Period: 7/75 - 7/81

Funds: \$16,100 FY 79

Chemical analysis, Oil spills, GC/MS, Equipment

Techniques for utilizing capillary columns in GC/MS systems are being developed and evaluated for their effects on the versatility and sensitivity of the system. Existing low resolution chemical ionization (CI) mass spectrometry equipment will be modified to permit mixing CI reagent gases with GC column effluent, and the feasibility of using various gases and gas mixtures, including oxidizing reagent gases, will be determined.

Status: Two low resolutions EI/CI systems have been adapted for glass capillary columns. Excellent resolution was demonstrated for oil spill hydrocarbons; poorer resolution was experienced with polar materials.

[from SSIE No. ZMA-987-2]

79D-R093

EVALUATION OF THE STABILITY CHARACTERISTICS OF OILY WATER EMULSIONS

Principal Investigator: Tuffly, B.

Performing Organization: Rockwell International Corp., Rocketdyne Division, 8900 DeSoto Ave., Canoga Park, CA 91304

Supporting Organization: US Environmental Protection Agency, Office of Research & Development, Industrial Environmental Research Lab., 5555 Ridge Ave., Cincinnati, OH 45268

Period: 9/77 - 6/79

Funds: \$80,000 FY 78

Chemical analysis, Sampling, Emulsions, Wastewater treatment, Ballast, Oil tanks

The objective of this research is to characterize the influent and effluent from each processing unit within an oil tank ballast-water treatment plant. This will be accomplished by a program of sampling and chemical analysis within the plant.

Status: Nearly half of the hydrocarbons discharged from the plant have been found to be benzene, toluene or xylene, compounds that were completely missed by the method of analysis specified by the plant's discharge permit.

[from SSIE No. GMA-4993-1]

CURRENT RESEARCH PROJECTS

3. Source Identification

79D-R094

HIGH-RESOLUTION SEPARATION OF ORGANICS IN WATER

Principal Investigator: Bertsch, W.

Performing Organization: University of Alabama, Department of Chemistry,
University, AL 35486

Supporting Organization: US Environmental Protection Agency, Office of
Research & Development, Environmental Research
Lab., College Station Rd., Athens, GA 30605

Period: 9/76 - 2/79

Funds: \$47,000 FY 78

Source identification, Crude oil, Petroleum products, Detection, Chemical
analysis, Sediments, Chromatography, *Fingerprinting

Organics in water and sediment will be analyzed with emphasis on development
of fingerprinting techniques for crude oil and petroleum products. High
resolution gas chromatography will be used to distinguish indigenous from
introduced hydrocarbons.

Status: A two-dimensional GC unit has been successfully tested and a
computer program has been applied to the comparison and matching of chroma-
tographic patterns from oil spill samples with those from suspect samples.
The project has been terminated.

[from SSIE No. GMA-3451-2]

CURRENT RESEARCH PROJECTS

B. OIL POLLUTION AND PREVENTION AND CONTROL

1. Cleanup and Removal

79D-R095

HYDRODYNAMIC CHARACTERISTICS OF BOOMS - PHASE II

Principal Investigator: Ackerman, R.

Performing Organization: Mason & Hanger Silas Mason Co., Inc., PO Box
156, Leonardo, NJ 07737

Supporting Organization: US Environmental Protection Agency, Office of
Research & Development, Industrial Environmental
Research Lab., 5555 Ridge Ave., Cincinnati, OH
45268

Period: 5/77 - 12/78

Funds: \$23,000 FY 78

Spill cleanup, Booms, Equipment, Design-engineering, *OHMSETT facility

The objective of the project was to determine the effects of boom angle, length and rigging configuration on the successful diversion of oil spilled on inland waters by experimentation with full-size equipment and oil of known characteristics at EPA's OHMSETT facility.

Reports and Publications

BOOM CONFIGURATION TESTS FOR CALM WATER, MEDIUM CURRENT SPILL DIVERSION

Breslin, M.K. 1979.

Report EPA-600/2-78-186. 49 p.

[from SSIE No. GMA-4987-1]

2. Legal and Regulatory Aspects

79D-R096

POLLUTION CONTROL GUIDANCE FOR OIL SHALE DEVELOPMENT

Principal Investigator: Cruse, H.

Performing Organization: Jacobs Engineering Co., 837 S. Fair Oaks Ave.,
Pasadena, CA 91105

Supporting Organization: US Environmental Protection Agency, Office of
Research & Development, Industrial Environmental
Research Lab., 5555 Ridge Ave., Cincinnati, OH
45268

Period: 6/78 - 12/79

Funds: \$121,000 FY 79

Oil shale, Development, EPA, Regulations, Pollution prevention, Guidelines

CURRENT RESEARCH PROJECTS

The environmental problems of oil shale development will be discussed and concerns and interest of EPA identified. Interim EPA emission effluent and solid waste standards will be suggested.

Status: The initial draft report has been submitted for review.

[from SSIE No. GMA-5687]

CURRENT RESEARCH PROJECTS

C. ENVIRONMENTAL IMPACTS OF OIL POLLUTION

1. Biological Aspects

79D-R097 (79B-R031)

EFFECTS OF DRILLING FLUIDS AND OIL IN CORALS OCCUPYING HARD-BANK COMMUNITIES

Principal Investigator: Bright, T.J.

Performing Organization: Texas A&M Research Foundation, Faculty Exchange
Box H, College Station, TX 77843

Supporting Organization: US Environmental Protection Agency, Office of
Research & Development, Gulf Breeze Environmental
Research Lab., Sabine Island, Gulf Breeze, FL
32516. Grant R-805441

Period: 7/77 - 6/79

Funds: \$1,500 FY 79

Drilling, Coral reefs, Toxicity, *Drilling muds

The effect of drilling muds and their components on corals will be determined by exposing the corals to the contaminants in flow through aquaria on a platform 12 mi offshore of Panama City.

Status: Preliminary acute toxicity tests have been completed.

[from SSIE No. GMA-5499-1]

79D-R098

SENSORY AND BEHAVIORAL EFFECTS OF POLLUTANTS ON THE CRAB AND LOBSTER FISHERY

Principal Investigator: Case, J.F.

Performing Organization: University of California, Santa Barbara, Marine
Science Institute, Santa Barbara, CA 93106

Supporting Organization: US Dept. of Commerce, NOAA, Sea Grant Office,
Washington, DC 20235

Period: 00/78 - 00/80

Funds: \$21,054 FY 78

Hydrocarbons, Biological effects, Behavior, Natural seepage, Crustaceans

The objectives of the project include assessment of the sensory and behavioral effects of oil seeps and other petroleum sources on orientation to traps, examination of the efficiency of natural and artificial baits in normal and contaminated environments, and determination of sensory and behavioral adaptation of crabs and lobsters to long-term exposure to petroleum.

[from SSIE No. GBP-3823]

CURRENT RESEARCH PROJECTS

79D-R099

EFFECTS OF PETROLEUM COMPOUNDS ON ESTUARINE FISHES

Principal Investigator: Martin, B.J.

Performing Organization: University of Southern Mississippi, Dept. of Biology, Hattiesburg, MS 39401

Supporting Organization: US Environmental Protection Agency, Office of Research & Development, Gulf Breeze Environmental Research Lab., Sabine Island, Gulf Breeze, FL 32561

Period: 6/76 - 10/78

Funds: \$60,000 FY 78

Carcinogens, Biological effects, Fish

Carcinogenic effects of benzo[a]pyrene and 3-methylcholanthrene were assayed in freshwater and saltwater fish. Other pathobiological tools were also utilized to determine the effects of carcinogens on fish.

Status: A final report is in preparation.

[from SSIE No. GMA-3065-3]

79D-R100

MEMBRANE TOXICITY THEORY AND ENVIRONMENTAL POLLUTANTS

Principal Investigators: Miller, D.S., D.B. Peakall, and R.G. Butler

Performing Organization: Mount Desert Island Biological Lab., Old Bar Harbor Road, Salisbury Cove, ME 04672

Supporting Organization: US Dept. of Health, Education and Welfare, Public Health Service, National Institute of Environmental Health Sciences, PO Box 12233, Research Triangle Park, NC 27709

Period: 6/77 - 5/80

Funds: \$62,994 FY 79

Biological effects, Toxicity, Birds, Fish, Behavior

The immediate objective of this study is a comprehensive evaluation of the effects of heavy metal, petroleum, and organochlorine pollutants on osmoregulatory and nutritive membrane functions in selected species of aquatic birds and fish. Current work is focused on petroleum and its effects on the physiology and behavior of marine birds and fish.

[from SSIE No. IES-920-7]

CURRENT RESEARCH PROJECTS

79D-R101 (R-014-77)

EFFECTS OF COMPOUNDS PRODUCED FROM PETROLEUM UTILIZATION ON SELECTED MARINE INVERTEBRATES WITH PARTICULAR REFERENCE TO CARCINOGENESIS

Principal Investigator: Mix, M.C.

Performing Organization: Oregon State University, Dept. of General Science, Corvallis, OR 97331

Supporting Organization: US Environmental Protection Agency, Office of Research & Development, Gulf Breeze Environmental Research Lab., Sabine Island, Gulf Breeze, FL 32561

Period: 6/76 - NA

Funds: \$20,000 FY 78

PAH, Carcinogens, Invertebrates, Mollusks, Uptake, Sources, Oregon

Objectives of this project are the following: To determine the concentration (body burdens) of selected environmental chemical carcinogens in economically important mollusks and crustaceans from Oregon waters; to determine if there is a potential public health hazard to man from consuming shellfish which contain petroleum by-products that are carcinogenic; to survey populations of bivalve mollusks, determine the incidence of neoplastic diseases, and ascertain if there is any correlation between carcinogen concentrations and incidence of disease; to identify point sources of carcinogens present in Oregon bays and estuaries used in this study; and to determine rates of PAH uptake and release in bivalve mollusks.

Status: The final report is in preparation.

[from SSIE No. GMA-5506-1]

79D-R102

ASSESSMENT OF THE EFFECTS OF BOTTOM DISTURBANCE ON THE ENVIRONMENT OF A CLEAR SUBARCTIC STREAM

Principal Investigators: Morrow, J.E., and R.L. Smith

Performing Organization: University of Alaska, School of Environmental Sciences, Fairbanks, AK 99701

Supporting Organization: US Environmental Protection Agency, Office of Research & Development, Environmental Research Lab., 200 SW 35th St., Corvallis, OR 97330

Period: 7/75 - 6/79

Funds: \$27,884 FY 78

Crude oil, WSF, Sublethal effects, Fish, Rivers, Subarctic regions,
*Juvenile chum-salmon

The effects of sublethal exposure to the WSF of crude oil on the condition and gut morphology of the juvenile chum-salmon will be studied. The morphology and structural integrity of the gut will be examined for potential abnormalities associated with the swallowing of oil-contaminated seawater.

[from SSIE No. GMA-2447-4]

CURRENT RESEARCH PROJECTS

79D-R103

TOXIC, SUBLETHAL AND LATENT EFFECTS OF SELECTED PETROLEUM HYDROCARBONS AND BARIUM SULFATE ON MARINE ORGANISMS

Principal Investigator: Rao, K.R.

Performing Organization: University of West Florida, Dept. of Biology, Pensacola, FL 32504

Supporting Organization: US Environmental Protection Agency, Office of Research & Development, Gulf Breeze Environmental Research Lab., Sabine Island, Gulf Breeze, FL 32561

Period: 5/76 - 5/79

Funds: \$47,000 FY 78

PAH, Hydrocarbons, Uptake, Toxicity, Sublethal effects, Growth, Invertebrates, *Bioaccumulation

The toxic, sublethal and latent effects of PAHs and barium sulfate on larvae and adult stages of selected invertebrates are being examined.

Status: Methods for detecting developmental effects of xenobiotics have been developed and bioaccumulation of xenobiotics used in offshore oil and gas exploration has been established.

[from SSIE No. GMA-2794-3]

79D-R104 (R-046-78)

GENETIC VARIATION AND RESISTANCE TO CARCINOGENS IN NATURAL WATERS

Principal Investigator: Schultz, R.J.

Performing Organization: University of Connecticut, Graduate School, Biological Sciences Group, Storrs, CT 06268

Supporting Organization: US Environmental Protection Agency, Office of Research & Development, Gulf Breeze Environmental Research Lab., Sabine Island, Gulf Breeze, FL 32561

Period: 6/77 - 6/80

Funds: \$1,500 FY 79

Carcinogens, Fish, Bioassay, Toxicity, Oil shale, Petroleum products

The feasibility of using isogenic fish to detect carcinogens will be evaluated. The validated bioassay system will be used to test the carcinogenic properties of compounds from petroleum and shale oil.

[from SSIE No. GMA-5602]

CURRENT RESEARCH PROJECTS

79D-R105

EFFECTS OF OIL ON THE GROWTH AND ENERGY UTILIZATION OF JUVENILE PINK SALMON

Principal Investigator: Shaw, D.G.

Performing Organization: University of Alaska, Institute of Marine Sciences, Fairbanks, AK 99701

Supporting Organization: US Department of Commerce, NOAA, Sea Grant Office, Washington, DC 20235

Period: 1978 - 10/80

Funds: \$23,594 FY 78

Biological effects, Contamination, Growth, Metabolism, Fish, *Juvenile pink salmon

In the title study oil-contaminated food will be used to determine its effect on the growth efficiency of young salmon. Exogenous factors will be held constant except for the presence of oil in the food of the test fish. Growth will be determined as a change in weight and length over time, and these two parameters will be correlated to each other. The study will help to predict the viability of pink salmon should they be exposed to oil contamination.

[from SSIE No. GBP-4107]

79D-R106 (79A-R001)

EFFECTS OF OIL ON REPRODUCTIVE STAGES OF MARINE MACROALGAE

Principal Investigators: Steele, R.L. and C. Belin

Performing Organization: US Environmental Protection Agency, Office of Research & Development, Environmental Research Lab., S. Ferry Rd., Narragansett, RI 02882

Supporting Organization: Same

Period: 6/76 - 12/80

Funds: \$60,000 FY 79

Crude oil, Fuel oil, Algae, Toxicity, Reproduction, Water quality

The effects of various oils on reproduction of marine algae will be determined. The data will be used in determining water quality criteria.

Status: 2 ppb of No. 2 fuel oil, JP-4, JP-5, or Willimar crude oil prevented fertilization of Fucus edentatus apparently because of toxic effects on sperm viability. Laminaria saccharina spores did not germinate at oil concentrations above 20 ppb.

[from SSIE No. ZMA-1184-2]

Reports and Publications

SENSITIVITY OF SOME BROWN ALGAL REPRODUCTIVE STAGES TO OIL POLLUTION
Steele, R.L. 1977.

Journal of Phycology 13(Supplement):64. Abstract.

CURRENT RESEARCH PROJECTS

79D-R107 (R-178-78)

EFFECTS OF HYDROCARBONS ON DEFENSE MECHANISMS

Principal Investigators: Tripp, M.R., and C.R. Fries

Performing Organization: University of Delaware, Dept. of Biological Sciences, Newark, DE 19711

Supporting Organization: US Dept. of Health, Education & Welfare, Public Health Service, National Institute of Environmental Health Sciences, PO Box 12233, Research Triangle Park, NC 27709

Period: 4/77 - 3/80

Funds: \$28,195 FY 79

Hydrocarbons, Biological effects, Fish, Mollusks, *Immune system

"An assay for fish lymphocytes that form rosettes with sheep red blood cells has been developed and used to measure the immune capabilities of normal and stressed animals....Studies will continue to determine the effects of hydrocarbon stress on tissues, cells, and hemolymph of clams."

[from SSIE No. 1ES-1531-3]

2. Physical and Chemical Aspects

79D-R108

CHEMISTRY OF AQUATIC ORGANIC MATTER

Principal Investigator: Goerlitz, D.F.

Performing Organization: US Geological Survey, Water Resources Division, 345 Middlefield Rd., Menlo Park, CA 94025

Supporting Organization: Same

Period: 7/75 - 10/78

Funds: \$60,036 FY 78

WSF, Physical effects, Chemical effects, Groundwater, Contamination, Chromatography

The title study will be investigating the physical-chemical interactions of relatively stable, water soluble organic compounds of natural and man-made origin when introduced into a groundwater system.

Status: Sorption studies using pentachlorophenol and aquifer material from the study site were completed. Two field techniques using high-pressure liquid chromatography were developed and tested.

[from SSIE No. ZUA-4131-2]

CURRENT RESEARCH PROJECTS

3. Baseline and Environmental Impact Studies

79D-R109 (R-188-78)

ENVIRONMENTAL ASSESSMENT OF THE NORTH ATLANTIC OUTER CONTINENTAL SHELF (GEORGES BANK)

Principal Investigator: Aaron, J.M.

Performing Organization: US Geological Survey, Geologic Division, Woods Hole, MA 02543

Supporting Organization: US Geological Survey, Geologic Division, 12201 Sunrise Valley Dr., Reston, VA 22092

Period: 10/77 - NA

Funds: \$272,100 FY 79

Offshore, Exploration, OCS, Environmental effects, Georges Bank, Baseline studies, Risk analysis

The end product of this project will be the documentation of the major stresses and potential hazards that may be encountered in petroleum exploration and development on Georges Bank. Sediment mobility and sea floor stability will be assessed; the composition, flux and direction of suspended matter transiting the Bank will be estimated; and new current meter, meteorological, and other oceanographic data will be gathered. The result will be "a better three-dimensional picture of the hydrography of the Bank, which is critical in determining trajectories of oil spills and other pollutants."

[from SSIE No. ZUA-4175-2]

79D-R110 (R-190-78)

ENVIRONMENTAL ORGANIC GEOCHEMISTRY OF OUTER CONTINENTAL SHELVES AND NEARSHORE ENVIRONMENT

Principal Investigator: Miller, R.E.

Performing Organization: US Geological Survey, Geologic Division, 12201 Sunrise Valley Dr., Reston, VA 22092

Supporting Organization: Same

Period: 10/77 - NA

Funds: \$237,400 FY 79

Baseline studies, OCS, Hydrocarbons, Sediments, Atlantic Coast, Gulf of Mexico, *Geochemistry

The principal objectives of this project are to determine quantitatively and distinguish qualitatively the low-level baseline concentrations of natural organic constituents such as hydrocarbons, asphaltics, fatty acids, sterols, and metallo-organic complexes in shelf and slope sediments, and to differentiate and classify those same substances that are related to specific geological and geochemical processes. The study area for this project encompasses the eastern seaboard Atlantic states and the Gulf of Mexico seaboard states.

[from SSIE No. ZUA-3570-4]

CURRENT RESEARCH PROJECTS

4. General Aspects

79D-R111

OIL SPILL EXPERIMENT

Principal Investigator: Menzel, D.W.

Performing Organization: Skidaway Institute of Oceanography, PO Box 13687,
Savannah, GA 31406

Supporting Organization: US Dept. of Commerce, NOAA, Sea Grant Office,
Washington, DC, 20235

Period: 9/76 - 12/79

Funds: \$63,200 FY 78

Oil spills, Marshes, Hydrocarbons, Environmental effects, Biodegradation,
Predictions

In order to better predict impacts of oil spills on coastal marshes, the
title experiment will determine water and sediment load exchanges, determine
degradation rates of hydrocarbon components in water and marsh sediment,
and determine hydrocarbon effects on marsh flora and fauna.

[from SSIE No. GBP-3077-1]

CURRENT RESEARCH PROJECTS

D. FATE OF OIL IN THE ENVIRONMENT

1. General Fate of Oil

79D-R112

PELAGIC AND BEACH TAR POLLUTION IN KUWAIT

Principal Investigators: Anderlini, V., and L. Al-harmi

Performing Organization: Kuwait Institute for Scientific Research,
PO Box (24885) Safat, Kuwait

Supporting Organization: Same, Contract E&ES 11A

Period: (2 yr)

Funds: 5,000 K.D.

Tar, Beaches, Source identification, Fate

Objectives of the project are to determine the extent of pelagic and beach tar pollution in Kuwait, estimate the residence time of tar on beaches and the total tar crop, and identify the sources of tar pollution.

Status: A preliminary investigation of tar pollution along the coast of Kuwait has been completed.

Reports and Publications

OIL SPILLS AND TAR POLLUTION ALONG THE COAST OF KUWAIT

Oostdam, B.L., and V. Anderlini. 1978.

Safat, Kuwait, Kuwait Institute of Scientific Research, 1978. 54 p.

Information source: V. Anderlini, address above.

CURRENT RESEARCH PROJECTS

E. POLLUTION ASPECTS OF OIL EXPLORATION, DEVELOPMENT AND PRODUCTION

1. Biological Aspects

79D-R113

AN ECOLOGICAL STUDY OF THE TERMINOS LAGOON (CAMPECHE, MEXICO) WITH SPECIAL REFERENCE TO FISHERIES RESOURCES AND THE POTENTIAL IMPACT OF MAN

Principal Investigator: Day, J.W.

Performing Organization: Louisiana State University, Dept. of Marine Science, Center for Wetlands Resources, University Station, Baton Rouge, LA 70803

Supporting Organization: US National Science Foundation, Division of International Programs, 1800 G St. NW, Washington, DC 20550

Period: 3/79 - 8/80

Funds: \$11,740 FY 79

Development, Environmental effects, Marine environment, Fisheries, Mexico, *Terminos Lagoon

This study will develop an environmental framework for documenting the functioning and value of natural resources of the Terminos Lagoon and predict changes which may occur due to the activities of man. Tasks include analysis of the lagoon's role in fisheries, implementation of a hydrodynamic-ecological model of the lagoon, and analysis of ecological and economic connections in the Terminos region.

[from SSIE No. GSN-3330]

2. General Aspects

79D-R114

ENVIRONMENTAL EFFECTS OF OFFSHORE DRILLING AND OIL ON THE MARINE ENVIRONMENT

Principal Investigator: Schuh, N.

Performing Organization: US Dept. of Defense, Navy, Naval Coastal Systems Lab., Panama City, FL 32407

Supporting Organization: US Environmental Protection Agency, Office of Research & Development, Gulf Breeze Environmental Research Lab., Sabine Island, Gulf Breeze, FL 32561

Period: 4/77 - 12/79

Funds: \$1,500 FY 79

Development, Environmental effects, Oil shale, Drilling, Marine environment, Platforms

CURRENT RESEARCH PROJECTS

An offshore platform in Panama City will be used to determine the environmental effects on the marine environment of offshore oil extraction in general, and specifically, of shale oil-derived bunker C fuel.

[from SSIE No. ZMA-1158-1]

79D-R115

EFFECTS OF DRILLING MUD CONSTITUENTS ON THE SEDIMENTARY MICROFLORA AND THE BASE OF THE MARINE BENTHIC FOOD WEB

Principal Investigator: White, D.C.

Performing Organization: Florida State University, Dept. of Biological Sciences, 205 Wildwood Dr., Tallahassee, FL 32306

Supporting Organization: US Environmental Protection Agency, Office of Research & Development, Gulf Breeze Environmental Research Lab., Sabine Island, Gulf Breeze, FL 32561

Period: 8/78 - 8/80

Funds: \$1,500 FY 79

Environmental effects, Offshore, Drilling, Benthos, Marine organisms, Food web, *Drilling muds

The objective of the title project is to develop and apply methods for assessing environmental effects of offshore oil and gas development on marine organisms. The approach used will be to determine effects resulting from exposure of marine organisms.

[from SSIE No. GMA-5601]

F. POLLUTION ASPECTS OF OIL TRANSPORT, TRANSFER AND STORAGE

[No entries.]

CURRENT RESEARCH PROJECTS

G. PETROLEUM AND PETROCHEMICAL INDUSTRY WASTE TREATMENT AND DISPOSAL

1. Waste Treatment and Disposal Methods

79D-R116

TREATMENT OF OIL REFINERY WASTEWATERS FOR REUSE USING A SAND FILTER-ACTIVATED CARBON SYSTEM

Principal Investigator: Bubri, L.

Performing Organization: B.P. Oil Corp., PO Box 428, Marcus Hook, PA 19061

Supporting Organization: US Environmental Protection Agency, Office of Research & Development, Robert S. Kerr Environmental Research Lab., PO Box 1198, Ada, OK 74820

Period: 7/71 - 7/79

Funds: NA

Wastewater treatment, Refineries, Filtration, Reuse

A refinery wastewater treatment facility was built consisting of sand filtration and activated carbon adsorption. Two-stage centrifugation was used for sludgedewatering and oil recovery, and investigation carried out of the reuse of treated effluent for cooling tower and boiler feed water makeup.

Status: A final report has been submitted; it addresses treatability, filtration, activated carbon, residual centrifugation, and economics.

[from SSIE No. GMA-5208-1]

79D-R117

EVALUATE PETROLEUM EFFLUENT DISCHARGES FOR IMPACTS ON THE WEST COAST AND/OR ESTUARINE ECOSYSTEMS

Principal Investigator: Randall, R.C., D.T. Specht, and R.M. Brice

Performing Organization: US Environmental Protection Agency, Office of Research & Development, Environmental Research Lab., Marine Div., 200 SW 35th St., Corvallis, OR 97330

Supporting Organization: Same

Period: 10/76 - 9/82

Funds: \$120,000 FY 79

Wastewaters, Estuaries, Ecosystems, Toxicity, Sublethal effects, Bioassay, *Staghorn sculpin

Assay techniques will be developed for response indications of lethal and sublethal stress effects of petroleum processing waste discharges. A "chem screen" approach will be used to determine stress effects in selected staghorn sculpin tissue.

CURRENT RESEARCH PROJECTS

Status: A procedure for stress detection in sculpin tissue has been developed, and analytical techniques have been determined for the chem screen protocol. "The marine algal assay procedure and "Ecologen" have been evaluated to the point where toxicity data may now be collected."

[from SSIE No. ZMA-1558-1]

2. Oil-Water Separation

79D-R118

FEASIBILITY STUDY OF OIL/WATER SEPARATION TECHNIQUES FOR APPLICATION TO RECOVERED OIL/WATER

Principal Investigator: Unknown

Performing Organization: US Department of Defense, Navy, David W. Taylor Naval Ship Research & Development Center, Bethesda, MD 20084

Supporting Organization: US Coast Guard, 400 7th St. SW, Washington, DC 20590

Period: 9/78 - 11/79

Funds: \$96,000 FY 79

Oil-water separation, Spill cleanup, Storage, Equipment, USCG

A feasibility study will be conducted on oil/water separation techniques for application to recovered oil/water. Temporary storage of recovered fluid during spill cleanup operation has become a major problem for the USCG. To alleviate the problem, Coast Guard formulated a requirement for a recovery device oil/water separator for increasing the oil content of the recovered fluid.

[from SSIE No. DC-162119]

Guide to the Master List of Keywords and the Subject Keyword Index

The following Master List of Keywords is a controlled list of approximately 400 scientific, technical, geographic, and other descriptive terms relevant to the field of oil pollution. For each literature abstract and research project summary contained in this issue, a string of several terms has been selected from this list to serve as a reference guide to each entry. The Master List is continually updated to reflect common word usage and current trends in oil pollution literature and research. When necessary, additional free-language terms are assigned to more thoroughly define the subject coverage of an entry; such terms are preceded by an asterisk (*).

The terms included in the Master List are alphabetically permuted by computer to form the Subject Keyword Index. Thus, the string of keywords for each abstract is listed in all possible alphabetical arrangements to provide rapid access to, and cross-referencing of, any entry in this issue. The free-language terms (*) are not alphabetically permuted.

To effectively use the permuted Subject Keyword Index, the reader should use the following procedure: 1) Scan the Master List of Keywords and Cross-Reference Guide to determine all possible terms and word variants applicable to the topic of interest; 2) look up all terms in the permuted Subject Keyword Index and scan the other keywords in each entry to determine the relevancy of the entry; 3) note the citation numbers of relevant entries and locate them in the body of the ABSTRACTS. Citation numbers prefixed with the letter R denote research project summaries.

MASTER LIST OF KEYWORDS
AND CROSS-REFERENCE GUIDE
TO RELATED TERMS

S: See
SA: See also

Absorption	Aromatic hydrocarbons
SA: Adsorption, Sorbents	SA: Hydrocarbons, PAH
Activated sludge	Atlantic coast
SA: Biological treatment,	Atlantic Ocean
Sludge, Solid wastes	Australia
Acute effects	Bacteria
SA: Biological effects,	SA: Microorganisms
Mortality, Toxicity	Bahamas
Adsorption	Ballast
SA: Absorption, Sorbents	Baltic Sea
Africa	SA: Segregated ballast, Tank-
Air-Sea interface	ers, Wastewater treatment
S: Sea surface	Barents Sea
Alabama	Baseline studies
Alaska	SA: EIS
SA: Gulf of Alaska	Bays
Algae	SA: Coastal waters,
SA: Phytoplankton	Estuaries, Harbors
Amoco Cadiz spill	Beach cleanup
SA: France	SA: Spill cleanup
Analytical techniques	Beaches
SA: Bioassay, Chemical anal-	SA: Coasts, Intertidal zone,
ysis, Chromatography, Concen-	Sediments, Shorelines
trations, Detection, GC/MS,	Beaufort Sea
Source identification,	Behavior
Spectrometry, Spectroscopy	SA: (Physical) Dispersion,
Animals	Drift, Fate, Models, Move-
SA: Birds, Invertebrates,	ment, Predictions, Simula-
Marine mammals, Marine organ-	tions, Spreading
isms, Vertebrates, Wildlife	SA: (Biological) Bioassay,
Annelids	Biological effects, Develop-
SA: Invertebrates, Marine	ment, Growth, Toxicity
organisms, Polychaetes	Benthos
Antarctica	SA: Invertebrates, Marine
API (American Petroleum	organisms
Institute)	Bering Sea
Aquatic environment	Bermuda
SA: Freshwater, Lakes, Marine	Bibliographies
environment, Rivers, Sea	Bilges
surface	S: Ballast, Ships, Tankers
Arctic	Bioassay
SA: Ice, Subarctic regions	SA: Analytical techniques
Arctic Ocean	Biodegradation
Argentina	SA: Bacteria, Microorganisms
Argo Merchant spill	

Biogenic hydrocarbons	Chronic effects
SA: Hydrocarbons	SA: Biological effects,
Bioindicators	Toxicity
SA: Detection	Coalescence
Biological effects	SA: Flocculation,
SA: Acute effects, Chronic	Wastewater treatment
effects, Sublethal effects,	Coastal waters
Toxicity	SA: Atlantic coast, Bays,
Biological treatment	Coasts, Harbors, Pacific
SA: Wastewater treatment	coast
Biomass	Coastal zone management
Birds	SA: Environmental management,
SA: Animals, Vertebrates,	Resource management
Wildlife	Coasts
Black Sea	SA: Bays, Beaches, Coastal
SA: USSR	waters, Harbors, Ports,
BLM (Bureau of Land Management)	Shorelines
SA: Government agencies,	Cold Climates
US government	SA: Arctic, Arctic Ocean,
Blowout prevention	Subarctic regions
Blowouts	Compensation
Book review	SA: Insurance, Liability
Booms	Concentrations
SA: Design-engineering,	SA: Analytical techniques,
Equipment, Spill containment	Chemical analysis, Chroma-
Bouchard 65 spill	tography, Detection
SA: Buzzards Bay	Connecticut
Brazil	Conservation
Burning	SA: Coastal zone management,
SA: Incineration	Environmental management,
Buzzards Bay	Resource management
SA: Massachusetts	Containment
California	S: Booms, Equipment, Spill
SA: Pacific coast	cleanup, Spill containment
Canada	Contamination
Carcinogens	Contingency planning
SA: Health hazards, Mutagens,	SA: Spill cooperatives,
PAH	Spill response
Caribbean Sea	Coral reefs
Caspian Sea	Cost analysis
SA: USSR	SA: Economics, Economic
Chemical analysis	effects
SA: Analytical techniques,	Crankcase oil
Chromatography, Detection,	SA: Lubricating oil
GC/MS, Source identification,	Crude oil
Spectrometry, Spectroscopy	SA: Aromatic hydrocarbons,
Chemical effects	Hydrocarbons
Chesapeake Bay	Crude oil washing
SA: Delaware, Maryland	SA: Ballast, Oil discharges,
Chile	Segregated ballast, Tankers
China	Crustaceans
Chromatography	SA: Invertebrates, Marine
SA: Analytical techniques,	organisms
Chemical analysis, GC/MS	Deepwater ports

Degradation	Economic effects
SA: Biodegradation	SA: Socioeconomic effects
SA: Harbors, Oil terminals, Ports	Economics
Delaware	SA: Cost analysis
Delaware Bay	Ecosystems
Demulsification	SA: Food web, Habitats, Niches
Denmark	Ecuador
Depuration	Effluents
SA: Uptake	S: Wastewaters
Design-engineering	Effluent treatment
SA: Equipment, Patent, Performance testing, Product information	S: Wastewater treatment
Detection	EIS (Environmental Impact Statement)
SA: Analytical techniques, Bioindicators, Chemical analysis, Monitoring, Remote sensing, Source identification, Surveillance	SA: Baseline studies
Development	Ekofisk blowout
SA: (Oil) Drilling, Exploration, Offshore, Production;	Emulsification
SA: (Biological) Behavior, Biological effects, Growth, Metabolism	SA: Dispersants, Surfactants
Diesel fuel	Emulsions
S: Fuel oil	Engineering
Dispersants	S: Design-engineering
SA: Emulsifiers, Spill cleanup, Surfactants	England
Dispersion	S: UK
SA: Behavior, Drift, Movement, Spreading	English Channel
Disposal	Environmental effects
SA: Waste oil, Wastewaters	Environmental Impact Statement
Distribution	S: Baseline studies, EIS
SA: Concentrations, Hydrocarbons	Environmental management
DOE (Department of Energy)	S: Coastal zone management, Resource management
SA: Government agencies, US government	Environmental protection
Drift	S: Pollution control, Pollution prevention
SA: Behavior, Dispersion, Models, Movement, Simulations, Spreading	EPA (Environmental Protection Agency)
Drilling	SA: Government agencies, US government
SA: Exploration, Offshore, Oil fields, Oil wells, Platforms	Equipment
Echinoderms	SA: Booms, Patents, Product information, Skimmers, Spill cleanup
S: Invertebrates, Marine organisms	ERDA (Energy Research and Development Administration)
	SA: DOE, Government agencies, US government
	Estuaries
	SA: Bays
	Europe
	Evaporation
	Exploration
	SA: Development, Drilling, Offshore, Production

Extraction	GC/MS (Gas chromatography/Mass spectrometry)
SA: Oil shale, Production, Tar sands	SA: Analytical techniques, Chemical analysis, Chromatography, Spectrometry
Fate	Georges Bank
SA: Behavior, Drift, Spreading	SA: Atlantic Ocean, OCS
FEA (Federal Energy Administration)	Georgia
SA: DOE, ERDA, Government agencies, US government	Germany
Field testing	Government agencies
S: Performance testing	SA: BLM, DOE, EPA, ERDA, FEA, NOAA, USCG, USGS, USN; Foreign governments, State governments, US government
Filtration	Gravity separation
SA: Flocculation, Wastewater treatment	SA: Oil-water separation, Wastewater treatment
Fingerprinting	Great Britain
S: Source identification	S: UK
Finland	Great Lakes
Fish	Greenland
SA: Vertebrates, Marine organisms	Groundwater
Fisheries	SA: Freshwater, Water quality
Flocculation	Growth
SA: Coalescence, Filtration, Wastewater treatment	SA: Behavior, Development, Metabolism
Florida	Guidelines
Florida spill	SA: Manuals, Regulations
Flotation	Gulf of Alaska
SA: Oil-water separation, Wastewater treatment	SA: Alaska
Food chain	Gulf of Mexico
S: Food web	SA: Mexico
Food web	Habitats
Foreign governments	SA: Ecosystems
SA: Government agencies	Harbors
Fossil fuels	SA: Bays, Coastal waters, Deepwater ports, Oil terminals, Ports
SA: Crude oil	Health hazards
France	SA: Carcinogens
Freshwater	Hydrocarbons
SA: Groundwater, Lakes, Rivers, Water quality	SA: Aromatic hydrocarbons, Biogenic hydrocarbons, Crude oil, PAH, WSF
Fuel oil	Ice
Fuels	SA: Arctic, Subarctic regions
S: Fossil fuels, Fuel oil, Gasoline, Petroleum products	Illinois
Fungi	IMCO (International Maritime Consultative Organization)
SA: Microorganisms	SA: International agreements
Gas-liquid chromatography	Incineration
S: Chemical analysis, Chromatography	SA: Burning, Waste oil treatment
Gasoline	
SA: Fuel oil	

India	Lightering
Indian Ocean	S: Oil transfer, Ships,
Indonesia	Tankers
Industries	Louisiana
SA: Oil industry, Petro-	Lubricating oil
chemicals	SA: Crankcase oil
Information systems	Maine
Infrared spectroscopy	Manuals
S: Analytical techniques,	SA: Guidelines
Spectroscopy	Marine environment
Insurance	SA: Offshore, Sea surface,
SA: Compensation, Liability	Seawater
International agreements	Marine mammals
SA: Foreign governments	SA: Animals, Vertebrates,
International conventions	Wildlife
SA: Foreign governments, Leg-	Marine organisms
islation, Regulations	SA: Animals, Annelids, Crus-
Intertidal zone	taceans, Echinoderms, Fish,
SA: Beaches, Coastal Waters,	Invertebrates, Microorgan-
Shorelines	isms, Mollusks, Vertbrates
Invertebrates	Marshes
SA: Benthos, Crustaceans,	Maryland
Echinoderms, Marine organ-	Massachusetts
isms, Mollusks	Mass spectrometry
Iran	S: GC/MS, Spectrometry
Ireland	Mass spectroscopy
SA: UK	S: Spectroscopy
Israel	Mediterranean Sea
Italy	Metabolism
Ixtoc 1 blowout	SA: Depuration, Growth,
SA: Gulf of Mexico, Mexico	Uptake
Japan	Metula spill
Kuwait	SA: Strait of Magellan
Labrador Sea	Mexico
Lakes	SA: Gulf of Mexico
SA: Freshwater, Great Lakes	Michigan
Land farming	SA: Great Lakes
SA: Waste oil disposal	Microorganisms
Land spills	SA: Algae, Bacteria, Biodeg-
SA: Leakage, Onshore, Onshore	radation, Fungi, Yeasts
impacts, Pipelines	Mississippi
Law enforcement	Mississippi River
SA: Legislation, Regulations,	Models
Surveillance	SA: Behavior, Predictions,
Leakage	Simulations, Spill
SA: Oil discharges	trajectories
Legislation	Mollusks
SA: International conven-	SA: Invertebrates, Marine
tions, Law enforcement	organisms
Regulations	Monitoring
Liability	SA: Detection, Remote sen-
SA: Compensation, Insurance,	sing, Sampling, Surveillance
Law enforcement	Mortality
	SA: Acute effects, Toxicity

Motor oil	Oil-gas leasing
S: Crankcase oil	SA: Development, Drilling,
Mousse	OCS, Offshore, Production
S: Emulsions, Emulsification	Oil industry
Movement	SA: Industries, Petro-
SA: Behavior, Drift,	chemicals, Refineries
Spreading	Oil removal
Mutagens	SA: Pollution control, Spill
SA: Carcinogens, Health	cleanup, Spill removal
hazards	Oil sands
Narragansett Bay	S: Tar sands
SA: Rhode Island	Oil shale
Natural seepage	SA: Extraction
SA: Santa Barbara Channel	Oil slicks
New Jersey	Oil spills
New York	SA: Spill cleanup, Spill
Niches	containment, Spill disposal,
S: Ecosystems, Habitats	Spill removal, Spill
NOAA (National Oceanic and	response
Atmospheric Administration)	Oil tanks
SA: Government agencies, US	SA: Storage
government	Oil terminals
North Carolina	SA: Deepwater ports, Har-
North Sea	bors, Oil transfer, Ports
Norway	Oil transfer
Oceans	SA: Harbors, Ports
S: Arctic Ocean, Atlantic	Oil transport
Ocean, Indian Ocean, Marine	SA: Pipelines, Tankers
environment, Pacific Ocean	Oil-water separation
OCS (Outer Continental Shelf)	SA: Gravity separation,
SA: Development, Drilling,	Waste oil treatment, Waste-
Exploration, Offshore,	water treatment
Oil fields, Oil-gas leasing,	Oil wells
Production	SA: Drilling, Offshore,
Offloading	Oil fields, Production
S: Oil transfer, Ships,	Olympic Games spill
Tankers	Onshore
Offshore	SA: Land spills
SA: Development, Drilling,	Onshore impacts
Exploration, OCS, Oil fields,	Oregon
Oil-gas leasing, Oil wells,	Oxidation
Platforms, Production	SA: Biodegradation, Weather-
Oil	ing
S: Crankcase oil, Crude oil,	Pacific coast
Fossil fuels, Fuel oil,	Pacific Ocean
Lubricating oil, Oil shale,	PAH (Polycyclic aromatic
Petroleum products, Residual	hydrocarbons)
oils, Tar, Tar sands, Waste	SA: Aromatic hydrocarbons,
oil, WSF	Hydrocarbons
Oil discharges	Patent
SA: Leakage	SA: Design-engineering,
Oil fields	Equipment
SA: Offshore, Platforms,	Pennsylvania
Production	

Performance testing	Product information
SA: Design-engineering,	SA: Design-engineering,
Equipment, Product information	Equipment, Performance
Persian Gulf	testing
Personnel training	Production
SA: Contingency planning,	SA: Development, Drilling,
Spill response	Exploration, Offshore
Petrochemicals	Prudhoe Bay
Petroleum	SA: Alaska, Gulf of Alaska
S: Hydrocarbons, Petroleum	Puerto Rico
products	Puget Sound
Petroleum industry	SA: Washington
S: Oil industry, Refineries	Reclamation
Petroleum products	SA: Recycling, Reuse
SA: Crankcase oil, Fuel oil,	Recovery
Fuels, Gasoline, Lubricating	SA: Restoration
oil	Recycling
Philippines	SA: Reclamation, Reuse
Physical aspects	Red Sea
Physical effects	Refineries
SA: Behavior, Drift,	SA: Oil industry
Movement	Refining
Phytoplankton	Regulations
SA: Algae, Microorganisms,	SA: Government agencies,
Plankton	Guidelines, International
Pipelines	agreements, International
SA: Oil transfer, Oil trans-	conventions, Legislation
port, Trans-Alaska Pipeline	Release
Plankton	S: Depuration
S: Microorganisms, Phyto-	Remote sensing
plankton, Zooplankton	SA: Detection, Monitoring,
Plants	Source identification,
SA: Vegetation	Surveillance
Platforms	Reproduction
SA: Drilling, Exploration,	Residual oils
Offshore, Production, Oil	S: Tar, Waste oil
wells	Resource management
Pollution control	SA: Coastal zone management
Pollution prevention	Restoration
SA: Environmental protection,	SA: Recovery
Contingency planning	Reuse
Polychaetes	SA: Reclamation, Recycling
S: Annelids, Invertebrates,	Rhine River
Marine organisms	SA: Germany, Mediterranean Sea
Ports	Rhode Island
SA: Deepwater ports, Harbors,	Risk analysis
Oil terminals	SA: Economics, Statistical
Portugal	analysis, Statistics
Predictions	Rivers
SA: Models, Simulations,	SA: Freshwater, Onshore
Spill trajectories	Russia
	S: USSR

Safety
 SA: Health hazards
 Sampling
 SA: Detection, Monitoring,
 Source identification
 San Francisco Bay
 SA: California
 Sansinena spill
 Santa Barbara Channel
 SA: California
 Sargasso Sea
 S: Atlantic Ocean
 Scotland
 SA: UK
 Seabirds
 S: Birds
 Sea surface
 Seawater
 SA: Marine environment,
 Sea surface
 Sedimentation
 Sediments
 SA: Soil
 Segregated ballast
 SA: Ballast, Crude oil
 washing, Tankers
 Ships
 SA: Tankers
 Shorelines
 SA: Beaches, Coasts
 Simulations
 SA: Models, Predictions
 Sinking agents
 Skimmers
 SA: Design-engineering,
 Equipment, Spill cleanup
 Sludge
 SA: Activated sludge, Solid
 wastes
 Socioeconomic effects
 SA: Economic effects
 Soil
 SA: Sediments
 Solid wastes
 SA: Disposal, Sludge
 Solubility
 Solution
 Solvents
 S: Dispersants, Emulsifiers
 Sorbents
 SA: Absorption, Adsorption

 Source identification
 SA: Detection, Monitoring,
 Remote sensing, Sampling,
 Surveillance
 Sources
 South Carolina
 Soviet Union
 S: USSR
 Spain
 Spectrometry
 SA: Analytical techniques,
 Chemical analysis, GC/MS
 Spectroscopy
 SA: Analytical techniques,
 Chemical analysis
 Spill cleanup
 SA: Booms, Dispersants,
 Equipment, Pollution control,
 Sinking agents, Skimmers,
 Spill containment
 Spill containment
 Spill cooperatives
 SA: Contingency planning,
 Spill cleanup, Spill response
 Spill disposal
 Spill removal
 Spill response
 SA: Contingency planning,
 Spill cleanup, Spill cooper-
 atives
 Spill trajectories
 SA: Drift, Models, Movement,
 Predictions
 Spreading
 SA: Behavior, Drift, Models,
 Movement, Oil slicks
 St. Lawrence River
 SA: Great Lakes
 State governments
 SA: Government agencies,
 Regulations
 Statistical analysis
 Statistics
 Storage
 SA: Oil tanks
 Strait of Magellan
 SA: Chili
 Strategic Petroleum Reserve
 Streams
 S: Freshwater, Onshore,
 Rivers

Subarctic regions	USN (US Navy)
SA: Arctic, Cold climates	USSR (Union of Soviet Socialist Republics)
Sublethal effects	Vegetation
SA: Biological effects,	SA: Plants
Toxicity	Venezuela
Superports	Vertebrates
S: Deepwater ports, Oil terminals, Ports	SA: Animals, Birds, Marine mammals, Marine organisms
Supertankers	Virgin Islands
S: Tankers	Virginia
Surfactants	Washington
SA: Dispersants, Emulsifiers	Waste oil
Surveillance	SA: Disposal, Reclamation, Recycling, Residual oils
SA: Law enforcement, Monitoring, Remote sensing	Waste oil treatment
Sweden	Wastewaters
Tainting	Wastewater treatment
S: Contamination	SA: Oil-water separation
Tank farms	Waterfowl
S: Oil tanks, Storage	S: Birds
Tankers	Water quality
SA: Oil transport, Ships	SA: Freshwater, Groundwater
Tar	Water soluble fraction
SA: Residual oils	S: WSF
Tar sands	Weathering
Testing	Wildlife
S: Performance testing	SA: Animals, Birds, Marine organisms, Marine mammals
Texas	WSF (Water soluble fraction)
Torrey Canyon spill	SA: Crude oil, Hydrocarbons, Solution
Toxicity	Yeasts
SA: Acute effects, Biological effects	SA: Microorganisms
Trans-Alaska Pipeline	Zooplankton
SA: Alaska, Pipelines	SA: Microorganisms, Plankton
Tropical regions	
UK (United Kingdom)	
Ultrafiltration	
S: Filtration	
UN (United Nations)	
SA: International agreements, International conventions	
Uptake	
SA: Depuration, Growth, Metabolism	
Urquiola spill	
SA: Spain	
US (United States)	
USCG (US Coast Guard)	
US Government	
SA: Government agencies	
USGS (US Geological Survey)	
SA: Government agencies, US government	

1180 ABSORPTION, SORBENTS, POLLUTION PREVENTION, EQUIPMENT, PATENT, *BILGES
1185 " SORBENTS, PLANTS, PATENT, *GRASS PEAT FIBERS
1206 " OIL REMOVAL, SORBENTS, PATENT
1210 " SPILL REMOVAL, OIL-WATER SEPARATION, SKIMMERS, DISPERSANTS, SORBENTS, FLOTATION, EQUIPMENT, SPREADING, BIBLIOGRAPHIES
1452 " OIL-WATER SEPARATION, *SORBENT FOAM
1441 ACTIVATED SLUDGE, WASTEWATER TREATMENT, PATENT
1192 ACUTE EFFECTS, SPILL CLEANUP, DISPERSANTS, TOXICITY, CHRONIC EFFECTS, MARINE ORGANISMS, HABITATS
1255 " DISPERSANTS, TOXICITY, PERFORMANCE TESTING, CANADA
1196 ADSORPTION, SPILL CLEANUP, WASTEWATER TREATMENT, PATENT, *POWDERED SHALE
1217 " SORBENTS, OIL REMOVAL, PATENT
1368 " CRUDE OIL, DISTRIBUTION, MOVEMENT, SIMULATIONS, SEDIMENTS, PUGET SOUND
1414 " WASTEWATER TREATMENT, OIL INDUSTRY, *PHENOL REMOVAL
1427 " WASTEWATER TREATMENT, OIL REMOVAL, PERFORMANCE TESTING, *FOAM SEPARATION
1428 " WASTEWATER TREATMENT, REFINERIES, PETROCHEMICALS, BIBLIOGRAPHIES, *ACTIVATED CARBON
1435 " WASTEWATER TREATMENT, SORBENTS, PATENT
1442 " WASTEWATER TREATMENT, OIL REMOVAL, PATENT
1307 ALASKA , BASELINE STUDIES, OFFSHORE, DEVELOPMENT, PRUDHOE BAY
1310 " OCS, DEVELOPMENT, BASELINE STUDIES, AQUATIC ENVIRONMENT, MARINE ORGANISMS
1449 " WASTE OIL TREATMENT, ENVIRONMENTAL EFFECTS, DISPOSAL
1247 ALGAE, CRUDE OIL, FUEL OIL, AROMATIC HYDROCARBONS, WSF, TOXICITY, MICROORGANISMS
1248 " CRUDE OIL, FUEL OIL, BIOLOGICAL EFFECTS, MICROORGANISMS, PAH, TOXICITY
1291 " FUEL OIL, BIOINDICATORS, TOXICITY, ANALYTICAL TECHNIQUES, INVERTEBRATES, *SPECIES DIVERSITY
1339 " BIODEGRADATION, OIL SPILLS, BACTERIA, SPILL CLEANUP, BIBLIOGRAPHIES
R106 " CRUDE OIL, FUEL OIL, TOXICITY, REPRODUCTION, WATER QUALITY
1194 AMOCO CADIZ SPILL, SPILL CLEANUP, PHYSICAL ASPECTS, BEHAVIOR, POLLUTION CONTROL, FRANCE
1221 " CONTINGENCY PLANNING, SPILL CLEANUP, POLLUTION CONTROL, COASTS, FRANCE
1238 " SPILL CLEANUP, ENVIRONMENTAL EFFECTS, COASTS, MORTALITY, BIRDS, MARINE ORGANISMS, FISHERIES, FRANCE
1243 " BIOLOGICAL EFFECTS, MORTALITY, BIRDS, MARINE ORGANISMS, FISHERIES
1253 " BIOLOGICAL EFFECTS, SHORELINES, MORTALITY, BIRDS, FISHERIES, FRANCE
1254 " BIOLOGICAL EFFECTS, SHORELINES, MORTALITY, BIRDS, FISHERIES, FRANCE
1263 " BIOLOGICAL EFFECTS, BENTHOS, INVERTEBRATES, ONSHORE, TOXICITY, FRANCE
1284 " MARINE ORGANISMS, FISHERIES, ENVIRONMENTAL EFFECTS, MORTALITY, FRANCE
1295 " WEATHERING, CHEMICAL EFFECTS, EMULSIONS, AROMATIC HYDROCARBONS, FRANCE
1296 " WEATHERING, CHEMICAL EFFECTS, AROMATIC HYDROCARBONS, FRANCE
1299 " PHYSICAL ASPECTS, PHYSICAL EFFECTS, CRUDE OIL, MOVEMENT, DISTRIBUTION, FRANCE
1300 " SHORELINES, BEACHES, SEDIMENTS, CRUDE OIL, DISTRIBUTION, PHYSICAL ASPECTS, FRANCE
1301 " SHORELINES, SEDIMENTS, CRUDE OIL, DISTRIBUTION, PHYSICAL EFFECTS, FRANCE
1315 " OIL SPILLS, ENVIRONMENTAL EFFECTS, CONTAMINATION, SPILL REMOVAL, FRANCE
1324 " SPILL CLEANUP, REMOTE SENSING, BEACHES, DISTRIBUTION, CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, FRANCE
1325 " SPILL CLEANUP, DISTRIBUTION, CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, NOAA, EPA, FRANCE
1119 ANALYTICAL TECHNIQUES, CONCENTRATIONS, DETECTION, PATENT, OIL-IN-WATER, *FLUORESCENCE
1120 " MONITORING, WASTEWATERS, CONTAMINATION, TOXICITY, GREAT LAKES
1123 " CONTAMINATION, MUTAGENS, BIOLOGICAL EFFECTS, DETECTION
1125 " PAH, HYDROCARBONS , EXTRACTION, DETECTION, WASTEWATERS, REFINERIES, *FLUOROMETRY
1128 " DETECTION, CONCENTRATIONS, *OIL-IN-WATER
1129 " DETECTION, CONCENTRATIONS, HYDROCARBONS , SPECTROMETRY, SEAWATER
1130 " PAH, WASTEWATERS, *FLUOROMETRY
1133 " HYDROCARBONS , SOIL, EQUIPMENT, DESIGN-ENGINEERING, PATENT, *VOLATILIZATION
1134 " HYDROCARBONS , SOIL, EQUIPMENT, DESIGN-ENGINEERING, PATENT, DETECTION
1139 " DETECTION, PAH, *FLUORESCENCE
1140 " SAMPLING, REMOTE SENSING, DETECTION, OIL SPILLS, WASTEWATERS, BIBLIOGRAPHIES
1143 " CHEMICAL ANALYSIS, HYDROCARBONS , CHROMATOGRAPHY, GEORGES BANK, ARGO MERCHANT SPILL
1145 " SAMPLING, PHYSICAL ASPECTS, ARGO MERCHANT SPILL
1147 " WASTEWATERS, SEDIMENTS, HYDROCARBONS , BIOGENIC HYDROCARBONS, MANUALS
1148 " PAH, CHROMATOGRAPHY
1149 " PETROLEUM PRODUCTS, CRUDE OIL, CHEMICAL ANALYSIS, SOURCE IDENTIFICATION
1150 " CHROMATOGRAPHY, SEDIMENTS, HYDROCARBONS , *TLC, *COLUMN CHROMATOGRAPHY
1151 " SAMPLING, CHROMATOGRAPHY, CRUDE OIL, PETROLEUM PRODUCTS
1152 " SAMPLING, TAR, JAPAN, CHROMATOGRAPHY, SOURCE IDENTIFICATION
1154 " HYDROCARBONS , SEDIMENTS, CHROMATOGRAPHY, MOVEMENT, ARGO MERCHANT SPILL
1155 " WSF, CONCENTRATIONS, SAMPLING, ARGO MERCHANT SPILL, *FLUORESCENCE SPECTROSCOPY
1158 " CHEMICAL ANALYSIS, DISPOSAL , HYDROCARBONS , WASTEWATERS
1159 " HYDROCARBONS , SAMPLING, MARINE ORGANISMS, SEDIMENTS, FISH, ARGO MERCHANT SPILL
1160 " HYDROCARBONS , WSF
1162 " PAH, SPECTROSCOPY, BAYS, NEW YORK
1164 " PETROLEUM PRODUCTS, SOURCE IDENTIFICATION
1169 " SOURCE IDENTIFICATION, GC/MS, HYDROCARBONS , SEDIMENTS, WEATHERING, DETECTION
1170 " SOURCE IDENTIFICATION, DETECTION, CHROMATOGRAPHY, MANUALS

1171 ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION, TAR, CALIFORNIA, *SANTA MONICA BAY,
NATURAL SEEPAGE, WEATHERING
1172 " SOURCE IDENTIFICATION, FUEL OIL, CRUDE OIL
1173 " SOURCE IDENTIFICATION, CONTAMINATION, *NI/N INDEX
1174 " SOURCE IDENTIFICATION, OIL SPILLS
1256 " BIOLOGICAL EFFECTS, ENVIRONMENTAL EFFECTS, MARINE ORGANISMS, *PROCEEDINGS
1280 " BIOLOGICAL EFFECTS, ZOOPLANKTON, CRUSTACEANS, ARGO MERCHANT SPILL,
*SPECTROFLUOROMETRY
1291 " ALGAE, FUEL OIL, BIOINDICATORS, TOXICITY, INVERTEBRATES, *SPECIES DIVERSITY
1327 " CONCENTRATIONS, DETECTION, SEDIMENTS, HYDROCARBONS
1430 " WASTE OIL TREATMENT, PETROLEUM PRODUCTS, BIODEGRADATION
R089 " CHEMICAL ANALYSIS, OIL DISCHARGES, WASTEWATERS, POLLUTION CONTROL
1127 ANIMALS, DETECTION, BIOINDICATORS, MICROORGANISMS, PLANTS, FISH, BIBLIOGRAPHIES
1273 " ECOSYSTEMS, BIBLIOGRAPHIES, PLANTS, ARCTIC
1293 " BIOLOGICAL EFFECTS, TOXICITY, CONTAMINATION, MARINE MAMMALS, *SEA OTTER
1310 AQUATIC ENVIRONMENT, ALASKA , OCS, DEVELOPMENT, BASELINE STUDIES, MARINE ORGANISMS
1316 " BIOLOGICAL EFFECTS, BIODEGRADATION, FATE, MOVEMENT
1326 " CONTAMINATION, FATE, BIOLOGICAL EFFECTS, ECOSYSTEMS
1230 ARCTIC, SPILL RESPONSE, CONTINGENCY PLANNING, POLLUTION PREVENTION, SPILL CLEANUP.
SHORELINES, BEAUFORT SEA
1273 " ANIMALS, ECOSYSTEMS, BIBLIOGRAPHIES, PLANTS
1329 " BIOLOGICAL EFFECTS, FATE, WEATHERING, BIRDS, FISH, BIODEGRADATION, COLD CLIMATES,
BOOK REVIEW, *TRANSPORT
1132 ARGO MERCHANT SPILL, OIL SLICKS, MONITORING, BEHAVIOR, MOVEMENT
1143 " ANALYTICAL TECHNIQUES, CHEMICAL ANALYSIS, HYDROCARBONS , CHROMATOGRAPHY, GEORGES
BANK
1145 " ANALYTICAL TECHNIQUES, SAMPLING, PHYSICAL ASPECTS
1154 " ANALYTICAL TECHNIQUES, HYDROCARBONS , SEDIMENTS, CHROMATOGRAPHY, MOVEMENT
1155 " ANALYTICAL TECHNIQUES, WSF, CONCENTRATIONS, SAMPLING, *FLUORESCENCE SPECTROSCOPY
1159 " ANALYTICAL TECHNIQUES, HYDROCARBONS , SAMPLING, MARINE ORGANISMS, SEDIMENTS, FISH
1165 " SOURCE IDENTIFICATION, TAR, BEACHES, MASSACHUSETTS, RHODE ISLAND
1223 " OIL SPILLS, PHYSICAL ASPECTS, SPILL RESPONSE, SPILL CLEANUP
1228 " SPILL RESPONSE, SPILL REMOVAL, CONTINGENCY PLANNING, USCG
1250 " BIOLOGICAL EFFECTS, FISH, FOOD WEB, TOXICITY
1251 " BIOLOGICAL EFFECTS, SUBLETHAL EFFECTS, MARINE ORGANISMS, BENTHOS
1267 " BIOLOGICAL EFFECTS, FUEL OIL, FISH, MORTALITY, REPRODUCTION
1271 " BIOLOGICAL EFFECTS, FISH, REPRODUCTION, MORTALITY, GROWTH, *CYTOGENETICS
1280 " ANALYTICAL TECHNIQUES, BIOLOGICAL EFFECTS, ZOOPLANKTON, CRUSTACEANS,
*SPECTROFLUOROMETRY
1281 " BIOLOGICAL EFFECTS, BIRDS, MORTALITY, TOXICITY
1282 " BIOLOGICAL EFFECTS, MARINE ORGANISMS, BENTHOS
1285 " BIOLOGICAL EFFECTS, BASELINE STUDIES, FISH, MOLLUSKS, CRUSTACEANS, *HISTOPATHOLOGY
1286 " BIOLOGICAL EFFECTS, FISH, MORTALITY, ZOOPLANKTON, TOXICITY
1290 " BIOLOGICAL EFFECTS, MOLLUSKS, FISH, SUBLETHAL EFFECTS
1302 " OIL SPILLS, SOCIOECONOMIC EFFECTS
1318 " OIL SPILLS, BIOLOGICAL EFFECTS, CHEMICAL EFFECTS, PHYSICAL EFFECTS, SOCIOECONOMIC
EFFECTS, *PROCEEDINGS
1346 " MOVEMENT, DRIFT, SPILL TRAJECTORIES, MONITORING, *NEAR-BOTTOM TRANSPORT
1362 " MODELS, OIL SPILLS, BEHAVIOR, MOVEMENT, DRIFT, PREDICTIONS, SEA SURFACE
1363 " MODELS, PREDICTIONS, MOVEMENT, DRIFT, SEA SURFACE
1365 " MOVEMENT, SPILL TRAJECTORIES, DRIFT, PREDICTIONS, SPILL RESPONSE
1366 " RISK ANALYSIS, MODELS, ENVIRONMENTAL EFFECTS, PREDICTIONS, ONSHORE IMPACTS
1121 AROMATIC HYDROCARBONS, CHEMICAL ANALYSIS, DETECTION, CONCENTRATIONS, SPECTROSCOPY
1122 " DETECTION, SEAWATER
1156 " CHEMICAL ANALYSIS, FISH, MOLLUSKS, CONTAMINATION, *FREEZE DRYING
1247 " ALGAE, CRUDE OIL, FUEL OIL, WSF, TOXICITY, MICROORGANISMS
1295 " AMOCO CADIZ SPILL, WEATHERING, CHEMICAL EFFECTS, EMULSIONS, FRANCE
1296 " AMOCO CADIZ SPILL, WEATHERING, CHEMICAL EFFECTS, FRANCE
1337 " BIODEGRADATION, BACTERIA, FUNGI
1308 ATLANTIC COAST, BASELINE STUDIES, PAH, FISH, OCS, OFFSHORE, DEVELOPMENT
R110 " BASELINE STUDIES, OCS, HYDROCARBONS , SEDIMENTS, GULF OF MEXICO, *GEOCHEMISTRY
1351 ATLANTIC OCEAN, OIL SLICKS, PHYSICAL ASPECTS, BEHAVIOR, HYDROCARBONS , DISPERSANTS
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 1148 " ANALYTICAL TECHNIQUES, PAH
 1150 " ANALYTICAL TECHNIQUES, SEDIMENTS, HYDROCARBONS , *TLC, *COLUMN CHROMATOGRAPHY
 1151 " ANALYTICAL TECHNIQUES, SAMPLING, CRUDE OIL, PETROLEUM PRODUCTS
 1152 " ANALYTICAL TECHNIQUES, SAMPLING, TAR, JAPAN, SOURCE IDENTIFICATION
 1153 " CHEMICAL ANALYSIS, SAMPLING, SPECTROMETRY, WEATHERING
 1154 " ARGO MERCHANT SPILL, ANALYTICAL TECHNIQUES, HYDROCARBONS , SEDIMENTS, MOVEMENT
 1166 " CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, CRUDE OIL
 1170 " ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION, DETECTION, MANUALS
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 R108 " CHEMICAL EFFECTS, WSF, PHYSICAL EFFECTS, GROUNDWATER, CONTAMINATION
 1192 CHRONIC EFFECTS, ACUTE EFFECTS, SPILL CLEANUP, DISPERSANTS, TOXICITY, MARINE
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 1244 " BIOLOGICAL EFFECTS, FATE, OIL SPILLS, HEALTH HAZARDS, MARINE ENVIRONMENT
 1262 " TOXICITY, MUTAGENS, CRUDE OIL
 1275 " CARCINOGENS, BIOLOGICAL EFFECTS, PAH, HEALTH HAZARDS
 1283 " BIRDS, CONTAMINATION, SUBLETHAL EFFECTS, *STERNA FUSCATA
 1455 COALESCENCE, OIL-WATER SEPARATION, EQUIPMENT, FILTRATION, PATENT
 1236 COASTAL WATERS, DISPERSANTS, SPILL CLEANUP, POLLUTION CONTROL, CONTINGENCY PLANNING
 1261 " BIRDS, NEW YORK, ENVIRONMENTAL EFFECTS
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1238 COASTS, BIRDS, AMOCO CADIZ SPILL, SPILL CLEANUP, ENVIRONMENTAL EFFECTS, MORTALITY,
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 1382 " ENVIRONMENTAL EFFECTS, RESOURCE MANAGEMENT, OIL INDUSTRY
 1411 " BALLAST , STATISTICS, OIL TRANSPORT, TANKERS, TAR, OIL SPILLS, POLLUTION CONTROL,
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 1329 " BOOK REVIEW, BIRDS, BIOLOGICAL EFFECTS, BIODEGRADATION, ARCTIC, FATE, WEATHERING,
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 1370 " BIODEGRADATION, PAH, FATE, WEATHERING, ZOOPLANKTON, UPTAKE, SEDIMENTS, ECOSYSTEMS
 1232 COMPENSATION, LEGISLATION, US, LIABILITY, SPILL CLEANUP, *SUPERFUND
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 1135 " CHROMATOGRAPHY, CHEMICAL ANALYSIS, SAMPLING, PAH, DETECTION
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 1155 " ARGO MERCHANT SPILL, ANALYTICAL TECHNIQUES, WSF, SAMPLING, *FLUORESCENCE
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 1163 " CHEMICAL ANALYSIS, BIOLOGICAL EFFECTS, CONTAMINATION, SURFACTANTS, FISH, JAPAN
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 1156 " CHEMICAL ANALYSIS, AROMATIC HYDROCARBONS, FISH, MOLLUSKS, *FREEZE DRYING
 1157 " CHEMICAL ANALYSIS, HYDROCARBONS , SOURCE IDENTIFICATION, MARINE ORGANISMS,
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 1163 " CONCENTRATIONS, CHEMICAL ANALYSIS, BIOLOGICAL EFFECTS, SURFACTANTS, FISH, JAPAN
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 1228 " ARGO MERCHANT SPILL, SPILL RESPONSE, SPILL REMOVAL, USCG
 1230 " BEAUFORT SEA, ARCTIC, SPILL RESPONSE, POLLUTION PREVENTION, SPILL CLEANUP,
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1260 " BIRDS, TOXICITY, DEVELOPMENT, GROWTH, MORTALITY, *ANAS PLATYRHYNCHOS, *HATCHABILITY
1262 " CHRONIC EFFECTS, TOXICITY, MUTAGENS
1268 " BIOLOGICAL EFFECTS, BIOASSAY, MUTAGENS, TOXICITY
1274 " HYDROCARBONS , MOLLUSKS, UPTAKE, DEPURATION, FOOD WEB
1288 " WSF, DISPERSANTS, TOXICITY, SUBLETHAL EFFECTS, CRUSTACEANS, *COPEPODS
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1309 " ENVIRONMENTAL EFFECTS, OIL INDUSTRY, REFINING, PETROLEUM PRODUCTS, WASTEWATERS, WASHINGTON, PUGET SOUND
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1336 " CONCENTRATIONS, CHEMICAL ANALYSIS, BIODEGRADATION, HYDROCARBONS
1340 " BIODEGRADATION, MICROORGANISMS, *VITAMINS
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1361 " CORAL REEFS, BIOLOGICAL EFFECTS, BACTERIA, MODELS, SUBLETHAL EFFECTS
1368 " ADSORPTION, DISTRIBUTION, MOVEMENT, SIMULATIONS, SEDIMENTS, PUGET SOUND
1380 " CONCENTRATIONS, OIL FIELDS, ENVIRONMENTAL EFFECTS, MARINE ENVIRONMENT, DEVELOPMENT
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R106 " ALGAE, FUEL OIL, TOXICITY, REPRODUCTION, WATER QUALITY
1280 CRUSTACEANS, BIOLOGICAL EFFECTS, ARGO MERCHANT SPILL, ANALYTICAL TECHNIQUES, ZOOPLANKTON, *SPECTROFLUOROMETRY
1285 " BIOLOGICAL EFFECTS, BASELINE STUDIES, ARGO MERCHANT SPILL, FISH, MOLLUSKS, *HISTOPATHOLOGY
1288 " CRUDE OIL, WSF, DISPERSANTS, TOXICITY, SUBLETHAL EFFECTS, *COPEPODS
R098 " BIOLOGICAL EFFECTS, BEHAVIOR, HYDROCARBONS , NATURAL SEEPAGE
1401 DEEPWATER PORTS, OIL TRANSFER, POLLUTION PREVENTION, TANKERS, *TRANSFER CONTROL SYSTEMS
1410 " REGULATIONS, POLLUTION PREVENTION, *OIL TRANSFER SYSTEM
1418 DEMULSIFICATION, WASTEWATER TREATMENT, OIL REMOVAL, PATENT
1446 " WASTEWATER TREATMENT, PATENT
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1274 " CRUDE OIL, HYDROCARBONS , MOLLUSKS, UPTAKE, FOOD WEB
1133 DESIGN-ENGINEERING, ANALYTICAL TECHNIQUES, HYDROCARBONS , SOIL, EQUIPMENT, PATENT, *VOLATILIZATION
1134 " ANALYTICAL TECHNIQUES, HYDROCARBONS , SOIL, EQUIPMENT, PATENT, DETECTION
1138 " CHEMICAL ANALYSIS, MONITORING, WASTEWATER TREATMENT, RIVERS, EQUIPMENT, INDIA
1177 " BOOMS, SPILL CONTAINMENT, PERFORMANCE TESTING, EQUIPMENT, EPA, *OHMSETT FACILITY
1179 " BOOMS, SPILL CONTAINMENT, EQUIPMENT, SIMULATIONS
1181 " BOOMS, SPILL CONTAINMENT, EQUIPMENT, PATENT
1182 " SPILL CLEANUP, SKIMMERS, PERFORMANCE TESTING, EPA, US, USSR, *OHMSETT FACILITY
1184 " DISPERSANTS, EQUIPMENT, PERFORMANCE TESTING, POLLUTION CONTROL
1193 " SPILL CLEANUP, SKIMMERS, OIL-WATER SEPARATION, EQUIPMENT, PATENT
1198 " SPILL REMOVAL, EQUIPMENT, PERFORMANCE TESTING, SKIMMERS
1200 " DISPERSANTS, EQUIPMENT, US, USSR, EPA, PERFORMANCE TESTING, *OHMSETT FACILITY
1202 " SPILL CLEANUP, SKIMMERS, PERFORMANCE TESTING, EQUIPMENT, EPA, *OHMSETT FACILITY
1203 " BOOMS, OIL REMOVAL, SKIMMERS, FILTRATION, GRAVITY SEPARATION, EQUIPMENT, PATENT
1204 " SPILL CLEANUP, SKIMMERS, EQUIPMENT, PATENT
1207 " BOOMS, SPILL CLEANUP, SKIMMERS, SHIPS, EQUIPMENT, PATENT
1208 " SPILL CLEANUP, SPILL REMOVAL, SHIPS, EQUIPMENT, PATENT
1209 " SPILL CLEANUP, OIL-WATER SEPARATION, SKIMMERS, SEA SURFACE, EQUIPMENT, PATENT
1211 " SPILL CLEANUP, EQUIPMENT, DISPERSANTS, *DISPERSANT APPLICATION
1212 " SKIMMERS, EQUIPMENT, SPILL CLEANUP, PERFORMANCE TESTING, *OHMSETT FACILITY
1214 " SPILL CLEANUP, SKIMMERS, EQUIPMENT, PATENT
1215 " SPILL CLEANUP, SKIMMERS, EQUIPMENT, PERFORMANCE TESTING, *OHMSETT FACILITY
1216 " SPILL CLEANUP, EQUIPMENT, *SIRENE
1387 " TANKERS, SKIMMERS, EQUIPMENT, SPILL CLEANUP, MODELS
1409 " OIL TRANSPORT, PETROLEUM PRODUCTS, SAFETY, *TANK TRUCKS

1413 DESIGN-ENGINEERING, WASTEWATER TREATMENT, OIL-WATER SEPARATION, EQUIPMENT, PATENT
1436 " WASTEWATER TREATMENT, OIL REMOVAL, GRAVITY SEPARATION, FILTRATION, PATENT
1444 " WASTEWATER TREATMENT, OIL REMOVAL, EQUIPMENT, PATENT
1451 " OIL-WATER SEPARATION, GRAVITY SEPARATION, WASTEWATER TREATMENT, EQUIPMENT
1459 " OIL-WATER SEPARATION, WASTEWATER TREATMENT, EQUIPMENT
1460 " OIL-WATER SEPARATION, WASTEWATER TREATMENT, EQUIPMENT, PATENT, *GREASE
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1119 " CONCENTRATIONS, ANALYTICAL TECHNIQUES, PATENT, OIL-IN-WATER, *FLUORESCENCE
1121 " CONCENTRATIONS, CHEMICAL ANALYSIS, AROMATIC HYDROCARBONS, SPECTROSCOPY
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1123 " CONTAMINATION, BIOLOGICAL EFFECTS, ANALYTICAL TECHNIQUES, MUTAGENS
1125 " ANALYTICAL TECHNIQUES, PAH, HYDROCARBONS, EXTRACTION, WASTEWATERS, REFINERIES, *FLUOROMETRY
1126 " HYDROCARBONS, WASTEWATERS, *IR
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1128 " CONCENTRATIONS, ANALYTICAL TECHNIQUES, *OIL-IN-WATER
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1134 " DESIGN-ENGINEERING, ANALYTICAL TECHNIQUES, HYDROCARBONS, SOIL, EQUIPMENT, PATENT
1135 " CONCENTRATIONS, CHROMATOGRAPHY, CHEMICAL ANALYSIS, SAMPLING, PAH
1136 " CONCENTRATIONS, SAMPLING, WASTE OIL
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1140 " BIBLIOGRAPHIES, ANALYTICAL TECHNIQUES, SAMPLING, REMOTE SENSING, OIL SPILLS, WASTEWATERS
1141 " BIBLIOGRAPHIES, REMOTE SENSING, OIL SPILLS, DISPERSION, FATE, ESTUARIES
1146 " CHEMICAL ANALYSIS, BIOGENIC HYDROCARBONS, SAMPLING, HYDROCARBONS
1169 " ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION, GC/MS, HYDROCARBONS, SEDIMENTS, WEATHERING
1170 " CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION, MANUALS
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1307 " BASELINE STUDIES, ALASKA, OFFSHORE, PRUDHOE BAY
1308 " BASELINE STUDIES, ATLANTIC COAST, PAH, FISH, OCS, OFFSHORE
1310 " BASELINE STUDIES, AQUATIC ENVIRONMENT, ALASKA, OCS, MARINE ORGANISMS
1311 " BASELINE STUDIES, OCS, ENVIRONMENTAL EFFECTS, OIL TRANSPORT
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1372 " BIOLOGICAL EFFECTS, OIL SPILLS, MARINE MAMMALS, SCOTLAND, *SULLOM VOE, *SEALS
1374 " CONTINGENCY PLANNING, BIRDS, BIOLOGICAL EFFECTS, STATISTICS, NORTH SEA, SCOTLAND, *SULLOM VOE
1375 " OIL SHALE, ENVIRONMENTAL EFFECTS, HEALTH HAZARDS
1378 " BASELINE STUDIES, OFFSHORE, OIL-GAS LEASING, OREGON
1380 " CRUDE OIL, CONCENTRATIONS, OIL FIELDS, ENVIRONMENTAL EFFECTS, MARINE ENVIRONMENT
1384 " OFFSHORE, NORTH SEA, POLLUTION PREVENTION, IMCO, OIL TRANSPORT, LEGISLATION, LAW ENFORCEMENT, FISHERIES
1385 " ATLANTIC OCEAN, OIL SPILLS, RISK ANALYSIS, OCS
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1184 " DESIGN-ENGINEERING, EQUIPMENT, PERFORMANCE TESTING, POLLUTION CONTROL
1186 " BURNING, BOOMS, SPILL CLEANUP, SPILL REMOVAL, SKIMMERS, SINKING AGENTS, SORBENTS, IMCO, MANUALS
1187 " CONTINGENCY PLANNING, ONSHORE, POLLUTION CONTROL, EQUIPMENT, GUIDELINES
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1191 " SPILL CLEANUP, POLLUTION CONTROL, GOVERNMENT AGENCIES, REGULATIONS
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1201 " TOXICITY, PERFORMANCE TESTING, SIMULATIONS, EQUIPMENT, ENVIRONMENTAL EFFECTS, GUIDELINES, *ASTM SYMPOSIUM
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1210 DISPERSANTS, BIBLIOGRAPHIES, ABSORPTION, SPILL REMOVAL, OIL-WATER SEPARATION, SKIMMERS, SORBENTS, FLOTATION, EQUIPMENT, SPREADING
 1211 " DESIGN-ENGINEERING, SPILL CLEANUP, EQUIPMENT, *DISPERSANT APPLICATION
 1220 " CONTINGENCY PLANNING, BEACH CLEANUP, GUIDELINES, SPILL CLEANUP, INTERTIDAL ZONE, SHORELINES
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 1288 " CRUSTACEANS, CRUDE OIL, WSF, TOXICITY, SUBLETHAL EFFECTS, *COPEPODS
 1320 " TOXICITY, ENVIRONMENTAL EFFECTS, TORREY CANYON SPILL, UK, MARSHES, RIVERS, LAKES
 1332 " SPILL CLEANUP, ENVIRONMENTAL EFFECTS, SHORELINES, MARINE ORGANISMS, TOXICITY, UK, GUIDELINES, TORREY CANYON SPILL
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 1371 " PETROLEUM PRODUCTS, FATE, INDUSTRIES, WATER QUALITY, SOLID WASTES
 1417 " BIODEGRADATION, EMULSIONS, WASTEWATER TREATMENT
 1421 " OIL SHALE, EXTRACTION, ENVIRONMENTAL EFFECTS, SOLID WASTES
 1426 " BIOLOGICAL TREATMENT, WASTEWATER TREATMENT, GRAVITY SEPARATION, FLOTATION, SLUDGE
 1432 " CRANKCASE OIL, WASTE OIL, RECYCLING
 1439 " EMULSIONS, WASTEWATERS, FLOTATION, OIL-WATER SEPARATION
 1443 " WASTE OIL, LAND FARMING, SLUDGE
 1449 " ALASKA, WASTE OIL TREATMENT, ENVIRONMENTAL EFFECTS
 1467 " BOOK REVIEW, REUSE, WASTEWATER TREATMENT, LAND FARMING, POLLUTION PREVENTION
 1124 DISTRIBUTION, CONCENTRATIONS, BIRDS, HYDROCARBONS, MONITORING, MARSHES, SCOTLAND, *SULLOM VOE
 1168 " SOURCE IDENTIFICATION, HYDROCARBONS, OIL TERMINALS, FATE, SEDIMENTS, SCOTLAND, *SULLOM VOE
 1299 " CRUDE OIL, AMOCO CADIZ SPILL, PHYSICAL ASPECTS, PHYSICAL EFFECTS, MOVEMENT, FRANCE
 1300 " CRUDE OIL, BEACHES, AMOCO CADIZ SPILL, SHORELINES, SEDIMENTS, PHYSICAL ASPECTS, FRANCE
 1301 " CRUDE OIL, AMOCO CADIZ SPILL, SHORELINES, SEDIMENTS, PHYSICAL EFFECTS, FRANCE
 1324 " CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, BEACHES, AMOCO CADIZ SPILL, SPILL CLEANUP, REMOTE SENSING, FRANCE
 1325 " CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, AMOCO CADIZ SPILL, SPILL CLEANUP, NOAA, EPA, FRANCE
 1333 " PAH, SOIL, FRESHWATER, SEAWATER, PLANTS
 1338 " BIODEGRADATION, BACTERIA, HYDROCARBONS, ITALY
 1348 " HYDROCARBONS, FATE, SEDIMENTATION, NARRAGANSETT BAY
 1349 " BEACHES, TAR, FATE, SEDIMENTS, PHYSICAL ASPECTS
 1355 " TAR, DRIFT, PACIFIC OCEAN
 1359 " CONCENTRATIONS, PAH, FATE, SOIL, SEDIMENTS, *POLLUTANT TRANSPORT
 1368 " CRUDE OIL, ADSORPTION, MOVEMENT, SIMULATIONS, SEDIMENTS, PUGET SOUND
 1406 DOE, STORAGE, STRATEGIC PETROLEUM RESERVE, RISK ANALYSIS
 1346 DRIFT, ARGO MERCHANT SPILL, MOVEMENT, SPILL TRAJECTORIES, MONITORING, *NEAR-BOTTOM TRANSPORT
 1355 " DISTRIBUTION, TAR, PACIFIC OCEAN
 1362 " BEHAVIOR, ARGO MERCHANT SPILL, MODELS, OIL SPILLS, MOVEMENT, PREDICTIONS, SEA SURFACE
 1363 " ARGO MERCHANT SPILL, MODELS, PREDICTIONS, MOVEMENT, SEA SURFACE
 1365 " ARGO MERCHANT SPILL, MOVEMENT, SPILL TRAJECTORIES, PREDICTIONS, SPILL RESPONSE
 1373 DRILLING, TOXICITY, INVERTEBRATES, FISH, *DRILLING FLUIDS
 1377 " OIL FIELDS, PRODUCTION, OIL INDUSTRY, EPA, REGULATIONS, *DRILLING MUDS
 1379 " BIBLIOGRAPHIES, OFFSHORE, OIL WELLS, ENVIRONMENTAL EFFECTS, EQUIPMENT, LEGISLATION
 1433 " WASTEWATER TREATMENT, POLLUTION PREVENTION, *HYDROCYCLONE
 R097 " CORAL REEFS, TOXICITY, *DRILLING MUDS
 R114 " DEVELOPMENT, ENVIRONMENTAL EFFECTS, OIL SHALE, MARINE ENVIRONMENT, PLATFORMS
 R115 " BENTHOS, ENVIRONMENTAL EFFECTS, OFFSHORE, MARINE ORGANISMS, FOOD WEB, *DRILLING MUDS

1305 ECONOMIC EFFECTS, CONTAMINATION, IXTOC 1 BLOWOUT, FISHERIES, TEXAS, *SHRIMP INDUSTRY
 1306 " COST ANALYSIS, BOOK REVIEW, BIBLIOGRAPHIES, ECONOMICS
 1197 ECONOMICS, DISPERSANTS, SPILL RESPONSE, POLLUTION CONTROL
 1306 " ECONOMIC EFFECTS, COST ANALYSIS, BOOK REVIEW, BIBLIOGRAPHIES
 1416 " BIBLIOGRAPHIES, WASTEWATER TREATMENT, PETROCHEMICALS, OIL INDUSTRY, POLLUTION PREVENTION
 1273 ECOSYSTEMS, BIBLIOGRAPHIES, ARCTIC, ANIMALS, PLANTS
 1326 " CONTAMINATION, BIOLOGICAL EFFECTS, AQUATIC ENVIRONMENT, FATE
 1370 " COLD CLIMATES, BIODEGRADATION, PAH, FATE, WEATHERING, ZOOPLANKTON, UPTAKE, SEDIMENTS
 R117 " BIOASSAY, WASTEWATERS, ESTUARIES, TOXICITY, SUBLETHAL EFFECTS, *STAGHORN SCULPIN
 1403 EIS, STORAGE, STRATEGIC PETROLEUM RESERVE, TEXAS
 1404 " STORAGE, STRATEGIC PETROLEUM RESERVE, OIL TRANSPORT, LOUISIANA
 1405 " STORAGE, STRATEGIC PETROLEUM RESERVE, LOUISIANA
 1213 EMULSIFICATION, SPILL REMOVAL, PATENT
 1295 EMULSIONS, CHEMICAL EFFECTS, AROMATIC HYDROCARBONS, AMOCO CADIZ SPILL, WEATHERING, FRANCE
 1417 " DISPOSAL , BIODEGRADATION, WASTEWATER TREATMENT
 1420 " WASTEWATER TREATMENT, FILTRATION, REFINERIES
 1429 " WASTEWATER TREATMENT, OIL REMOVAL, *ELECTROCOAGULATION
 1439 " DISPOSAL , WASTEWATERS, FLOTATION, OIL-WATER SEPARATION
 1450 " OIL-WATER SEPARATION, REGULATIONS
 R093 " CHEMICAL ANALYSIS, BALLAST , SAMPLING, WASTEWATER TREATMENT, OIL TANKS
 1201 ENVIRONMENTAL EFFECTS, DISPERSANTS, TOXICITY, PERFORMANCE TESTING, SIMULATIONS, EQUIPMENT, GUIDELINES, *ASTM SYMPOSIUM
 1229 " DISPERSANTS, SPILL RESPONSE
 1238 " COASTS, BIRDS, AMOCO CADIZ SPILL, SPILL CLEANUP, MORTALITY, MARINE ORGANISMS, FISHERIES, FRANCE
 1256 " BIOLOGICAL EFFECTS, ANALYTICAL TECHNIQUES, MARINE ORGANISMS, *PROCEEDINGS
 1261 " COASTAL WATERS, BIRDS, NEW YORK
 1234 " AMOCO CADIZ SPILL, MARINE ORGANISMS, FISHERIES, MORTALITY, FRANCE
 1298 " FATE, TOXICITY, GROUNDWATER, SOIL
 1309 " CRUDE OIL, OIL INDUSTRY, REFINING, PETROLEUM PRODUCTS, WASTEWATERS, WASHINGTON, PUGET SOUND
 1311 " DEVELOPMENT, BASELINE STUDIES, OCS, OIL TRANSPORT
 1312 " DEVELOPMENT, BASELINE STUDIES, OCS
 1315 " CONTAMINATION, AMOCO CADIZ SPILL, OIL SPILLS, SPILL REMOVAL, FRANCE
 1319 " BIOLOGICAL EFFECTS, BENTHOS, FLORIDA SPILL, FATE, INTERTIDAL ZONE, MARSHES, MARINE ORGANISMS, MASSACHUSETTS
 1320 " DISPERSANTS, TOXICITY, TORREY CANYON SPILL, UK, MARSHES, RIVERS, LAKES
 1322 " CRUDE OIL, BIOLOGICAL EFFECTS, PETROCHEMICALS, HEALTH HAZARDS, *BIOACCUMULATION
 1323 " MOVEMENT, MONITORING, MARINE ENVIRONMENT, ESTUARIES, *PROCEEDINGS
 1330 " OFFSHORE, PRODUCTION, MARINE ORGANISMS
 1331 " OIL INDUSTRY, PETROCHEMICALS, FISHERIES, JAPAN, *SETO INLAND SEA
 1332 " DISPERSANTS, SPILL CLEANUP, SHORELINES, MARINE ORGANISMS, TOXICITY, UK, GUIDELINES, TORREY CANYON SPILL
 1334 " FOSSIL FUELS, INDUSTRIES
 1366 " ARGO MERCHANT SPILL, RISK ANALYSIS, MODELS, PREDICTIONS, ONSHORE IMPACTS
 1375 " DEVELOPMENT, OIL SHALE, HEALTH HAZARDS
 1376 " PRODUCTION, OIL INDUSTRY, GROUNDWATER
 1379 " DRILLING, BIBLIOGRAPHIES, OFFSHORE, OIL WELLS, EQUIPMENT, LEGISLATION
 1380 " DEVELOPMENT, CRUDE OIL, CONCENTRATIONS, OIL FIELDS, MARINE ENVIRONMENT
 1381 " OIL SHALE, *SURFACE TECHNOLOGY
 1382 " COASTS, RESOURCE MANAGEMENT, OIL INDUSTRY
 1383 " MODELS, OIL SPILLS, SOCIOECONOMIC EFFECTS, RESOURCE MANAGEMENT, RISK ANALYSIS, PUGET SOUND, OIL INDUSTRY
 1391 " DEVELOPMENT, BIBLIOGRAPHIES, TANKERS, PORTS , OFFSHORE
 1394 " TANKERS, SAFETY, POLLUTION PREVENTION, RISK ANALYSIS, OIL SPILLS, SEGREGATED BALLAST, USCG
 1401 " COST ANALYSIS, STORAGE, STRATEGIC PETROLEUM RESERVE, LOUISIANA
 1421 " DISPOSAL , OIL SHALE, EXTRACTION, SOLID WASTES
 1438 " WASTEWATER TREATMENT, OIL INDUSTRY
 1449 " DISPOSAL , ALASKA , WASTE OIL TREATMENT
 R109 " BASELINE STUDIES, OFFSHORE, EXPLORATION, OCS, GEORGES BANK, RISK ANALYSIS
 R111 " BIODEGRADATION, OIL SPILLS, MOLLUSKS, HYDROCARBONS , PREDICTIONS
 R113 " DEVELOPMENT, MARINE ENVIRONMENT, FISHERIES, MEXICO , *TERMINOS LAGOON
 R114 " DRILLING, DEVELOPMENT, OIL SHALE, MARINE ENVIRONMENT, PLATFORMS
 R115 " DRILLING, BENTHOS, OFFSHORE, MARINE ORGANISMS, FOOD WEB, *DRILLING MUDS
 1177 EPA, DESIGN-ENGINEERING, BOOMS, SPILL CONTAINMENT, PERFORMANCE TESTING, EQUIPMENT, *OHMSETT FACILITY
 1132 " DESIGN-ENGINEERING, SPILL CLEANUP, SKIMMERS, PERFORMANCE TESTING, US, USSR, *OHMSETT FACILITY
 1200 " DISPERSANTS, DESIGN-ENGINEERING, EQUIPMENT, US, USSR, PERFORMANCE TESTING, *OHMSETT FACILITY

1202 EPA, DESIGN-ENGINEERING, SPILL CLEANUP, SKIMMERS, PERFORMANCE TESTING, EQUIPMENT,
 *OHMSETT FACILITY
 1241 " CONTINGENCY PLANNING, BUZZARDS BAY, BOUCHARD 65 SPILL, BIOLOGICAL EFFECTS, SPILL
 CLEANUP, SPILL RESPONSE, FUEL OIL, SAMPLING
 1325 " DISTRIBUTION, CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, AMOCO CADIZ SPILL, SPILL
 CLEANUP, NOAA, FRANCE
 1377 " DRILLING, OIL FIELDS, PRODUCTION, OIL INDUSTRY, REGULATIONS, *DRILLING MUDS
 1469 " DESIGN-ENGINEERING, POLLUTION CONTROL, EQUIPMENT, PERFORMANCE TESTING, *OHMSETT
 FACILITY
 1470 " DESIGN-ENGINEERING, PERFORMANCE TESTING, EQUIPMENT, *OHMSETT FACILITY
 R090 " CHEMICAL ANALYSIS, WATER QUALITY, EQUIPMENT, SAMPLING
 R096 " DEVELOPMENT, OIL SHALE, REGULATIONS, POLLUTION PREVENTION, GUIDELINES
 1133 EQUIPMENT, DESIGN-ENGINEERING, ANALYTICAL TECHNIQUES, HYDROCARBONS , SOIL, PATENT,
 *VOLATILIZATION
 1134 " DETECTION, DESIGN-ENGINEERING, ANALYTICAL TECHNIQUES, HYDROCARBONS , SOIL, PATENT
 1138 " DESIGN-ENGINEERING, CHEMICAL ANALYSIS, MONITORING, WASTEWATER TREATMENT, RIVERS,
 INDIA
 1142 " REMOTE SENSING, HYDROCARBONS , OIL SPILLS, MONITORING
 1176 " SPILL CONTAINMENT, OIL SLICKS, SPREADING
 1177 " EPA, DESIGN-ENGINEERING, BOOMS, SPILL CONTAINMENT, PERFORMANCE TESTING, *OHMSETT
 FACILITY
 1178 " CONTINGENCY PLANNING, CANADA, BOOMS, PRODUCT INFORMATION, SPILL CONTAINMENT,
 PERFORMANCE TESTING, RIVERS, US
 1179 " DESIGN-ENGINEERING, BOOMS, SPILL CONTAINMENT, SIMULATIONS
 1180 " ABSORPTION, SORBENTS, POLLUTION PREVENTION, PATENT, *BILGES
 1181 " DESIGN-ENGINEERING, BOOMS, SPILL CONTAINMENT, PATENT
 1184 " DISPERSANTS, DESIGN-ENGINEERING, PERFORMANCE TESTING, POLLUTION CONTROL
 1187 " DISPERSANTS, CONTINGENCY PLANNING, ONSHORE, POLLUTION CONTROL, GUIDELINES
 1189 " DISPERSANTS, CONTINGENCY PLANNING, POLLUTION CONTROL, UK, *APPLICATION METHODS
 1193 " DESIGN-ENGINEERING, SPILL CLEANUP, SKIMMERS, OIL-WATER SEPARATION, PATENT
 1198 " DESIGN-ENGINEERING, SPILL REMOVAL, PERFORMANCE TESTING, SKIMMERS
 1200 " EPA, DISPERSANTS, DESIGN-ENGINEERING, US, USSR, PERFORMANCE TESTING, *OHMSETT
 FACILITY
 1201 " ENVIRONMENTAL EFFECTS, DISPERSANTS, TOXICITY, PERFORMANCE TESTING, SIMULATIONS,
 GUIDELINES, *ASTM SYMPOSIUM
 1202 " EPA, DESIGN-ENGINEERING, SPILL CLEANUP, SKIMMERS, PERFORMANCE TESTING, *OHMSETT
 FACILITY
 1203 " DESIGN-ENGINEERING, BOOMS, OIL REMOVAL, SKIMMERS, FILTRATION, GRAVITY SEPARATION,
 PATENT
 1204 " DESIGN-ENGINEERING, SPILL CLEANUP, SKIMMERS, PATENT
 1207 " DESIGN-ENGINEERING, BOOMS, SPILL CLEANUP, SKIMMERS, SHIPS, PATENT
 1208 " DESIGN-ENGINEERING, SPILL CLEANUP, SPILL REMOVAL, SHIPS, PATENT
 1209 " DESIGN-ENGINEERING, SPILL CLEANUP, OIL-WATER SEPARATION, SKIMMERS, SEA SURFACE,
 PATENT
 1210 " DISPERSANTS, BIBLIOGRAPHIES, ABSORPTION, SPILL REMOVAL, OIL-WATER SEPARATION,
 SKIMMERS, SORBENTS, FLOTATION, SPREADING
 1211 " DISPERSANTS, DESIGN-ENGINEERING, SPILL CLEANUP, *DISPERSANT APPLICATION
 1212 " DESIGN-ENGINEERING, SKIMMERS, SPILL CLEANUP, PERFORMANCE TESTING, *OHMSETT FACILITY
 1214 " DESIGN-ENGINEERING, SPILL CLEANUP, SKIMMERS, PATENT
 1215 " DESIGN-ENGINEERING, SPILL CLEANUP, SKIMMERS, PERFORMANCE TESTING, *OHMSETT FACILITY
 1216 " DESIGN-ENGINEERING, SPILL CLEANUP, *SIRENE
 1225 " DISPERSANTS, COST ANALYSIS, SIMULATIONS, *AERIAL APPLICATION
 1237 " DISPERSANTS, CANADA, SPILL REMOVAL, PERFORMANCE TESTING, *HOVERCRAFT SPRAYING
 1240 " DISPERSANTS, PERFORMANCE TESTING, SPILL REMOVAL, *AERIAL SPRAYING
 1379 " ENVIRONMENTAL EFFECTS, DRILLING, BIBLIOGRAPHIES, OFFSHORE, OIL WELLS, LEGISLATION
 1387 " DESIGN-ENGINEERING, TANKERS, SKIMMERS, SPILL CLEANUP, MODELS
 1392 " TANKERS, POLLUTION PREVENTION, OIL TRANSPORT, OIL TRANSFER, MANUALS
 1413 " DESIGN-ENGINEERING, WASTEWATER TREATMENT, OIL-WATER SEPARATION, PATENT
 1444 " DESIGN-ENGINEERING, WASTEWATER TREATMENT, OIL REMOVAL, PATENT
 1451 " DESIGN-ENGINEERING, OIL-WATER SEPARATION, GRAVITY SEPARATION, WASTEWATER TREATMENT
 1453 " OIL-WATER SEPARATION, WASTEWATER TREATMENT
 1455 " COALESCENCE, OIL-WATER SEPARATION, FILTRATION, PATENT
 1456 " BIBLIOGRAPHIES, BALLAST , OIL-WATER SEPARATION, SPILL REMOVAL, POLLUTION CONTROL
 1459 " DESIGN-ENGINEERING, OIL-WATER SEPARATION, WASTEWATER TREATMENT
 1460 " DESIGN-ENGINEERING, OIL-WATER SEPARATION, WASTEWATER TREATMENT, PATENT, *GREASE
 1461 " REUSE, WASTE OIL TREATMENT, RECYCLING, GASOLINE, EXTRACTION
 1469 " EPA, DESIGN-ENGINEERING, POLLUTION CONTROL, PERFORMANCE TESTING, *OHMSETT FACILITY
 1470 " EPA, DESIGN-ENGINEERING, PERFORMANCE TESTING, *OHMSETT FACILITY
 R087 " DETECTION, WASTEWATERS, MONITORING, SAMPLING, WATER QUALITY
 R088 " CHROMATOGRAPHY, MONITORING, WASTEWATERS, OIL INDUSTRY
 R090 " EPA, CHEMICAL ANALYSIS, WATER QUALITY, SAMPLING
 R092 " CHEMICAL ANALYSIS, OIL SPILLS, GC/MS
 R095 " DESIGN-ENGINEERING, BOOMS, SPILL CLEANUP, *OHMSETT FACILITY
 R118 " OIL-WATER SEPARATION, SPILL CLEANUP, STORAGE, USCG
 1141 ESTUARIES, DISPERSION, DETECTION, BIBLIOGRAPHIES, REMOTE SENSING, OIL SPILLS, FATE

1323 ESTUARIES, ENVIRONMENTAL EFFECTS, MOVEMENT, MONITORING, MARINE ENVIRONMENT,
*PROCEEDINGS
R117 " ECOSYSTEMS, BIOASSAY, WASTEWATERS, TOXICITY, SUBLETHAL EFFECTS, *STAGHORN SCULPIN
1464 EUROPE, CRANKCASE OIL, RECLAMATION, RECYCLING, WASTE OIL, LEGISLATION, US, GOVERNMENT
AGENCIES
1352 EVAPORATION, DISPERSION, OIL SLICKS, HYDROCARBONS , MODELS
1354 " HYDROCARBONS , PHYSICAL ASPECTS, SOLUBILITY, *AIR-WATER INTERFACE, *HENRY'S LAW
R109 EXPLORATION, ENVIRONMENTAL EFFECTS, BASELINE STUDIES, OFFSHORE, OCS, GEORGES BANK,
RISK ANALYSIS
1125 EXTRACTION, DETECTION, ANALYTICAL TECHNIQUES, PAH, HYDROCARBONS , WASTEWATERS,
REFINERIES, *FLUOROMETRY
1390 " TANKERS, OIL TRANSFER, POLLUTION PREVENTION
1421 " ENVIRONMENTAL EFFECTS, DISPOSAL , OIL SHALE, SOLID WASTES
1461 " EQUIPMENT, REUSE, WASTE OIL TREATMENT, RECYCLING, GASOLINE
1141 FATE, ESTUARIES, DISPERSION, DETECTION, BIBLIOGRAPHIES, REMOTE SENSING, OIL SPILLS
1168 " DISTRIBUTION, SOURCE IDENTIFICATION, HYDROCARBONS , OIL TERMINALS, SEDIMENTS,
SCOTLAND, *SULLOM VOE
1244 " CHRONIC EFFECTS, BIOLOGICAL EFFECTS, OIL SPILLS, HEALTH HAZARDS, MARINE ENVIRONMENT
1298 " ENVIRONMENTAL EFFECTS, TOXICITY, GROUNDWATER, SOIL
1316 " BIOLOGICAL EFFECTS, BIODEGRADATION, AQUATIC ENVIRONMENT, MOVEMENT
1319 " ENVIRONMENTAL EFFECTS, BIOLOGICAL EFFECTS, BENTHOS, FLORIDA SPILL, INTERTIDAL
ZONE, MARSHES, MARINE ORGANISMS, MASSACHUSETTS
1326 " ECOSYSTEMS, CONTAMINATION, BIOLOGICAL EFFECTS, AQUATIC ENVIRONMENT
1329 " COLD CLIMATES, BOOK REVIEW, BIRDS, BIOLOGICAL EFFECTS, BIODEGRADATION, ARCTIC,
WEATHERING, FISH, *TRANSPORT
1348 " DISTRIBUTION, HYDROCARBONS , SEDIMENTATION, NARRAGANSETT BAY
1349 " DISTRIBUTION, BEACHES, TAR, SEDIMENTS, PHYSICAL ASPECTS
1359 " DISTRIBUTION, CONCENTRATIONS, PAH, SOIL, SEDIMENTS, *POLLUTANT TRANSPORT
1369 " CARIBBEAN SEA, BIOLOGICAL EFFECTS, NATURAL SEEPAGE, HYDROCARBONS , TEXAS, GULF OF
MEXICO
1370 " ECOSYSTEMS, COLD CLIMATES, BIODEGRADATION, PAH, WEATHERING, ZOOPLANKTON, UPTAKE,
SEDIMENTS
1371 " DISPOSAL , PETROLEUM PRODUCTS, INDUSTRIES, WATER QUALITY, SOLID WASTES
R112 " BEACHES, TAR, SOURCE IDENTIFICATION
1203 FILTRATION, EQUIPMENT, DESIGN-ENGINEERING, BOOMS, OIL REMOVAL, SKIMMERS, GRAVITY
SEPARATION, PATENT
1415 " BIOLOGICAL EFFECTS, WASTEWATER TREATMENT, OIL INDUSTRY, TOXICITY
1420 " EMULSIONS, WASTEWATER TREATMENT, REFINERIES
1423 " WASTEWATER TREATMENT, REFINERIES, OIL REMOVAL
1434 " WASTEWATER TREATMENT, OIL REMOVAL, SOLID WASTES, PATENT
1436 " DESIGN-ENGINEERING, WASTEWATER TREATMENT, OIL REMOVAL, GRAVITY SEPARATION, PATENT
1437 " WASTEWATER TREATMENT, OIL REMOVAL, GRAVITY SEPARATION, PATENT
1440 " WASTEWATER TREATMENT, REFINERIES
1454 " OIL-WATER SEPARATION, PATENT
1455 " EQUIPMENT, COALESCENCE, OIL-WATER SEPARATION, PATENT
R116 " WASTEWATER TREATMENT, REFINERIES, REUSE
1127 FISH, DETECTION, BIOINDICATORS, BIBLIOGRAPHIES, ANIMALS, MICROORGANISMS, PLANTS
1156 " CONTAMINATION, CHEMICAL ANALYSIS, AROMATIC HYDROCARBONS, MOLLUSKS, *FREEZE DRYING
1159 " ARGO MERCHANT SPILL, ANALYTICAL TECHNIQUES, HYDROCARBONS , SAMPLING, MARINE
ORGANISMS, SEDIMENTS
1163 " CONTAMINATION, CONCENTRATIONS, CHEMICAL ANALYSIS, BIOLOGICAL EFFECTS, SURFACTANTS,
JAPAN
1167 " CONTAMINATION, BIOLOGICAL EFFECTS, AUSTRALIA, SOURCE IDENTIFICATION
1246 " CONTAMINATION, BIOLOGICAL EFFECTS, HEALTH HAZARDS, *NECROSIS
1250 " BIOLOGICAL EFFECTS, ARGO MERCHANT SPILL, FOOD WEB, TOXICITY
1257 " CRUDE OIL, TOXICITY, *PLASMA, *COPPER
1266 " BIOLOGICAL EFFECTS, PETROLEUM PRODUCTS, METABOLISM, *LIVER, *GLUCOSE
1267 " BIOLOGICAL EFFECTS, ARGO MERCHANT SPILL, FUEL OIL, MORTALITY, REPRODUCTION
1270 " BIRDS, BIOLOGICAL EFFECTS, BIBLIOGRAPHIES, TOXICITY, MARINE ORGANISMS, MOLLUSKS,
ZOOPLANKTON, *DIESEL FUEL
1271 " BIOLOGICAL EFFECTS, ARGO MERCHANT SPILL, REPRODUCTION, MORTALITY, GROWTH,
*CYTOGENETICS
1279 " CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, INVERTEBRATES, HYDROCARBONS ,
*MIXED-FUNCTION OXIDASE ACTIVITY
1285 " CRUSTACEANS, BIOLOGICAL EFFECTS, BASELINE STUDIES, ARGO MERCHANT SPILL, MOLLUSKS,
*HISTOPATHOLOGY
1286 " BIOLOGICAL EFFECTS, ARGO MERCHANT SPILL, MORTALITY, ZOOPLANKTON, TOXICITY
1290 " BIOLOGICAL EFFECTS, ARGO MERCHANT SPILL, MOLLUSKS, SUBLETHAL EFFECTS
1308 " DEVELOPMENT, BASELINE STUDIES, ATLANTIC COAST, PAH, OCS, OFFSHORE
1329 " FATE, COLD CLIMATES, BOOK REVIEW, BIRDS, BIOLOGICAL EFFECTS, BIODEGRADATION,
ARCTIC, WEATHERING, *TRANSPORT
1373 " DRILLING, TOXICITY, INVERTEBRATES, *DRILLING FLUIDS
R086 " DETECTION, CARCINOGENS, BIOINDICATORS
R099 " CARCINOGENS, BIOLOGICAL EFFECTS
R100 " BIRDS, BIOLOGICAL EFFECTS, BEHAVIOR, TOXICITY

R102 FISH, CRUDE OIL, WSF, SUBLETHAL EFFECTS, RIVERS, SUBARCTIC REGIONS, *JUVENILE
 CHUM-SALMON
 R104 " CARCINOGENS, BIOASSAY, TOXICITY, OIL SHALE, PETROLEUM PRODUCTS
 R105 " CONTAMINATION, BIOLOGICAL EFFECTS, GROWTH, METABOLISM, *JUVENILE PINK SALMON
 R107 " BIOLOGICAL EFFECTS, HYDROCARBONS, MOLLUSKS, *IMMUNE SYSTEM
 1234 FISHERIES, COMPENSATION, LIABILITY, LEGISLATION, REGULATIONS, US
 1238 " ENVIRONMENTAL EFFECTS, COASTS, BIRDS, AMOCO CADIZ SPILL, SPILL CLEANUP, MORTALITY,
 MARINE ORGANISMS, FRANCE
 1243 " BIRDS, BIOLOGICAL EFFECTS, AMOCO CADIZ SPILL, MORTALITY, MARINE ORGANISMS
 1253 " BIRDS, BIOLOGICAL EFFECTS, AMOCO CADIZ SPILL, SHORELINES, MORTALITY, FRANCE
 1254 " BIRDS, BIOLOGICAL EFFECTS, AMOCO CADIZ SPILL, SHORELINES, MORTALITY, FRANCE
 1284 " ENVIRONMENTAL EFFECTS, AMOCO CADIZ SPILL, MARINE ORGANISMS, MORTALITY, FRANCE
 1305 " ECONOMIC EFFECTS, CONTAMINATION, IXTOC 1 BLOWOUT, TEXAS, *SHRIMP INDUSTRY
 1331 " ENVIRONMENTAL EFFECTS, OIL INDUSTRY, PETROCHEMICALS, JAPAN, *SETO INLAND SEA
 1384 " DEVELOPMENT, OFFSHORE, NORTH SEA, POLLUTION PREVENTION, IMCO, OIL TRANSPORT,
 LEGISLATION, LAW ENFORCEMENT
 R113 " ENVIRONMENTAL EFFECTS, DEVELOPMENT, MARINE ENVIRONMENT, MEXICO, *TERMINOS LAGOON
 1425 FLOCCULATION, WASTEWATER TREATMENT, OIL REMOVAL, PATENT
 1319 FLORIDA SPILL, FATE, ENVIRONMENTAL EFFECTS, BIOLOGICAL EFFECTS, BENTHOS, INTERTIDAL
 ZONE, MARSHES, MARINE ORGANISMS, MASSACHUSETTS
 1210 FLOTATION, EQUIPMENT, DISPERSANTS, BIBLIOGRAPHIES, ABSORPTION, SPILL REMOVAL,
 OIL-WATER SEPARATION, SKIMMERS, SORBENTS, SPREADING
 1426 " DISPOSAL, BIOLOGICAL TREATMENT, WASTEWATER TREATMENT, GRAVITY SEPARATION, SLUDGE
 1439 " EMULSIONS, DISPOSAL, WASTEWATERS, OIL-WATER SEPARATION
 1458 " OIL-WATER SEPARATION, WASTEWATER TREATMENT, PATENT
 1250 FOOD WEB, FISH, BIOLOGICAL EFFECTS, ARGO MERCHANT SPILL, TOXICITY
 1274 " DEPURATION, CRUDE OIL, HYDROCARBONS, MOLLUSKS, UPTAKE
 R115 " ENVIRONMENTAL EFFECTS, DRILLING, BENTHOS, OFFSHORE, MARINE ORGANISMS, *DRILLING
 MUDS
 1334 FOSSIL FUELS, ENVIRONMENTAL EFFECTS, INDUSTRIES
 1194 FRANCE, BEHAVIOR, AMOCO CADIZ SPILL, SPILL CLEANUP, PHYSICAL ASPECTS, POLLUTION CONTROL
 1221 " CONTINGENCY PLANNING, COASTS, AMOCO CADIZ SPILL, SPILL CLEANUP, POLLUTION CONTROL
 1238 " FISHERIES, ENVIRONMENTAL EFFECTS, COASTS, BIRDS, AMOCO CADIZ SPILL, SPILL CLEANUP,
 MORTALITY, MARINE ORGANISMS
 1253 " FISHERIES, BIRDS, BIOLOGICAL EFFECTS, AMOCO CADIZ SPILL, SHORELINES, MORTALITY
 1254 " FISHERIES, BIRDS, BIOLOGICAL EFFECTS, AMOCO CADIZ SPILL, SHORELINES, MORTALITY
 1263 " BIOLOGICAL EFFECTS, BENTHOS, AMOCO CADIZ SPILL, INVERTEBRATES, ONSHORE, TOXICITY
 1284 " FISHERIES, ENVIRONMENTAL EFFECTS, AMOCO CADIZ SPILL, MARINE ORGANISMS, MORTALITY
 1295 " EMULSIONS, CHEMICAL EFFECTS, AROMATIC HYDROCARBONS, AMOCO CADIZ SPILL, WEATHERING
 1296 " CHEMICAL EFFECTS, AROMATIC HYDROCARBONS, AMOCO CADIZ SPILL, WEATHERING
 1299 " DISTRIBUTION, CRUDE OIL, AMOCO CADIZ SPILL, PHYSICAL ASPECTS, PHYSICAL EFFECTS,
 MOVEMENT
 1300 " DISTRIBUTION, CRUDE OIL, BEACHES, AMOCO CADIZ SPILL, SHORELINES, SEDIMENTS,
 PHYSICAL ASPECTS
 1301 " DISTRIBUTION, CRUDE OIL, AMOCO CADIZ SPILL, SHORELINES, SEDIMENTS, PHYSICAL EFFECTS
 1315 " ENVIRONMENTAL EFFECTS, CONTAMINATION, AMOCO CADIZ SPILL, OIL SPILLS, SPILL REMOVAL
 1324 " DISTRIBUTION, CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, BEACHES, AMOCO CADIZ SPILL,
 SPILL CLEANUP, REMOTE SENSING
 1325 " EPA, DISTRIBUTION, CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, AMOCO CADIZ SPILL, SPILL
 CLEANUP, NOAA
 1117 FRESHWATER, CHEMICAL ANALYSIS, SAMPLING, SOILS, SEDIMENTS
 1333 " DISTRIBUTION, PAH, SOIL, SEAWATER, PLANTS
 1172 FUEL OIL, CRUDE OIL, ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION
 1241 " EPA, CONTINGENCY PLANNING, BUZZARDS BAY, BOUCHARD 65 SPILL, BIOLOGICAL EFFECTS,
 SPILL CLEANUP, SPILL RESPONSE, SAMPLING
 1247 " CRUDE OIL, AROMATIC HYDROCARBONS, ALGAE, WSF, TOXICITY, MICROORGANISMS
 1248 " CRUDE OIL, BIOLOGICAL EFFECTS, ALGAE, MICROORGANISMS, PAH, TOXICITY
 1265 " DISPERSANTS, ZOOPLANKTON, TOXICITY, MORTALITY
 1267 " FISH, BIOLOGICAL EFFECTS, ARGO MERCHANT SPILL, MORTALITY, REPRODUCTION
 1269 " OXIDATION, GC/MS, MICROORGANISMS, TOXICITY, *PHOTOOXIDATION
 1277 " DISPERSANTS, BACTERIA, TOXICITY, MICROORGANISMS, *BACTERIOPLANKTON, *WHITE SEA
 1289 " BIRDS, TOXICITY, MORTALITY, *ANAS PLATYRHYNCHOS, *HATCHABILITY
 1291 " BIOINDICATORS, ANALYTICAL TECHNIQUES, ALGAE, TOXICITY, INVERTEBRATES, *SPECIES
 DIVERSITY
 R106 " CRUDE OIL, ALGAE, TOXICITY, REPRODUCTION, WATER QUALITY
 1337 FUNGI, BIODEGRADATION, BACTERIA, AROMATIC HYDROCARBONS
 1461 GASOLINE, EXTRACTION, EQUIPMENT, REUSE, WASTE OIL TREATMENT, RECYCLING
 1169 GC/MS, DETECTION, ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION, HYDROCARBONS,
 SEDIMENTS, WEATHERING
 1269 " FUEL OIL, OXIDATION, MICROORGANISMS, TOXICITY, *PHOTOOXIDATION
 R092 " EQUIPMENT, CHEMICAL ANALYSIS, OIL SPILLS
 1143 GEORGES BANK, CHROMATOGRAPHY, CHEMICAL ANALYSIS, ARGO MERCHANT SPILL, ANALYTICAL
 TECHNIQUES, HYDROCARBONS
 R109 " EXPLORATION, ENVIRONMENTAL EFFECTS, BASELINE STUDIES, OFFSHORE, OCS, RISK ANALYSIS
 1191 GOVERNMENT AGENCIES, DISPERSANTS, SPILL CLEANUP, POLLUTION CONTROL, REGULATIONS

1222 GOVERNMENT AGENCIES, CONTINGENCY PLANNING, LEGISLATION, SPILL RESPONSE
 1235 " POLLUTION CONTROL, LEGISLATION, REGULATIONS, SPILL RESPONSE, LAW ENFORCEMENT
 1242 " COMPENSATION, POLLUTION CONTROL, LEGISLATION, LIABILITY, UK
 1464 " EUROPE, CRANKCASE OIL, RECLAMATION, RECYCLING, WASTE OIL, LEGISLATION, US
 1203 GRAVITY SEPARATION, FILTRATION, EQUIPMENT, DESIGN-ENGINEERING, BOOMS, OIL REMOVAL,
 SKIMMERS, PATENT
 1426 " FLOTATION, DISPOSAL, BIOLOGICAL TREATMENT, WASTEWATER TREATMENT, SLUDGE
 1436 " FILTRATION, DESIGN-ENGINEERING, WASTEWATER TREATMENT, OIL REMOVAL, PATENT
 1437 " FILTRATION, WASTEWATER TREATMENT, OIL REMOVAL, PATENT
 1451 " EQUIPMENT, DESIGN-ENGINEERING, OIL-WATER SEPARATION, WASTEWATER TREATMENT
 1120 GREAT LAKES, CONTAMINATION, ANALYTICAL TECHNIQUES, MONITORING, WASTEWATERS, TOXICITY
 1294 GROUNDWATER, SOIL, *VULNERABILITY, *BULGARIA
 1298 " FATE, ENVIRONMENTAL EFFECTS, TOXICITY, SOIL
 1360 " CONTAMINATION, MODELS, PETROLEUM PRODUCTS, MOVEMENT
 1376 " ENVIRONMENTAL EFFECTS, PRODUCTION, OIL INDUSTRY
 R108 " CONTAMINATION, CHROMATOGRAPHY, CHEMICAL EFFECTS, WSF, PHYSICAL EFFECTS
 1260 GROWTH, DEVELOPMENT, CRUDE OIL, BIRDS, TOXICITY, MORTALITY, *ANAS PLATYRHYNCHOS,
 *HATCHABILITY
 1271 " FISH, BIOLOGICAL EFFECTS, ARGO MERCHANT SPILL, REPRODUCTION, MORTALITY,
 *CYTOGENETICS
 1287 " BIOLOGICAL EFFECTS, PAH, METABOLISM, *CALLINECTES SAPIDUS
 R103 " PAH, HYDROCARBONS, UPTAKE, TOXICITY, SUBLETHAL EFFECTS, INVERTEBRATES,
 *BIOACCUMULATION
 R105 " FISH, CONTAMINATION, BIOLOGICAL EFFECTS, METABOLISM, *JUVENILE PINK SALMON
 1197 GUIDELINES, EQUIPMENT, DISPERSANTS, CONTINGENCY PLANNING, ONSHORE, POLLUTION CONTROL
 1201 " EQUIPMENT, ENVIRONMENTAL EFFECTS, DISPERSANTS, TOXICITY, PERFORMANCE TESTING,
 SIMULATIONS, *ASTM SYMPOSIUM
 1220 " DISPERSANTS, CONTINGENCY PLANNING, BEACH CLEANUP, SPILL CLEANUP, INTERTIDAL ZONE,
 SHORELINES
 1332 " ENVIRONMENTAL EFFECTS, DISPERSANTS, SPILL CLEANUP, SHORELINES, MARINE ORGANISMS,
 TOXICITY, UK, TORREY CANYON SPILL
 1468 " REUSE, WASTE OIL, RECYCLING, MANUALS
 R096 " EPA, DEVELOPMENT, OIL SHALE, REGULATIONS, POLLUTION PREVENTION
 1369 GULF OF MEXICO, FATE, CARIBBEAN SEA, BIOLOGICAL EFFECTS, NATURAL SEEPAGE, HYDROCARBONS
 , TEXAS
 R110 " BASELINE STUDIES, ATLANTIC COAST, OCS, HYDROCARBONS, SEDIMENTS, *GEOCHEMISTRY
 1192 HABITATS, DISPERSANTS, CHRONIC EFFECTS, ACUTE EFFECTS, SPILL CLEANUP, TOXICITY, MARINE
 ORGANISMS
 R091 " COASTS, BENTHOS, SAMPLING, OIL SPILLS, MARINE ORGANISMS, SPILL RESPONSE,
 STATISTICAL ANALYSIS
 1157 HARBORS, CONTAMINATION, CHEMICAL ANALYSIS, HYDROCARBONS, SOURCE IDENTIFICATION,
 MARINE ORGANISMS, *TAIWAN
 1244 HEALTH HAZARDS, FATE, CHRONIC EFFECTS, BIOLOGICAL EFFECTS, OIL SPILLS, MARINE
 ENVIRONMENT
 1246 " FISH, CONTAMINATION, BIOLOGICAL EFFECTS, *NECROSIS
 1258 " CARCINOGENS, BIBLIOGRAPHIES, OIL INDUSTRY, PETROCHEMICALS, TOXICITY, REGULATIONS
 1275 " CHRONIC EFFECTS, CARCINOGENS, BIOLOGICAL EFFECTS, PAH
 1322 " ENVIRONMENTAL EFFECTS, CRUDE OIL, BIOLOGICAL EFFECTS, PETROCHEMICALS,
 *BIOACCUMULATION
 1328 " BIBLIOGRAPHIES, SAFETY, TOXICITY, *DIESEL FUEL
 1375 " ENVIRONMENTAL EFFECTS, DEVELOPMENT, OIL SHALE
 1124 HYDROCARBONS, DISTRIBUTION, CONCENTRATIONS, BIRDS, MONITORING, MARSHES, SCOTLAND,
 *SULLOM VOE
 1125 " EXTRACTION, DETECTION, ANALYTICAL TECHNIQUES, PAH, WASTEWATERS, REFINERIES,
 *FLUOROMETRY
 1126 " DETECTION, WASTEWATERS, *IR
 1129 " DETECTION, CONCENTRATIONS, ANALYTICAL TECHNIQUES, SPECTROMETRY, SEAWATER
 1133 " EQUIPMENT, DESIGN-ENGINEERING, ANALYTICAL TECHNIQUES, SOIL, PATENT, *VOLATILIZATION
 1134 " EQUIPMENT, DETECTION, DESIGN-ENGINEERING, ANALYTICAL TECHNIQUES, SOIL, PATENT
 1142 " EQUIPMENT, REMOTE SENSING, OIL SPILLS, MONITORING
 1143 " GEORGES BANK, CHROMATOGRAPHY, CHEMICAL ANALYSIS, ARGO MERCHANT SPILL, ANALYTICAL
 TECHNIQUES
 1144 " DISPERSION, DISPERSANTS, CONCENTRATIONS, CHEMICAL ANALYSIS
 1146 " DETECTION, CHEMICAL ANALYSIS, BIOGENIC HYDROCARBONS, SAMPLING
 1147 " BIOGENIC HYDROCARBONS, ANALYTICAL TECHNIQUES, WASTEWATERS, SEDIMENTS, MANUALS
 1150 " CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, SEDIMENTS, *TLC, *COLUMN CHROMATOGRAPHY
 1154 " CHROMATOGRAPHY, ARGO MERCHANT SPILL, ANALYTICAL TECHNIQUES, SEDIMENTS, MOVEMENT
 1157 " HARBORS, CONTAMINATION, CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, MARINE
 ORGANISMS, *TAIWAN
 1158 " DISPOSAL, CHEMICAL ANALYSIS, ANALYTICAL TECHNIQUES, WASTEWATERS
 1159 " FISH, ARGO MERCHANT SPILL, ANALYTICAL TECHNIQUES, SAMPLING, MARINE ORGANISMS,
 SEDIMENTS
 1160 " ANALYTICAL TECHNIQUES, WSF
 1161 " CHEMICAL ANALYSIS, BEACHES, SOIL, SURFACTANTS

1163 HYDROCARBONS , FATE, DISTRIBUTION, SOURCE IDENTIFICATION, OIL TERMINALS, SEDIMENTS,
 SCOTLAND, *SULLOM VOE
 1169 " GC/MS, DETECTION, ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION, SEDIMENTS,
 WEATHERING
 1245 " DEPURATION, BIOLOGICAL EFFECTS, BENTHOS, INTERTIDAL ZONE, SEDIMENTS, MARINE
 ORGANISMS, *RECRUITMENT
 1259 " BIOLOGICAL EFFECTS, MOLLUSKS, RESOURCE MANAGEMENT, MASSACHUSETTS
 1274 " FOOD WEB, DEPURATION, CRUDE OIL, MOLLUSKS, UPTAKE
 1279 " FISH, CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, INVERTEBRATES, *MIXED-FUNCTION OXIDASE
 ACTIVITY
 1327 " DETECTION, CONCENTRATIONS, ANALYTICAL TECHNIQUES, SEDIMENTS
 1336 " CRUDE OIL, CONCENTRATIONS, CHEMICAL ANALYSIS, BIODEGRADATION
 1338 " DISTRIBUTION, BIODEGRADATION, BACTERIA, ITALY
 1343 " BIODEGRADATION, BACTERIA, PETROLEUM PRODUCTS, MICROORGANISMS
 1344 " DISPERSANTS, CRUDE OIL, BIODEGRADATION, MICROORGANISMS
 1345 " BIODEGRADATION, BACTERIA, SHORELINES, SEDIMENTS, PUGET SOUND
 1348 " FATE, DISTRIBUTION, SEDIMENTATION, NARRAGANSETT BAY
 1351 " DISPERSANTS, BEHAVIOR, ATLANTIC OCEAN, OIL SLICKS, PHYSICAL ASPECTS
 1352 " EVAPORATION, DISPERSION, OIL SLICKS, MODELS
 1354 " EVAPORATION, PHYSICAL ASPECTS, SOLUBILITY, *AIR-WATER INTERFACE, *HENRY'S LAW
 1356 " CRUDE OIL, CHEMICAL ANALYSIS, OXIDATION, SEAWATER
 1369 " GULF OF MEXICO, FATE, CARIBBEAN SEA, BIOLOGICAL EFFECTS, NATURAL SEEPAGE, TEXAS
 1431 " BIODEGRADATION, WASTE OIL TREATMENT, MICROORGANISMS, MODELS, *MYCOTORULA.
 *PSEUDOMONAS
 R098 " CRUSTACEANS, BIOLOGICAL EFFECTS, BEHAVIOR, NATURAL SEEPAGE
 R103 " GROWTH, PAH, UPTAKE, TOXICITY, SUBLETHAL EFFECTS, INVERTEBRATES, *BIOACCUMULATION
 R107 " FISH, BIOLOGICAL EFFECTS, MOLLUSKS, *IMMUNE SYSTEM
 R110 " GULF OF MEXICO, BASELINE STUDIES, ATLANTIC COAST, OCS, SEDIMENTS, *GEOCHEMISTRY
 R111 " ENVIRONMENTAL EFFECTS, BIODEGRADATION, OIL SPILLS, MOLLUSKS, PREDICTIONS
 1226 ICE, CONTINGENCY PLANNING, COLD CLIMATES, SPILL RESPONSE, SPILL CLEANUP, USCG
 1186 IMCO, DISPERSANTS, BURNING, BOOMS, SPILL CLEANUP, SPILL REMOVAL, SKIMMERS, SINKING
 AGENTS, SORBENTS, MANUALS
 1384 " FISHERIES, DEVELOPMENT, OFFSHORE, NORTH SEA, POLLUTION PREVENTION, OIL TRANSPORT,
 LEGISLATION, LAW ENFORCEMENT
 1407 " INTERNATIONAL CONVENTIONS, TANKERS, OIL TERMINALS, POLLUTION CONTROL, LAW
 ENFORCEMENT, SPILL CLEANUP
 1138 INDIA, EQUIPMENT, DESIGN-ENGINEERING, CHEMICAL ANALYSIS, MONITORING, WASTEWATER
 TREATMENT, RIVERS
 1183 INDUSTRIES, SPILL CLEANUP, ONSHORE, WASTEWATERS, POLLUTION PREVENTION
 1321 " BAYS, PETROLEUM PRODUCTS, POLLUTION CONTROL, *GREECE
 1334 " FOSSIL FUELS, ENVIRONMENTAL EFFECTS
 1371 " FATE, DISPOSAL , PETROLEUM PRODUCTS, WATER QUALITY, SOLID WASTES
 1422 " WASTE OIL TREATMENT, RECLAMATION
 1393 INFORMATION SYSTEMS, MODELS, TANKERS, SHIPS, OIL SPILLS, RISK ANALYSIS, USCG, *PIRS
 1448 " WASTEWATERS, MANUALS
 1231 INTERNATIONAL AGREEMENTS, BIBLIOGRAPHIES, LEGISLATION, MARINE ENVIRONMENT, POLLUTION
 CONTROL
 1397 INTERNATIONAL CONVENTIONS, BALLAST , TANKERS, OIL SPILLS, STATISTICS, OIL DISCHARGES,
 POLLUTION PREVENTION
 1407 " IMCO, TANKERS, OIL TERMINALS, POLLUTION CONTROL, LAW ENFORCEMENT, SPILL CLEANUP
 1220 INTERTIDAL ZONE, GUIDELINES, DISPERSANTS, CONTINGENCY PLANNING, BEACH CLEANUP, SPILL
 CLEANUP, SHORELINES
 1245 " HYDROCARBONS , DEPURATION, BIOLOGICAL EFFECTS, BENTHOS, SEDIMENTS, MARINE
 ORGANISMS, *RECRUITMENT
 1319 " FLORIDA SPILL, FATE, ENVIRONMENTAL EFFECTS, BIOLOGICAL EFFECTS, BENTHOS, MARSHES,
 MARINE ORGANISMS, MASSACHUSETTS
 1218 INVERTEBRATES, CRUDE OIL, SPILL CLEANUP, MARSHES, RESTORATION, RECOVERY, SOIL, PLANTS
 1252 " BIOASSAY, BENTHOS, REFINERIES, WASTEWATERS, TOXICITY
 1263 " FRANCE, BIOLOGICAL EFFECTS, BENTHOS, AMOCO CADIZ SPILL, ONSHORE, TOXICITY
 1279 " HYDROCARBONS , FISH, CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, *MIXED-FUNCTION OXIDASE
 ACTIVITY
 1291 " FUEL OIL, BIOINDICATORS, ANALYTICAL TECHNIQUES, ALGAE, TOXICITY, *SPECIES DIVERSITY
 1373 " FISH, DRILLING, TOXICITY, *DRILLING FLUIDS
 R101 " CARCINOGENS, PAH, MOLLUSKS, UPTAKE, SOURCES, OREGON
 R103 " HYDROCARBONS , GROWTH, PAH, UPTAKE, TOXICITY, SUBLETHAL EFFECTS, *BIOACCUMULATION
 1205 IRELAND, DISPERSANTS, SPILL CLEANUP, *BETELGEUSE SPILL, *AERIAL APPLICATION
 1338 ITALY, HYDROCARBONS , DISTRIBUTION, BIODEGRADATION, BACTERIA
 1305 IXTOC 1 BLOWOUT, FISHERIES, ECONOMIC EFFECTS, CONTAMINATION, TEXAS, *SHRIMP INDUSTRY
 1152 JAPAN, CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, SAMPLING, TAR, SOURCE IDENTIFICATION
 1163 " FISH, CONTAMINATION, CONCENTRATIONS, CHEMICAL ANALYSIS, BIOLOGICAL EFFECTS,
 SURFACTANTS
 1175 " SPILL CONTAINMENT, POLLUTION CONTROL, SPILL RESPONSE, *GELATINIZATION AGENT
 1331 " FISHERIES, ENVIRONMENTAL EFFECTS, OIL INDUSTRY, PETROCHEMICALS, *SETO INLAND SEA
 1411 KUWAIT, COASTS, BALLAST , STATISTICS, OIL TRANSPORT, TANKERS, TAR, OIL SPILLS,
 POLLUTION CONTROL

1320 LAKES , ENVIRONMENTAL EFFECTS, DISPERSANTS, TOXICITY, TORREY CANYON SPILL, UK, MARSHES, RIVERS
 1443 LAND FARMING, DISPOSAL , WASTE OIL, SLUDGE
 1467 " DISPOSAL , BOOK REVIEW, REUSE, WASTEWATER TREATMENT, POLLUTION PREVENTION
 1235 LAW ENFORCEMENT, GOVERNMENT AGENCIES, POLLUTION CONTROL, LEGISLATION; REGULATIONS, SPILL RESPONSE
 1384 " IMCO, FISHERIES, DEVELOPMENT, OFFSHORE, NORTH SEA, POLLUTION PREVENTION, OIL TRANSPORT, LEGISLATION
 1407 " INTERNATIONAL CONVENTIONS, IMCO, TANKERS, OIL TERMINALS, POLLUTION CONTROL, SPILL CLEANUP
 1222 LEGISLATION, GOVERNMENT AGENCIES, CONTINGENCY PLANNING, SPILL RESPONSE
 1231 " INTERNATIONAL AGREEMENTS, BIBLIOGRAPHIES, MARINE ENVIRONMENT, POLLUTION CONTROL
 1232 " COMPENSATION, US, LIABILITY, SPILL CLEANUP. *SUPERFUND
 1233 " POLLUTION PREVENTION, RESOURCE MANAGEMENT, MISSISSIPPI
 1234 " FISHERIES, COMPENSATION, LIABILITY, REGULATIONS, US
 1235 " LAW ENFORCEMENT, GOVERNMENT AGENCIES, POLLUTION CONTROL, REGULATIONS, SPILL RESPONSE
 1242 " GOVERNMENT AGENCIES, COMPENSATION, POLLUTION CONTROL, LIABILITY, UK
 1314 " LIABILITY, REGULATIONS, *SUPERFUND
 1379 " EQUIPMENT, ENVIRONMENTAL EFFECTS, DRILLING, BIBLIOGRAPHIES, OFFSHORE, OIL WELLS
 1384 " LAW ENFORCEMENT, IMCO, FISHERIES, DEVELOPMENT, OFFSHORE, NORTH SEA, POLLUTION PREVENTION, OIL TRANSPORT
 1408 " BIOLOGICAL EFFECTS, OIL SPILLS, TANKERS, STATISTICS, UK
 1464 " GOVERNMENT AGENCIES, EUROPE, CRANKCASE OIL, RECLAMATION, RECYCLING, WASTE OIL, US
 1232 LIABILITY, LEGISLATION, COMPENSATION, US, SPILL CLEANUP, *SUPERFUND
 1234 " LEGISLATION, FISHERIES, COMPENSATION, REGULATIONS, US
 1242 " LEGISLATION, GOVERNMENT AGENCIES, COMPENSATION, POLLUTION CONTROL, UK
 1314 " LEGISLATION, REGULATIONS, *SUPERFUND
 1389 " OIL TRANSPORT, OIL TRANSFER, TANKERS, PORTS , OIL TERMINALS, SPILL CLEANUP, POLLUTION PREVENTION, REGULATIONS
 1401 LOUISIANA, ENVIRONMENTAL EFFECTS, COST ANALYSIS, STORAGE, STRATEGIC PETROLEUM RESERVE
 1404 " EIS, STORAGE, STRATEGIC PETROLEUM RESERVE, OIL TRANSPORT
 1405 " EIS, STORAGE, STRATEGIC PETROLEUM RESERVE
 1463 LUBRICATING OIL, REUSE, WASTE OIL, RECLAMATION, REFINING, PATENT
 1147 MANUALS, HYDROCARBONS , BIOGENIC HYDROCARBONS, ANALYTICAL TECHNIQUES, WASTEWATERS, SEDIMENTS
 1170 " DETECTION, CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION
 1186 " IMCO, DISPERSANTS, BURNING, BOOMS, SPILL CLEANUP, SPILL REMOVAL, SKIMMERS, SINKING AGENTS, SORBENTS
 1392 " EQUIPMENT, TANKERS, POLLUTION PREVENTION, OIL TRANSPORT, OIL TRANSFER
 1448 " INFORMATION SYSTEMS, WASTEWATERS
 1468 " GUIDELINES, REUSE, WASTE OIL, RECYCLING
 1231 MARINE ENVIRONMENT, LEGISLATION, INTERNATIONAL AGREEMENTS, BIBLIOGRAPHIES, POLLUTION CONTROL
 1244 " HEALTH HAZARDS, FATE, CHRONIC EFFECTS, BIOLOGICAL EFFECTS, OIL SPILLS
 1323 " ESTUARIES, ENVIRONMENTAL EFFECTS, MOVEMENT, MONITORING, *PROCEEDINGS
 1358 " ATLANTIC OCEAN, TAR, SEA SURFACE, WEATHERING, *SARGASSO SEA
 1380 " ENVIRONMENTAL EFFECTS, DEVELOPMENT, CRUDE OIL, CONCENTRATIONS, OIL FIELDS
 R113 " FISHERIES, ENVIRONMENTAL EFFECTS, DEVELOPMENT, MEXICO , *TERMINOS LAGOON
 R114 " ENVIRONMENTAL EFFECTS, DRILLING, DEVELOPMENT, OIL SHALE, PLATFORMS
 1293 MARINE MAMMALS, CONTAMINATION, BIOLOGICAL EFFECTS, ANIMALS, TOXICITY, *SEA OTTER
 1372 " DEVELOPMENT, BIOLOGICAL EFFECTS, OIL SPILLS, SCOTLAND, *SULLOM VOE, *SEALS
 1131 MARINE ORGANISMS, BIOINDICATORS, *CHIRONOMUS
 1157 " HYDROCARBONS , HARBORS, CONTAMINATION, CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, *TAIWAN
 1159 " HYDROCARBONS , FISH, ARGO MERCHANT SPILL, ANALYTICAL TECHNIQUES, SAMPLING, SEDIMENTS
 1192 " HABITATS, DISPERSANTS, CHRONIC EFFECTS, ACUTE EFFECTS, SPILL CLEANUP, TOXICITY
 1238 " FRANCE, FISHERIES, ENVIRONMENTAL EFFECTS, COASTS, BIRDS, AMOCO CADIZ SPILL, SPILL CLEANUP, MORTALITY
 1243 " FISHERIES, BIRDS, BIOLOGICAL EFFECTS, AMOCO CADIZ SPILL, MORTALITY
 1245 " INTERTIDAL ZONE, HYDROCARBONS , DEPURATION, BIOLOGICAL EFFECTS, BENTHOS, SEDIMENTS, *RECRUITMENT
 1251 " BIOLOGICAL EFFECTS, BENTHOS, ARGO MERCHANT SPILL, SUBLETHAL EFFECTS
 1256 " ENVIRONMENTAL EFFECTS, BIOLOGICAL EFFECTS, ANALYTICAL TECHNIQUES, *PROCEEDINGS
 1270 " FISH, BIRDS, BIOLOGICAL EFFECTS, BIBLIOGRAPHIES, TOXICITY, MOLLUSKS, ZOOPLANKTON, *DIESEL FUEL
 1272 " BEHAVIOR, PAH, METABOLISM
 1276 " DISPERSANTS, BIOASSAY, BEACHES, TOXICITY
 1282 " BIOLOGICAL EFFECTS, BENTHOS, ARGO MERCHANT SPILL
 1284 " FRANCE, FISHERIES, ENVIRONMENTAL EFFECTS, AMOCO CADIZ SPILL, MORTALITY
 1310 " DEVELOPMENT, BASELINE STUDIES, AQUATIC ENVIRONMENT, ALASKA , OCS
 1319 " INTERTIDAL ZONE, FLORIDA SPILL, FATE, ENVIRONMENTAL EFFECTS, BIOLOGICAL EFFECTS, BENTHOS, MARSHES, MASSACHUSETTS
 1330 " ENVIRONMENTAL EFFECTS, OFFSHORE, PRODUCTION

1332 MARINE ORGANISMS, GUIDELINES, ENVIRONMENTAL EFFECTS, DISPERSANTS, SPILL CLEANUP,
 R091 " SHORELINES, TOXICITY, UK, TORREY CANYON SPILL
 R115 " HABITATS, COASTS, BENTHOS, SAMPLING, OIL SPILLS, SPILL RESPONSE, STATISTICAL
 1124 ANALYSIS
 R115 " FOOD WEB, ENVIRONMENTAL EFFECTS, DRILLING, BENTHOS, OFFSHORE, *DRILLING MUDS
 1124 MARSHES, HYDROCARBONS , DISTRIBUTION, CONCENTRATIONS, BIRDS, MONITORING, SCOTLAND,
 *SULLOM VOE
 1218 " INVERTEBRATES, CRUDE OIL, SPILL CLEANUP, RESTORATION, RECOVERY, SOIL, PLANTS
 1319 " MARINE ORGANISMS, INTERTIDAL ZONE, FLORIDA SPILL, FATE, ENVIRONMENTAL EFFECTS,
 BIOLOGICAL EFFECTS, BENTHOS, MASSACHUSETTS
 1320 " LAKES , ENVIRONMENTAL EFFECTS, DISPERSANTS, TOXICITY, TORREY CANYON SPILL, UK,
 RIVERS
 1165 MASSACHUSETTS, BEACHES, ARGO MERCHANT SPILL, SOURCE IDENTIFICATION, TAR, RHODE ISLAND
 1259 " HYDROCARBONS , BIOLOGICAL EFFECTS, MOLLUSKS, RESOURCE MANAGEMENT
 1319 " MARSHES, MARINE ORGANISMS, INTERTIDAL ZONE, FLORIDA SPILL, FATE, ENVIRONMENTAL
 EFFECTS, BIOLOGICAL EFFECTS, BENTHOS
 1396 " OIL SPILLS, TANKERS, *M/V CHESTER A. POLING
 1266 METABOLISM, FISH, BIOLOGICAL EFFECTS, PETROLEUM PRODUCTS, *LIVER, *GLUCOSE
 1272 " MARINE ORGANISMS, BEHAVIOR, PAH
 1287 " GROWTH, BIOLOGICAL EFFECTS, PAH, *CALLINECTES SAPIDUS
 1341 " BIODEGRADATION, BACTERIA
 R105 " GROWTH, FISH, CONTAMINATION, BIOLOGICAL EFFECTS, *JUVENILE PINK SALMON
 R113 MEXICO , MARINE ENVIRONMENT, FISHERIES, ENVIRONMENTAL EFFECTS, DEVELOPMENT, *TERMINOS
 LAGOON
 1127 MICROORGANISMS, FISH, DETECTION, BIOINDICATORS, BIBLIOGRAPHIES, ANIMALS, PLANTS
 1247 " FUEL OIL, CRUDE OIL, AROMATIC HYDROCARBONS, ALGAE, WSF, TOXICITY
 1248 " FUEL OIL, CRUDE OIL, BIOLOGICAL EFFECTS, ALGAE, PAH, TOXICITY
 1269 " GC/MS, FUEL OIL, OXIDATION, TOXICITY, *PHOTOOXIDATION
 1277 " FUEL OIL, DISPERSANTS, BACTERIA, TOXICITY, *BACTERIOPLANKTON, *WHITE SEA
 1335 " BIODEGRADATION, SOIL
 1340 " CRUDE OIL, BIODEGRADATION, *VITAMINS
 1342 " BIODEGRADATION, OIL REMOVAL, SPILL CLEANUP, PATENT
 1343 " HYDROCARBONS , BIODEGRADATION, BACTERIA, PETROLEUM PRODUCTS
 1344 " HYDROCARBONS , DISPERSANTS, CRUDE OIL, BIODEGRADATION
 1431 " HYDROCARBONS , BIODEGRADATION, WASTE OIL TREATMENT, MODELS, *MYCOTORULA,
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 1233 MISSISSIPPI, LEGISLATION, POLLUTION PREVENTION, RESOURCE MANAGEMENT
 1395 MISSISSIPPI RIVER, TANKERS, OIL SPILLS, *ACCIDENT REPORT
 1352 MODELS, HYDROCARBONS , EVAPORATION, DISPERSION, OIL SLICKS
 1353 " DISPERSION, BEHAVIOR, OIL SLICKS, SEA SURFACE
 1360 " GROUNDWATER, CONTAMINATION, PETROLEUM PRODUCTS, MOVEMENT
 1361 " CRUDE OIL, CORAL REEFS, BIOLOGICAL EFFECTS, BACTERIA, SUBLETHAL EFFECTS
 1362 " DRIFT, BEHAVIOR, ARGO MERCHANT SPILL, OIL SPILLS, MOVEMENT, PREDICTIONS, SEA
 SURFACE
 1363 " DRIFT, ARGO MERCHANT SPILL, PREDICTIONS, MOVEMENT, SEA SURFACE
 1364 " CALIFORNIA, PREDICTIONS, RISK ANALYSIS, SPILL TRAJECTORIES, OIL-GAS LEASING, SANTA
 BARBARA CHANNEL
 1366 " ENVIRONMENTAL EFFECTS, ARGO MERCHANT SPILL, RISK ANALYSIS, PREDICTIONS, ONSHORE
 IMPACTS
 1383 " ENVIRONMENTAL EFFECTS, OIL SPILLS, SOCIOECONOMIC EFFECTS, RESOURCE MANAGEMENT,
 RISK ANALYSIS, PUGET SOUND, OIL INDUSTRY
 1387 " EQUIPMENT, DESIGN-ENGINEERING, TANKERS, SKIMMERS, SPILL CLEANUP
 1393 " INFORMATION SYSTEMS, TANKERS, SHIPS, OIL SPILLS, RISK ANALYSIS, USCG, *PIRS
 1399 " PIPELINES, SAFETY, POLLUTION PREVENTION
 1431 " MICROORGANISMS, HYDROCARBONS , BIODEGRADATION, WASTE OIL TREATMENT, *MYCOTORULA,
 *PSEUDOMONAS
 1156 MOLLUSKS, FISH, CONTAMINATION, CHEMICAL ANALYSIS, AROMATIC HYDROCARBONS, *FREEZE DRYING
 1259 " MASSACHUSETTS, HYDROCARBONS , BIOLOGICAL EFFECTS, RESOURCE MANAGEMENT
 1270 " MARINE ORGANISMS, FISH, BIRDS, BIOLOGICAL EFFECTS, BIBLIOGRAPHIES, TOXICITY,
 ZOOPLANKTON, *DIESEL FUEL
 1274 " HYDROCARBONS , FOOD WEB, DEPURATION, CRUDE OIL, UPTAKE
 1278 " CONCENTRATIONS, CHEMICAL ANALYSIS, PAH, UPTAKE, *CLAMS
 1285 " FISH, CRUSTACEANS, BIOLOGICAL EFFECTS, BASELINE STUDIES, ARGO MERCHANT SPILL,
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 1290 " FISH, BIOLOGICAL EFFECTS, ARGO MERCHANT SPILL, SUBLETHAL EFFECTS
 R101 " INVERTEBRATES, CARCINOGENS, PAH, UPTAKE, SOURCES, OREGON
 R107 " HYDROCARBONS , FISH, BIOLOGICAL EFFECTS, *IMMUNE SYSTEM
 R111 " HYDROCARBONS , ENVIRONMENTAL EFFECTS, BIODEGRADATION, OIL SPILLS, PREDICTIONS
 1118 MONITORING, DETECTION, BIOINDICATORS, POLLUTION PREVENTION, *BIOMONITORING
 1120 " GREAT LAKES, CONTAMINATION, ANALYTICAL TECHNIQUES, WASTEWATERS, TOXICITY
 1124 " MARSHES, HYDROCARBONS , DISTRIBUTION, CONCENTRATIONS, BIRDS, SCOTLAND, *SULLOM VOE
 1132 " BEHAVIOR, ARGO MERCHANT SPILL, OIL SLICKS, MOVEMENT
 1138 " INDIA, EQUIPMENT, DESIGN-ENGINEERING, CHEMICAL ANALYSIS, WASTEWATER TREATMENT,
 RIVERS
 1142 " HYDROCARBONS , EQUIPMENT, REMOTE SENSING, OIL SPILLS

1292 MONITORING, BIOINDICATORS, REFINERIES, WASTEWATERS, SUBLETHAL EFFECTS, TOXICITY,
*DAPHNIA

1323 " MARINE ENVIRONMENT, ESTUARIES, ENVIRONMENTAL EFFECTS, MOVEMENT, *PROCEEDINGS

1346 " DRIFT, ARGO MERCHANT SPILL, MOVEMENT, SPILL TRAJECTORIES, *NEAR-BOTTOM TRANSPORT

R087 " EQUIPMENT, DETECTION, WASTEWATERS, SAMPLING, WATER QUALITY

R088 " EQUIPMENT, CHROMATOGRAPHY, WASTEWATERS, OIL INDUSTRY

1238 MORTALITY, MARINE ORGANISMS, FRANCE, FISHERIES, ENVIRONMENTAL EFFECTS, COASTS, BIRDS,
AMOCO CADIZ SPILL, SPILL CLEANUP

1243 " MARINE ORGANISMS, FISHERIES, BIRDS, BIOLOGICAL EFFECTS, AMOCO CADIZ SPILL

1253 " FRANCE, FISHERIES, BIRDS, BIOLOGICAL EFFECTS, AMOCO CADIZ SPILL, SHORELINES

1254 " FRANCE, FISHERIES, BIRDS, BIOLOGICAL EFFECTS, AMOCO CADIZ SPILL, SHORELINES

1260 " GROWTH, DEVELOPMENT, CRUDE OIL, BIRDS, TOXICITY, *ANAS PLATYRHYNCHOS, *HATCHABILITY

1264 " BIRDS, BIOLOGICAL EFFECTS, *VULNERABILITY INDEX

1265 " FUEL OIL, DISPERSANTS, ZOOPLANKTON, TOXICITY

1267 " FUEL OIL, FISH, BIOLOGICAL EFFECTS, ARGO MERCHANT SPILL, REPRODUCTION

1271 " GROWTH, FISH, BIOLOGICAL EFFECTS, ARGO MERCHANT SPILL, REPRODUCTION, *CYTOGENETICS

1281 " BIRDS, BIOLOGICAL EFFECTS, ARGO MERCHANT SPILL, TOXICITY

1284 " MARINE ORGANISMS, FRANCE, FISHERIES, ENVIRONMENTAL EFFECTS, AMOCO CADIZ SPILL

1286 " FISH, BIOLOGICAL EFFECTS, ARGO MERCHANT SPILL, ZOOPLANKTON, TOXICITY

1289 " FUEL OIL, BIRDS, TOXICITY, *ANAS PLATYRHYNCHOS, *HATCHABILITY

1132 MOVEMENT, MONITORING, BEHAVIOR, ARGO MERCHANT SPILL, OIL SLICKS

1154 " HYDROCARBONS , CHROMATOGRAPHY, ARGO MERCHANT SPILL, ANALYTICAL TECHNIQUES,
SEDIMENTS

1299 " FRANCE, DISTRIBUTION, CRUDE OIL, AMOCO CADIZ SPILL, PHYSICAL ASPECTS, PHYSICAL
EFFECTS

1316 " FATE, BIOLOGICAL EFFECTS, BIODEGRADATION, AQUATIC ENVIRONMENT

1323 " MONITORING, MARINE ENVIRONMENT, ESTUARIES, ENVIRONMENTAL EFFECTS, *PROCEEDINGS

1346 " MONITORING, DRIFT, ARGO MERCHANT SPILL, SPILL TRAJECTORIES, *NEAR-BOTTOM TRANSPORT

1360 " MODELS, GROUNDWATER, CONTAMINATION, PETROLEUM PRODUCTS

1362 " MODELS, DRIFT, BEHAVIOR, ARGO MERCHANT SPILL, OIL SPILLS, PREDICTIONS, SEA SURFACE

1363 " MODELS, DRIFT, ARGO MERCHANT SPILL, PREDICTIONS, SEA SURFACE

1365 " DRIFT, ARGO MERCHANT SPILL, SPILL TRAJECTORIES, PREDICTIONS, SPILL RESPONSE

1368 " DISTRIBUTION, CRUDE OIL, ADSORPTION, SIMULATIONS, SEDIMENTS, PUGET SOUND

1123 MUTAGENS, DETECTION, CONTAMINATION, BIOLOGICAL EFFECTS, ANALYTICAL TECHNIQUES

1262 " CRUDE OIL, CHRONIC EFFECTS, TOXICITY

1268 " CRUDE OIL, BIOLOGICAL EFFECTS, BIOASSAY, TOXICITY

1348 NARRAGANSETT BAY, HYDROCARBONS , FATE, DISTRIBUTION, SEDIMENTATION

1171 NATURAL SEEPAGE, CALIFORNIA, ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION, TAR, *SANTA
MONICA BAY, WEATHERING

1369 " HYDROCARBONS , GULF OF MEXICO, FATE, CARIBBEAN SEA, BIOLOGICAL EFFECTS, TEXAS

R098 " HYDROCARBONS , CRUSTACEANS, BIOLOGICAL EFFECTS, BEHAVIOR

1162 NEW YORK, BAYS, ANALYTICAL TECHNIQUES, PAH, SPECTROSCOPY

1261 " ENVIRONMENTAL EFFECTS, COASTAL WATERS, BIRDS

1313 NOAA, DEVELOPMENT, BIOLOGICAL EFFECTS, OCS, *OCSEAP, *PROCEEDINGS

1325 " FRANCE, EPA, DISTRIBUTION, CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, AMOCO CADIZ
SPILL, SPILL CLEANUP

1374 NORTH SEA, DEVELOPMENT, CONTINGENCY PLANNING, BIRDS, BIOLOGICAL EFFECTS, STATISTICS,
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1384 " LEGISLATION, LAW ENFORCEMENT, IMCO, FISHERIES, DEVELOPMENT, OFFSHORE, POLLUTION
PREVENTION, OIL TRANSPORT

1304 OCS, DEVELOPMENT, SOCIOECONOMIC EFFECTS, OIL INDUSTRY

1308 " FISH, DEVELOPMENT, BASELINE STUDIES, ATLANTIC COAST, PAH, OFFSHORE

1310 " MARINE ORGANISMS, DEVELOPMENT, BASELINE STUDIES, AQUATIC ENVIRONMENT, ALASKA

1311 " ENVIRONMENTAL EFFECTS, DEVELOPMENT, BASELINE STUDIES, OIL TRANSPORT

1312 " ENVIRONMENTAL EFFECTS, DEVELOPMENT, BASELINE STUDIES

1313 " NOAA, DEVELOPMENT, BIOLOGICAL EFFECTS, *OCSEAP, *PROCEEDINGS

1385 " DEVELOPMENT, ATLANTIC OCEAN, OIL SPILLS, RISK ANALYSIS

1386 " DEVELOPMENT, CONTINGENCY PLANNING, PRODUCTION

R109 " GEORGES BANK, EXPLORATION, ENVIRONMENTAL EFFECTS, BASELINE STUDIES, OFFSHORE, RISK
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R110 " HYDROCARBONS , GULF OF MEXICO, BASELINE STUDIES, ATLANTIC COAST, SEDIMENTS,
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1307 OFFSHORE, DEVELOPMENT, BASELINE STUDIES, ALASKA , PRUDHOE BAY

1308 " OCS, FISH, DEVELOPMENT, BASELINE STUDIES, ATLANTIC COAST, PAH

1330 " MARINE ORGANISMS, ENVIRONMENTAL EFFECTS, PRODUCTION

1378 " DEVELOPMENT, BASELINE STUDIES, OIL-GAS LEASING, OREGON

1379 " LEGISLATION, EQUIPMENT, ENVIRONMENTAL EFFECTS, DRILLING, BIBLIOGRAPHIES, OIL WELLS

1384 " NORTH SEA, LEGISLATION, LAW ENFORCEMENT, IMCO, FISHERIES, DEVELOPMENT, POLLUTION
PREVENTION, OIL TRANSPORT

1391 " ENVIRONMENTAL EFFECTS, DEVELOPMENT, BIBLIOGRAPHIES, TANKERS, PORTS

1398 " PIPELINES, SAFETY, POLLUTION PREVENTION, REGULATIONS

R109 " OCS, GEORGES BANK, EXPLORATION, ENVIRONMENTAL EFFECTS, BASELINE STUDIES, RISK
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R115 " MARINE ORGANISMS, FOOD WEB, ENVIRONMENTAL EFFECTS, DRILLING, BENTHOS, *DRILLING
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1397 OIL DISCHARGES, INTERNATIONAL CONVENTIONS, BALLAST , TANKERS, OIL SPILLS, STATISTICS, POLLUTION PREVENTION
 1445 " WASTEWATERS, TAR SANDS, RIVERS
 R089 " CHEMICAL ANALYSIS, ANALYTICAL TECHNIQUES, WASTEWATERS, POLLUTION CONTROL
 1377 OIL FIELDS, EPA, DRILLING, PRODUCTION, OIL INDUSTRY, REGULATIONS, *DRILLING MUDS
 1380 " MARINE ENVIRONMENT, ENVIRONMENTAL EFFECTS, DEVELOPMENT, CRUDE OIL, CONCENTRATIONS
 1364 OIL-GAS LEASING, MODELS, CALIFORNIA, PREDICTIONS, RISK ANALYSIS, SPILL TRAJECTORIES, SANTA BARBARA CHANNEL
 1378 " OFFSHORE, DEVELOPMENT, BASELINE STUDIES, OREGON
 1258 OIL INDUSTRY, HEALTH HAZARDS, CARCINOGENS, BIBLIOGRAPHIES, PETROCHEMICALS, TOXICITY, REGULATIONS
 1303 " SANTA BARBARA CHANNEL, OIL SPILLS, SOCIOECONOMIC EFFECTS, *TOURISM
 1304 " OCS, DEVELOPMENT, SOCIOECONOMIC EFFECTS
 1309 " ENVIRONMENTAL EFFECTS, CRUDE OIL, REFINING, PETROLEUM PRODUCTS, WASTEWATERS, WASHINGTON, PUGET SOUND
 1331 " JAPAN, FISHERIES, ENVIRONMENTAL EFFECTS, PETROCHEMICALS, *SETO INLAND SEA
 1376 " GROUNDWATER, ENVIRONMENTAL EFFECTS, PRODUCTION
 1377 " OIL FIELDS, EPA, DRILLING, PRODUCTION, REGULATIONS, *DRILLING MUDS
 1382 " ENVIRONMENTAL EFFECTS, COASTS, RESOURCE MANAGEMENT
 1383 " MODELS, ENVIRONMENTAL EFFECTS, OIL SPILLS, SOCIOECONOMIC EFFECTS, RESOURCE MANAGEMENT, RISK ANALYSIS, PUGET SOUND
 1414 " ADSORPTION, WASTEWATER TREATMENT, *PHENOL REMOVAL
 1415 " FILTRATION, BIOLOGICAL EFFECTS, WASTEWATER TREATMENT, TOXICITY
 1416 " ECONOMICS, BIBLIOGRAPHIES, WASTEWATER TREATMENT, PETROCHEMICALS, POLLUTION PREVENTION
 1438 " ENVIRONMENTAL EFFECTS, WASTEWATER TREATMENT
 R088 " MONITORING, EQUIPMENT, CHROMATOGRAPHY, WASTEWATERS
 1195 OIL REMOVAL, SPILL CLEANUP, PATENT
 1203 " GRAVITY SEPARATION, FILTRATION, EQUIPMENT, DESIGN-ENGINEERING, BOOMS, SKIMMERS, PATENT
 1206 " ABSORPTION, SORBENTS, PATENT
 1217 " ADSORPTION, SORBENTS, PATENT
 1342 " MICROORGANISMS, BIODEGRADATION, SPILL CLEANUP, PATENT
 1418 " DEMULSIFICATION, WASTEWATER TREATMENT, PATENT
 1419 " WASTEWATER TREATMENT, OIL-WATER SEPARATION, REFINERIES
 1423 " FILTRATION, WASTEWATER TREATMENT, REFINERIES
 1424 " WASTEWATER TREATMENT, PATENT
 1425 " FLOCCULATION, WASTEWATER TREATMENT, PATENT
 1427 " ADSORPTION, WASTEWATER TREATMENT, PERFORMANCE TESTING, *FOAM SEPARATION
 1429 " EMULSIONS, WASTEWATER TREATMENT, *ELECTROCOAGULATION
 1434 " FILTRATION, WASTEWATER TREATMENT, SOLID WASTES, PATENT
 1436 " GRAVITY SEPARATION, FILTRATION, DESIGN-ENGINEERING, WASTEWATER TREATMENT, PATENT
 1437 " GRAVITY SEPARATION, FILTRATION, WASTEWATER TREATMENT, PATENT
 1442 " ADSORPTION, WASTEWATER TREATMENT, PATENT
 1444 " EQUIPMENT, DESIGN-ENGINEERING, WASTEWATER TREATMENT, PATENT
 1447 " WASTEWATER TREATMENT, PATENT
 1375 OIL SHALE, HEALTH HAZARDS, ENVIRONMENTAL EFFECTS, DEVELOPMENT
 1381 " ENVIRONMENTAL EFFECTS, *SURFACE TECHNOLOGY
 1412 " WASTEWATERS, TAR SANDS
 1421 " EXTRACTION, ENVIRONMENTAL EFFECTS, DISPOSAL , SOLID WASTES
 R096 " GUIDELINES, EPA, DEVELOPMENT, REGULATIONS, POLLUTION PREVENTION
 R104 " FISH, CARCINOGENS, BIOASSAY, TOXICITY, PETROLEUM PRODUCTS
 R114 " MARINE ENVIRONMENT, ENVIRONMENTAL EFFECTS, DRILLING, DEVELOPMENT, PLATFORMS
 1132 OIL SLICKS, MOVEMENT, MONITORING, BEHAVIOR, ARGO MERCHANT SPILL
 1176 " EQUIPMENT, SPILL CONTAINMENT, SPREADING
 1351 " HYDROCARBONS , DISPERSANTS, BEHAVIOR, ATLANTIC OCEAN, PHYSICAL ASPECTS
 1352 " MODELS, HYDROCARBONS , EVAPORATION, DISPERSION
 1353 " MODELS, DISPERSION, BEHAVIOR, SEA SURFACE
 1357 " CONTAMINATION, BEHAVIOR, SPREADING
 1367 " DISPERSION, SPREADING, SIMULATIONS, PREDICTIONS
 1140 OIL SPILLS, DETECTION, BIBLIOGRAPHIES, ANALYTICAL TECHNIQUES, SAMPLING, REMOTE SENSING, WASTEWATERS
 1141 " FATE, ESTUARIES, DISPERSION, DETECTION, BIBLIOGRAPHIES, REMOTE SENSING
 1142 " MONITORING, HYDROCARBONS , EQUIPMENT, REMOTE SENSING
 1174 " ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION
 1223 " ARGO MERCHANT SPILL, PHYSICAL ASPECTS, SPILL RESPONSE, SPILL CLEANUP
 1244 " MARINE ENVIRONMENT, HEALTH HAZARDS, FATE, CHRONIC EFFECTS, BIOLOGICAL EFFECTS
 1302 " ARGO MERCHANT SPILL, SOCIOECONOMIC EFFECTS
 1303 " OIL INDUSTRY, SANTA BARBARA CHANNEL, SOCIOECONOMIC EFFECTS, *TOURISM
 1315 " FRANCE, ENVIRONMENTAL EFFECTS, CONTAMINATION, AMOCO CADIZ SPILL, SPILL REMOVAL
 1317 " BIRDS, BIOLOGICAL EFFECTS, SPILL RESPONSE, *CRISTOS BITAS SPILL
 1318 " CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, ARGO MERCHANT SPILL, PHYSICAL EFFECTS, SOCIOECONOMIC EFFECTS, *PROCEEDINGS
 1339 " BIODEGRADATION, BIBLIOGRAPHIES, BACTERIA, ALGAE, SPILL CLEANUP
 1362 " MOVEMENT, MODELS, DRIFT, BEHAVIOR, ARGO MERCHANT SPILL, PREDICTIONS, SEA SURFACE

1372 OIL SPILLS, MARINE MAMMALS, DEVELOPMENT, BIOLOGICAL EFFECTS, SCOTLAND, *SULLOM VOE, *SEALS
1383 " OIL INDUSTRY, MODELS, ENVIRONMENTAL EFFECTS, SOCIOECONOMIC EFFECTS, RESOURCE MANAGEMENT, RISK ANALYSIS, PUGET SOUND
1385 " OCS, DEVELOPMENT, ATLANTIC OCEAN, RISK ANALYSIS
1388 " OIL TRANSPORT, POLLUTION PREVENTION, *BARGES
1393 " MODELS, INFORMATION SYSTEMS, TANKERS, SHIPS, RISK ANALYSIS, USCG, *PIRS
1394 " ENVIRONMENTAL EFFECTS, TANKERS, SAFETY, POLLUTION PREVENTION, RISK ANALYSIS, SEGREGATED BALLAST, USCG
1395 " MISSISSIPPI RIVER, TANKERS, *ACCIDENT REPORT
1396 " MASSACHUSETTS, TANKERS, *M/V CHESTER A. POLING
1397 " OIL DISCHARGES, INTERNATIONAL CONVENTIONS, BALLAST , TANKERS, STATISTICS, POLLUTION PREVENTION
1408 " LEGISLATION, BIOLOGICAL EFFECTS, TANKERS, STATISTICS, UK
1411 " KUWAIT, COASTS, BALLAST , STATISTICS, OIL TRANSPORT, TANKERS, TAR, POLLUTION CONTROL
R091 " MARINE ORGANISMS, HABITATS, COASTS, BENTHOS, SAMPLING, SPILL RESPONSE, STATISTICAL ANALYSIS
R092 " GC/MS, EQUIPMENT, CHEMICAL ANALYSIS
R111 " MOLLUSKS, HYDROCARBONS , ENVIRONMENTAL EFFECTS, BIODEGRADATION, PREDICTIONS
R093 OIL TANKS, EMULSIONS, CHEMICAL ANALYSIS, BALLAST , SAMPLING, WASTEWATER TREATMENT
1168 OIL TERMINALS, HYDROCARBONS , FATE, DISTRIBUTION, SOURCE IDENTIFICATION, SEDIMENTS, SCOTLAND, *SULLOM VOE
1227 " CONTINGENCY PLANNING, POLLUTION PREVENTION, SPILL CLEANUP, SCOTLAND, *SULLOM VOE
1389 " LIABILITY, OIL TRANSPORT, OIL TRANSFER, TANKERS, PORTS , SPILL CLEANUP. POLLUTION PREVENTION, REGULATIONS
1400 " BIOLOGICAL EFFECTS, TANKERS, OIL TRANSFER, SCOTLAND, *SULLOM VOE
1407 " LAW ENFORCEMENT, INTERNATIONAL CONVENTIONS, IMCO, TANKERS, POLLUTION CONTROL, SPILL CLEANUP
1389 OIL TRANSFER, OIL TERMINALS, LIABILITY, OIL TRANSPORT, TANKERS, PORTS , SPILL CLEANUP, POLLUTION PREVENTION, REGULATIONS
1390 " EXTRACTION, TANKERS, POLLUTION PREVENTION
1392 " MANUALS, EQUIPMENT, TANKERS, POLLUTION PREVENTION, OIL TRANSPORT
1400 " OIL TERMINALS, BIOLOGICAL EFFECTS, TANKERS, SCOTLAND, *SULLOM VOE
1401 " DEEPWATER PORTS, POLLUTION PREVENTION, TANKERS, *TRANSFER CONTROL SYSTEMS
1311 OIL TRANSPORT, OCS, ENVIRONMENTAL EFFECTS, DEVELOPMENT, BASELINE STUDIES
1384 " OFFSHORE, NORTH SEA, LEGISLATION, LAW ENFORCEMENT, IMCO, FISHERIES, DEVELOPMENT, POLLUTION PREVENTION
1388 " OIL SPILLS, POLLUTION PREVENTION, *BARGES
1389 " OIL TRANSFER, OIL TERMINALS, LIABILITY, TANKERS, PORTS , SPILL CLEANUP, POLLUTION PREVENTION, REGULATIONS
1392 " OIL TRANSFER, MANUALS, EQUIPMENT, TANKERS, POLLUTION PREVENTION
1404 " LOUISIANA, EIS, STORAGE, STRATEGIC PETROLEUM RESERVE
1409 " DESIGN-ENGINEERING, PETROLEUM PRODUCTS, SAFETY, *TANK TRUCKS
1411 " OIL SPILLS, KUWAIT, COASTS, BALLAST , STATISTICS, TANKERS, TAR, POLLUTION CONTROL
1193 OIL-WATER SEPARATION, EQUIPMENT, DESIGN-ENGINEERING, SPILL CLEANUP, SKIMMERS, PATENT
1209 " EQUIPMENT, DESIGN-ENGINEERING, SPILL CLEANUP, SKIMMERS, SEA SURFACE, PATENT
1210 " FLOTATION, EQUIPMENT, DISPERSANTS, BIBLIOGRAPHIES, ABSORPTION, SPILL REMOVAL, SKIMMERS, SORBENTS, SPREADING
1413 " EQUIPMENT, DESIGN-ENGINEERING, WASTEWATER TREATMENT, PATENT
1419 " OIL REMOVAL, WASTEWATER TREATMENT, REFINERIES
1439 " FLOTATION, EMULSIONS, DISPOSAL , WASTEWATERS
1450 " EMULSIONS, REGULATIONS
1451 " GRAVITY SEPARATION, EQUIPMENT, DESIGN-ENGINEERING, WASTEWATER TREATMENT
1452 " ABSORPTION, *SORBENT FOAM
1453 " EQUIPMENT, WASTEWATER TREATMENT
1454 " FILTRATION, PATENT
1455 " FILTRATION, EQUIPMENT, COALESCENCE, PATENT
1456 " EQUIPMENT, BIBLIOGRAPHIES, BALLAST , SPILL REMOVAL, POLLUTION CONTROL
1457 " WASTEWATER TREATMENT, PATENT
1458 " FLOTATION, WASTEWATER TREATMENT, PATENT
1459 " EQUIPMENT, DESIGN-ENGINEERING, WASTEWATER TREATMENT
1460 " EQUIPMENT, DESIGN-ENGINEERING, WASTEWATER TREATMENT, PATENT, *GREASE
R118 " EQUIPMENT, SPILL CLEANUP, STORAGE, USCG
1379 OIL WELLS, OFFSHORE, LEGISLATION, EQUIPMENT, ENVIRONMENTAL EFFECTS, DRILLING, BIBLIOGRAPHIES
1187 ONSHORE, GUIDELINES, EQUIPMENT, DISPERSANTS, CONTINGENCY PLANNING, POLLUTION CONTROL
1198 " INDUSTRIES, SPILL CLEANUP, WASTEWATERS, POLLUTION PREVENTION
1263 " INVERTEBRATES, FRANCE, BIOLOGICAL EFFECTS, BENTHOS, AMOCO CADIZ SPILL, TOXICITY
1366 ONSHORE IMPACTS, MODELS, ENVIRONMENTAL EFFECTS, ARGO MERCHANT SPILL, RISK ANALYSIS, PREDICTIONS
1378 OREGON, OIL-GAS LEASING, OFFSHORE, DEVELOPMENT, BASELINE STUDIES
R101 " MOLLUSKS, INVERTEBRATES, CARCINOGENS, PAH, UPTAKE, SOURCES
1269 OXIDATION, MICROORGANISMS, GC/MS, FUEL OIL, TOXICITY, *PHOTOOXIDATION
1356 " HYDROCARBONS , CRUDE OIL, CHEMICAL ANALYSIS, SEAWATER

1355 PACIFIC OCEAN, DRIFT, DISTRIBUTION, TAR
 1125 PAH, HYDROCARBONS , EXTRACTION, DETECTION, ANALYTICAL TECHNIQUES, WASTEWATERS,
 REFINERIES, *FLUOROMETRY
 1130 " ANALYTICAL TECHNIQUES, WASTEWATERS, *FLUOROMETRY
 1135 " DETECTION, CONCENTRATIONS, CHROMATOGRAPHY, CHEMICAL ANALYSIS, SAMPLING
 1139 " DETECTION, ANALYTICAL TECHNIQUES, *FLUORESCENCE
 1148 " CHROMATOGRAPHY, ANALYTICAL TECHNIQUES
 1162 " NEW YORK, BAYS, ANALYTICAL TECHNIQUES, SPECTROSCOPY
 1248 " MICROORGANISMS, FUEL OIL, CRUDE OIL, BIOLOGICAL EFFECTS, ALGAE, TOXICITY
 1272 " METABOLISM, MARINE ORGANISMS, BEHAVIOR
 1275 " HEALTH HAZARDS, CHRONIC EFFECTS, CARCINOGENS, BIOLOGICAL EFFECTS
 1278 " MOLLUSKS, CONCENTRATIONS, CHEMICAL ANALYSIS, UPTAKE, *CLAMS
 1287 " METABOLISM, GROWTH, BIOLOGICAL EFFECTS, *CALLINECTES SAPIDUS
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 1359 " FATE, DISTRIBUTION, CONCENTRATIONS, SOIL, SEDIMENTS, *POLLUTANT TRANSPORT
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 1203 " OIL REMOVAL, GRAVITY SEPARATION, FILTRATION, EQUIPMENT, DESIGN-ENGINEERING, BOOMS,
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 1207 " EQUIPMENT, DESIGN-ENGINEERING, BOOMS, SPILL CLEANUP, SKIMMERS, SHIPS
 1208 " EQUIPMENT, DESIGN-ENGINEERING, SPILL CLEANUP, SPILL REMOVAL, SHIPS
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 1425 " OIL REMOVAL, FLOCCULATION, WASTEWATER TREATMENT
 1434 " OIL REMOVAL, FILTRATION, WASTEWATER TREATMENT, SOLID WASTES
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 1436 " OIL REMOVAL, GRAVITY SEPARATION, FILTRATION, DESIGN-ENGINEERING, WASTEWATER
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 1454 " OIL-WATER SEPARATION, FILTRATION
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1151 " PETROLEUM PRODUCTS, CRUDE OIL, CHROMATOGRAPHY, ANALYTICAL TECHNIQUES
1152 " JAPAN, CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, TAR, SOURCE IDENTIFICATION
1153 " CHROMATOGRAPHY, CHEMICAL ANALYSIS, SPECTROMETRY, WEATHERING
1155 " CONCENTRATIONS, ARGO MERCHANT SPILL, ANALYTICAL TECHNIQUES, WSF. *FLUORESCENCE SPECTROSCOPY
1159 " MARINE ORGANISMS, HYDROCARBONS , FISH, ARGO MERCHANT SPILL, ANALYTICAL TECHNIQUES, SEDIMENTS
1241 " FUEL OIL, EPA, CONTINGENCY PLANNING, BUZZARDS BAY, BOUCHARD 65 SPILL, BIOLOGICAL EFFECTS, SPILL CLEANUP, SPILL RESPONSE
R087 " MONITORING, EQUIPMENT, DETECTION, WASTEWATERS, WATER QUALITY
R090 " EQUIPMENT, EPA, CHEMICAL ANALYSIS, WATER QUALITY
R091 " OIL SPILLS, MARINE ORGANISMS, HABITATS, COASTS, BENTHOS, SPILL RESPONSE, STATISTICAL ANALYSIS
R093 " OIL TANKS, EMULSIONS, CHEMICAL ANALYSIS, BALLAST , WASTEWATER TREATMENT
1303 SANTA BARBARA CHANNEL, OIL SPILLS, OIL INDUSTRY, SOCIOECONOMIC EFFECTS, *TOURISM
1364 " RISK ANALYSIS, PREDICTIONS, OIL-GAS LEASING, MODELS, CALIFORNIA, SPILL TRAJECTORIES
1124 SCOTLAND, MONITORING, MARSHES, HYDROCARBONS , DISTRIBUTION, CONCENTRATIONS, BIRDS, *SULLOM VOE
1168 " OIL TERMINALS, HYDROCARBONS , FATE, DISTRIBUTION, SOURCE IDENTIFICATION, SEDIMENTS, *SULLOM VOE
1227 " POLLUTION PREVENTION, OIL TERMINALS, CONTINGENCY PLANNING, SPILL CLEANUP, *SULLOM VOE
1372 " OIL SPILLS, MARINE MAMMALS, DEVELOPMENT, BIOLOGICAL EFFECTS, *SULLOM VOE, *SEALS
1374 " NORTH SEA, DEVELOPMENT, CONTINGENCY PLANNING, BIRDS, BIOLOGICAL EFFECTS, STATISTICS, *SULLOM VOE
1400 " OIL TRANSFER, OIL TERMINALS, BIOLOGICAL EFFECTS, TANKERS, *SULLOM VOE
1209 SEA SURFACE, PATENT, OIL-WATER SEPARATION, EQUIPMENT, DESIGN-ENGINEERING, SPILL CLEANUP, SKIMMERS
1353 " OIL SLICKS, MODELS, DISPERSION, BEHAVIOR
1358 " MARINE ENVIRONMENT, ATLANTIC OCEAN, TAR, WEATHERING, *SARGASSO SEA
1362 " PREDICTIONS, OIL SPILLS, MOVEMENT, MODELS, DRIFT, BEHAVIOR, ARGO MERCHANT SPILL
1363 " PREDICTIONS, MOVEMENT, MODELS, DRIFT, ARGO MERCHANT SPILL
1122 SEAWATER, DETECTION, AROMATIC HYDROCARBONS
1129 " HYDROCARBONS , DETECTION, CONCENTRATIONS, ANALYTICAL TECHNIQUES, SPECTROMETRY
1333 " PLANTS, PAH, FRESHWATER, DISTRIBUTION, SOIL
1356 " OXIDATION, HYDROCARBONS , CRUDE OIL, CHEMICAL ANALYSIS
1348 SEDIMENTATION, NARRAGANSETT BAY, HYDROCARBONS , FATE, DISTRIBUTION
1117 SEDIMENTS, SAMPLING, FRESHWATER, CHEMICAL ANALYSIS, SOILS
1147 " MANUALS, HYDROCARBONS , BIOGENIC HYDROCARBONS, ANALYTICAL TECHNIQUES, WASTEWATERS
1150 " HYDROCARBONS , CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, *TLC, *COLUMN CHROMATOGRAPHY
1154 " MOVEMENT, HYDROCARBONS , CHROMATOGRAPHY, ARGO MERCHANT SPILL, ANALYTICAL TECHNIQUES
1159 " SAMPLING, MARINE ORGANISMS, HYDROCARBONS , FISH, ARGO MERCHANT SPILL, ANALYTICAL TECHNIQUES
1168 " SCOTLAND, OIL TERMINALS, HYDROCARBONS , FATE, DISTRIBUTION, SOURCE IDENTIFICATION, *SULLOM VOE
1169 " HYDROCARBONS , GC/MS, DETECTION, ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION, WEATHERING
1245 " MARINE ORGANISMS, INTERTIDAL ZONE, HYDROCARBONS , DEPURATION, BIOLOGICAL EFFECTS, BENTHOS, *RECRUITMENT
1300 " PHYSICAL ASPECTS, FRANCE, DISTRIBUTION, CRUDE OIL, BEACHES, AMOCO CADIZ SPILL, SHORELINES
1301 " PHYSICAL EFFECTS, FRANCE, DISTRIBUTION, CRUDE OIL, AMOCO CADIZ SPILL, SHORELINES
1327 " HYDROCARBONS , DETECTION, CONCENTRATIONS, ANALYTICAL TECHNIQUES
1345 " PUGET SOUND, HYDROCARBONS , BIODEGRADATION, BACTERIA, SHORELINES
1349 " PHYSICAL ASPECTS, FATE, DISTRIBUTION, BEACHES, TAR
1359 " PAH, FATE, DISTRIBUTION, CONCENTRATIONS, SOIL, *POLLUTANT TRANSPORT
1368 " PUGET SOUND, MOVEMENT, DISTRIBUTION, CRUDE OIL, ADSORPTION, SIMULATIONS
1370 " PAH, FATE, ECOSYSTEMS, COLD CLIMATES, BIODEGRADATION, WEATHERING, ZOOPLANKTON, UPTAKE
R094 " PETROLEUM PRODUCTS, DETECTION, CRUDE OIL, CHROMATOGRAPHY, SOURCE IDENTIFICATION, CHEMICAL ANALYSIS, *FINGERPRINTING
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1394 SEGREGATED BALLAST, SAFETY, RISK ANALYSIS, POLLUTION PREVENTION, OIL SPILLS, ENVIRONMENTAL EFFECTS, TANKERS, USCG
1207 SHIPS, PATENT, EQUIPMENT, DESIGN-ENGINEERING, BOOMS, SPILL CLEANUP, SKIMMERS
1208 " PATENT, EQUIPMENT, DESIGN-ENGINEERING, SPILL CLEANUP, SPILL REMOVAL
1393 " RISK ANALYSIS, OIL SPILLS, MODELS, INFORMATION SYSTEMS, TANKERS, USCG, *PIRS

1220 SHORELINES, INTERTIDAL ZONE, GUIDELINES, DISPERSANTS, CONTINGENCY PLANNING, BEACH
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 1230 " POLLUTION PREVENTION, CONTINGENCY PLANNING, BEAUFORT SEA, ARCTIC, SPILL RESPONSE,
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 1253 " MORTALITY, FRANCE, FISHERIES, BIRDS, BIOLOGICAL EFFECTS, AMOCO CADIZ SPILL
 1254 " MORTALITY, FRANCE, FISHERIES, BIRDS, BIOLOGICAL EFFECTS, AMOCO CADIZ SPILL
 1300 " SEDIMENTS, PHYSICAL ASPECTS, FRANCE, DISTRIBUTION, CRUDE OIL, BEACHES, AMOCO CADIZ
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 1301 " SEDIMENTS, PHYSICAL EFFECTS, FRANCE, DISTRIBUTION, CRUDE OIL, AMOCO CADIZ SPILL
 1332 " MARINE ORGANISMS, GUIDELINES, ENVIRONMENTAL EFFECTS, DISPERSANTS, SPILL CLEANUP,
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 1345 " SEDIMENTS, PUGET SOUND, HYDROCARBONS , BIODEGRADATION, BACTERIA
 1179 SIMULATIONS, EQUIPMENT, DESIGN-ENGINEERING, BOOMS, SPILL CONTAINMENT
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 1201 " PERFORMANCE TESTING, GUIDELINES, EQUIPMENT, ENVIRONMENTAL EFFECTS, DISPERSANTS,
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 1225 " EQUIPMENT, DISPERSANTS, COST ANALYSIS, *AERIAL APPLICATION
 1367 " PREDICTIONS, OIL SLICKS, DISPERSION, SPREADING
 1368 " SEDIMENTS, PUGET SOUND, MOVEMENT, DISTRIBUTION, CRUDE OIL, ADSORPTION
 1186 SINKING AGENTS, MANUALS, IMCO, DISPERSANTS, BURNING, BOOMS, SPILL CLEANUP, SPILL
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 1182 SKIMMERS, PERFORMANCE TESTING, EPA, DESIGN-ENGINEERING, SPILL CLEANUP, US, USSR,
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 1186 " SINKING AGENTS, MANUALS, IMCO, DISPERSANTS, BURNING, BOOMS, SPILL CLEANUP, SPILL
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 1193 " PATENT, OIL-WATER SEPARATION, EQUIPMENT, DESIGN-ENGINEERING, SPILL CLEANUP
 1193 " PERFORMANCE TESTING, EQUIPMENT, DESIGN-ENGINEERING, SPILL REMOVAL
 1202 " PERFORMANCE TESTING, EQUIPMENT, EPA, DESIGN-ENGINEERING, SPILL CLEANUP, *OHMSETT
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 1203 " PATENT, OIL REMOVAL, GRAVITY SEPARATION, FILTRATION, EQUIPMENT,
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 1204 " PATENT, EQUIPMENT, DESIGN-ENGINEERING, SPILL CLEANUP
 1207 " SHIPS, PATENT, EQUIPMENT, DESIGN-ENGINEERING, BOOMS, SPILL CLEANUP
 1209 " SEA SURFACE, PATENT, OIL-WATER SEPARATION, EQUIPMENT, DESIGN-ENGINEERING, SPILL
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 1210 " OIL-WATER SEPARATION, FLOTATION, EQUIPMENT, DISPERSANTS, BIBLIOGRAPHIES,
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 1212 " PERFORMANCE TESTING, EQUIPMENT, DESIGN-ENGINEERING, SPILL CLEANUP, *OHMSETT
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 1214 " PATENT, EQUIPMENT, DESIGN-ENGINEERING, SPILL CLEANUP
 1215 " PERFORMANCE TESTING, EQUIPMENT, DESIGN-ENGINEERING, SPILL CLEANUP, *OHMSETT
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 1303 " SANTA BARBARA CHANNEL, OIL SPILLS, OIL INDUSTRY, *TOURISM
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 1318 " PHYSICAL EFFECTS, OIL SPILLS, CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, ARGO MERCHANT
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 1383 " RISK ANALYSIS, RESOURCE MANAGEMENT, PUGET SOUND, OIL SPILLS, OIL INDUSTRY, MODELS,
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 1133 SOIL, PATENT, HYDROCARBONS , EQUIPMENT, DESIGN-ENGINEERING, ANALYTICAL TECHNIQUES,
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 1134 " PATENT, HYDROCARBONS , EQUIPMENT, DETECTION, DESIGN-ENGINEERING, ANALYTICAL
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 1190 " CONTAMINATION, BIOLOGICAL TREATMENT, BIODEGRADATION, SPILL CLEANUP
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 1298 " GROUNDWATER, FATE, ENVIRONMENTAL EFFECTS, TOXICITY
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 1359 " SEDIMENTS, PAH, FATE, DISTRIBUTION, CONCENTRATIONS, *POLLUTANT TRANSPORT
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 1183 " PATENT, SPILL CLEANUP
 1185 " PLANTS, PATENT, ABSORPTION, *GRASS PEAT FIBERS
 1186 " SKIMMERS, SINKING AGENTS, MANUALS, IMCO, DISPERSANTS, BURNING, BOOMS, SPILL
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1206 SORBENTS, PATENT, OIL REMOVAL, ABSORPTION
1210 " SKIMMERS, OIL-WATER SEPARATION, FLOTATION, EQUIPMENT, DISPERSANTS, BIBLIOGRAPHIES, ABSORPTION, SPILL REMOVAL, SPREADING
1217 " PATENT, OIL REMOVAL, ADSORPTION
1435 " PATENT, ADSORPTION, WASTEWATER TREATMENT
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1157 " MARINE ORGANISMS, HYDROCARBONS , HARBORS, CONTAMINATION, CHEMICAL ANALYSIS, *TAIWAN
1164 " PETROLEUM PRODUCTS, ANALYTICAL TECHNIQUES
1165 " RHODE ISLAND, MASSACHUSETTS, BEACHES, ARGO MERCHANT SPILL, TAR
1166 " CRUDE OIL, CHROMATOGRAPHY, CHEMICAL ANALYSIS
1167 " FISH, CONTAMINATION, BIOLOGICAL EFFECTS, AUSTRALIA
1168 " SEDIMENTS, SCOTLAND, OIL TERMINALS, HYDROCARBONS , FATE, DISTRIBUTION, *SULLOM VOE
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1171 " NATURAL SEEPAGE, CALIFORNIA, ANALYTICAL TECHNIQUES, TAR, *SANTA MONICA BAY, WEATHERING
1172 " FUEL OIL, CRUDE OIL, ANALYTICAL TECHNIQUES
1173 " CONTAMINATION, ANALYTICAL TECHNIQUES, *NI/N INDEX
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1129 SPECTROMETRY, SEAWATER, HYDROCARBONS , DETECTION, CONCENTRATIONS, ANALYTICAL TECHNIQUES
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1121 SPECTROSCOPY, DETECTION, CONCENTRATIONS, CHEMICAL ANALYSIS, AROMATIC HYDROCARBONS
1162 " PAH, NEW YORK, BAYS, ANALYTICAL TECHNIQUES
1182 SPILL CLEANUP, SKIMMERS, PERFORMANCE TESTING, EPA, DESIGN-ENGINEERING, US, USSR, *OHMSETT FACILITY
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1186 " SORBENTS, SKIMMERS, SINKING AGENTS, MANUALS, IMCO, DISPERSANTS, BURNING, BOOMS, SPILL REMOVAL
1188 " POLLUTION PREVENTION, ONSHORE, INDUSTRIES, WASTEWATERS
1190 " SOIL, CONTAMINATION, BIOLOGICAL TREATMENT, BIODEGRADATION
1191 " REGULATIONS, POLLUTION CONTROL, GOVERNMENT AGENCIES, DISPERSANTS
1192 " MARINE ORGANISMS, HABITATS, DISPERSANTS, CHRONIC EFFECTS, ACUTE EFFECTS, TOXICITY
1193 " SKIMMERS, PATENT, OIL-WATER SEPARATION, EQUIPMENT, DESIGN-ENGINEERING
1194 " POLLUTION CONTROL, PHYSICAL ASPECTS, FRANCE, BEHAVIOR, AMOCO CADIZ SPILL
1195 " PATENT, OIL REMOVAL
1196 " PATENT, ADSORPTION, WASTEWATER TREATMENT, *POWDERED SHALE
1202 " SKIMMERS, PERFORMANCE TESTING, EQUIPMENT, EPA, DESIGN-ENGINEERING, *OHMSETT FACILITY
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1205 " IRELAND, DISPERSANTS, *BETELGEUSE SPILL, *AERIAL APPLICATION
1207 " SKIMMERS, SHIPS, PATENT, EQUIPMENT, DESIGN-ENGINEERING, BOOMS
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1209 " SKIMMERS, SEA SURFACE, PATENT, OIL-WATER SEPARATION, EQUIPMENT, DESIGN-ENGINEERING
1211 " EQUIPMENT, DISPERSANTS, DESIGN-ENGINEERING, *DISPERSANT APPLICATION
1212 " SKIMMERS, PERFORMANCE TESTING, EQUIPMENT, DESIGN-ENGINEERING, *OHMSETT FACILITY
1214 " SKIMMERS, PATENT, EQUIPMENT, DESIGN-ENGINEERING
1215 " SKIMMERS, PERFORMANCE TESTING, EQUIPMENT, DESIGN-ENGINEERING, *OHMSETT FACILITY
1216 " EQUIPMENT, DESIGN-ENGINEERING, *SIRENE
1218 " SOIL, RESTORATION, RECOVERY, PLANTS, MARSHES, INVERTEBRATES, CRUDE OIL
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1221 " POLLUTION CONTROL, FRANCE, CONTINGENCY PLANNING, COASTS, AMOCO CADIZ SPILL
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1227 " SCOTLAND, POLLUTION PREVENTION, OIL TERMINALS, CONTINGENCY PLANNING, *SULLOM VOE
1230 " SHORELINES, POLLUTION PREVENTION, CONTINGENCY PLANNING, BEAUFORT SEA, ARCTIC, SPILL RESPONSE
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 1181 " PATENT, EQUIPMENT, DESIGN-ENGINEERING, BOOMS
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498,043	79D-1193	7 802,657	79D-1207
		7 806,198	79D-1208
<u>Austrian Patent</u>		<u>Swedish Patent</u>	
348,491	79D-1217	405,981	79D-1183
<u>British Patent</u>		<u>US Patent</u>	
1,535,606	79D-1455	4,021,333	79D-1463
1,535,848	79D-1437	4,028,226	79D-1462
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2,806,851	79D-1442	4,146,482	79D-1209
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79 18,152	79D-1446		
79 18,480	79D-1457		
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APPENDIX A
Periodicals Reviewed

Abstracts on Health Effects of Environmental Pollutants
Alternatives: Perspectives on Society and Environment
Ambio
American Fisheries Society Transactions
Analytical Chemistry
Applied Ecology Abstracts
Applied Energy
Applied Microbiology
Applied Science & Technology Index
Aquatic Sciences & Fisheries Abstracts
Audubon
Australian Science Index
Berichte der Deutschen Wissenschaftlichen Kommission fuer
 Meeresforschung
Bibliography and Index of Geology
Biological Abstracts
Bioresearch Index
Bioscience
British Birds
British Library. Lending Division. Index of Conference
 Proceedings Received
Bulletin of Environmental Contamination and Toxicology
Bulletin of Marine Science
Catalyst for Environmental Quality
Chemical Abstracts
Chemical and Engineering News
Chemical Engineering
Chemical Engineering Progress
Chemical Week
Chemistry in Canada
Chemosphere
Coastal Engineering
Coastal Zone Management Journal
Conservation News
Current Contents: Life Sciences
Current Contents: Physical and Chemical Sciences
Deep-Sea Research/Oceanographic Bibliography
Ecological Abstracts
Ecological Modelling
The Ecologist
Ecology Law Quarterly
Effluent & Water Treatment Journal
Energy Information Abstracts
Energy Review
The Engineering Index Monthly
Environment

Environment Abstracts
 Environment Reporter
 Environmental Action
 Environmental Conservation
 Environmental Geology
 Environmental Health and Pollution Control
 Environmental Management
 Environmental Periodicals Bibliography
 Environmental Pollution
 Environmental Research
 Environmental Science & Technology
 Environmental Technology and Economics
 EPA Environmental News
 EPA Reports Bibliography Quarterly
 ERDA Energy Research Abstracts
 Estuarine and Coastal Marine Science
 Fuel Abstracts and Current Titles
 Geochimica et Cosmochimica Acta
 Government Reports Announcements
 Groundwater
 Hydrocarbon Processing
 India Journal of Environmental Health
 Industrial Wastes Information Bulletin
 INTERDOK Directory of Published Proceedings
 International Aerospace Abstracts
 International Journal of Ecology and Environmental Science
 International Journal of Environmental Analytical Chemistry
 International Journal of Environmental Studies
 International Petroleum Abstracts
 Iranian Journal of Science and Technology
 The Journal of Applied Ecology
 Journal of Canadian Petroleum Technology
 Journal of Chromatography
 Journal of Environmental Science and Health, Part A
 Journal of Environmental Sciences
 Journal of the Institute of Water Pollution Control
 Journal of Petroleum Technology
 Journal of the Fisheries Research Board of Canada
 Journal of Toxicology and Environmental Health
 Limnology and Oceanography
 Marine Biological Association of the United Kingdom, Journal
 Marine Biology
 Marine Chemistry
 Marine Geology
 Marine Geotechnology
 Marine Policy
 Marine Pollution Bulletin
 Marine Pollution Research Titles
 Marine Science Contents Tables
 Marine Technology
 Marine Technology Society, Journal
 Maritime Research Information Service Abstracts
 Microbial Ecology
 National Fisherman
 National Research Council, News Report

National Wildlife
 Nature
 New Technical Books
 Nippon Susan Gakkai Shi. Bulletin of the Japanese Society of
 Scientific Fisheries
 Northwest and Alaska Fisheries Center Monthly Reports
 Ocean Engineering
 Ocean Industry
 Ocean Management
 Oceanic Abstracts
 Oceanographic Abstracts and Bibliography
 Oceanus
 Offshore
 Oil and Gas Journal
 Oil Spill Intelligence Report
 Outdoor California
 Pacific Oil World
 Petroleum Abstracts
 Petroleum Engineer International
 Petroleum Today
 Pollution Abstracts
 Pollution Engineering
 Proceedings in Print
 Progress in Water Technology
 Rapports et Proces Verbaux
 Resources
 Resource Recovery and Conservation
 Royal Society of London, Proceedings, Series B, Biological
 Sciences
 Science
 The Sciences
 Science News
 Science of the Total Environment
 Scientific and Technical Aerospace Reports
 Scientific Meetings
 Sea Frontiers
 Sea Secrets
 Sea Technology
 Selected Water Resources Abstracts
 Shore and Beach
 Spill Technology Newsletter
 Summaries of Foreign Government Environmental Reports
 Tanker Advisory Center Newsletter
 Technical Book Review Index
 Technology Review
 Toxicity Bibliography
 UDS Water Quality Control Digest
 Underwater Information Bulletin
 Underwater Naturalist
 Waste Materials Biodegradation Research Titles
 Water, Air and Soil Pollution
 Water & Pollution Control
 Water & Wastes Engineering
 Water Pollution Control Federation, Journal
 Water Research
 Western Fisheries

APPENDIX B
OIL POLLUTION ABSTRACTS--AVAILABILITY LISTING

OPA -current title: OIL POLLUTION ABSTRACTS
 OPR -former title: OIL POLLUTION REPORTS
 OSOPR-former title: OIL SPILL AND OIL POLLUTION REPORTS

TITLE	REPORT PERIOD	EPA ACCESSION NUMBER	NTIS ORDER NUMBER	PRICE	PAGES
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