OCS Study
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Coastal Marine Institute

Effects of Oil and Gas Development: A Current Awareness Bibliography

MMS U.S. Department of the Interior
Minerals Management Service
Gulf of Mexico OCS Region

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Preface

Effects of oil and gas development: A current awareness bibliography is the second cumulative bibliography created as part of the LUMCON-MMS University Research Initiative (URI) in 1990 with the aim of providing current awareness in all aspects of the URI. Nineteen quarterly issues were prepared from January 1990 to July 1994 that contained ~2,830 citations and were compiled into *Effects of offshore oil and gas development: A current awareness bibliography* (1994). Eleven quarterly issues were prepared from January 1995 to July 1997 that contained ~1,275 citations, and were compiled into *Effects of oil and gas development: A current awareness bibliography.*

The bibliography evolved from 1990 to 1994 in response to increased demand and MMS's changing needs. Initially, there were no subject divisions and circulation was relatively limited. Eventually, the bibliography was sent quarterly to over 300 patrons who have direct ties to or interest in the Minerals Management Service and coastal marine issues.

Denise Landry, LUMCON Librarian, compiled the first three issues of the bibliography. Ms. Landry's successor as LUMCON Librarian, Jacqueline Riley, prepared the October 1990 through January 1993 issues. Sue Ann Lewandowski, Ms. Riley's successor, prepared the April 1993 through October 1994 issues and edited the first cumulative bibliography. Ms. Lewandowski was succeeded by Chris Hooper-Lane, who compiled the January 1995 through April 1997 issues. Shanna Bonvillain, LUMCON Library paraprofessional, compiled the July 1997 issue with the assistance of Glenda Carter. Ms. Bonvillain also assisted in the compilation of all previous issues of the bibliography. The second cumulative bibliography was compiled by Shanna Bonvillain and Mr. Hooper-Lane's successor as LUMCON Librarian, Donna Rice.

The bibliography was compiled at the Louisiana Universities Marine Consortium's Marine Center Library (LUMCON Library) in Pro-Cite format on an IBM-compatible PC and uploaded to *Microsoft Word for Windows* for editing. The quarterly issues were formatted, photocopied, and mailed-out from the LUMCON Library.

Contained in the following bibliography are citations from approximately 1995 through 1997.

The citations are arranged by main entry, which is author, if known, and title if there is no acknowledged author or if the author's name was unavailable to the bibliographers. Corporate author citations were used whenever appropriate. The title main entry citations are listed at the beginning of each of the five sections followed by the author main entry citations.

The bibliography is alphabetized in an order represented by the example in Table 1.

Table 1. Example of Alphabetization. (The first few words of hypothetical citations are listed.)

1 tanker ...	LAB Laboratories	Nednor, G.
1a becomes the ...	LaBrea, L.	The next phase ...
96 sites ...	MacAllister, T.	Norton, J. C.
Abernathy, C.	MacPherson, A. J.	A novel plan ...
Al-Ahmed, M.	McMahon, S.	US Congress, Director ...
Albanny, P. K.	Manuel, A. T.	US Congress, Office of ...
Al-Sarif, B.	Manuel, A. T. D.	US Congress, Personnel ...
Axon Corporation	Manuel, J.	USA all the way ...
Bertram, D. J. M.	NAF database is ...	United Industries says ...
Bertram-Xavier, A.	NETCO cited in ...	
La Link, O.	Nash, C. S.	

Information that appears in square brackets, [], in a citation is tentatively correct. As much information as was available was included.

The majority of citations are to journal articles, books, book chapters, conference proceedings and papers in conference proceedings. A few audio-visual and electronic works are cited and their format is indicated, though the citations are not divided into sections by format.

The broad subject areas covered in the bibliography are biology, chemistry/geochemistry/geology, engineering/physics, environment/ecosystem management/spills, and socioeconomic/regulation/general.

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BIOLOGY

Al-Gounaim, M. Y.; Diab, A.; Al-Abdulla, R.; Al-Zamil, N. **Effects of petroleum oil pollution on the microbiological populations of the desert soil of Kuwait.** *Arab Gulf Journal of Scientific Research.* December 1995; 13(3):653-672; ISSN: 1015-4442.

Al-Hadhrami, M. N.; Lappin-Scott, H. M.; Fisher, P. J. **Bacterial survival and n-alkane degradation within *Omani* crude oil and a mousse.** *Marine Pollution Bulletin.* March 1995; 30(6):403-408; ISSN: 0025-326X.
Researchers studied the oil-degrading community of bacteria from contaminated sediments in the Gulf of Oman and their survival in an oil-water mousse. In the 50% oil-water mousse, *Pseudomonas aeruginosa* demonstrated long-term survival. In the 50% and 75% oil-water mousse, cfu's of *P. aeruginosa* remained level over 60 days. In a 90% mixture, the mousse failed to form and by day 10 no bacterial survival. Also, *P. aeruginosa* grown in a nutrient-rich broth resulted in higher oxidation and greater reduction of n-alkanes.

Albertini, R. J.; Nicklas, J. A.; O'Neill, J. P. **Future research directions for evaluating human genetic and cancer risk from environmental exposures.** *Environmental Health Perspectives.* May 1996; 104(Suppl. 3):503-510; ISSN: 0091-6765.
Biomarkers provide the basis for assessing human-genotoxicant interactions and may provide an indication of future disease risk. Researchers describe some aspects of biomarker assays, the use of susceptibility measures in biomonitoring protocols, and the need for evaluation of disease relevance.

Alkindi, A. Y. A.; Brown, J. A.; Waring, C. P.; Collins, J. E. **Endocrine, osmoregulatory, respiratory and haematological parameters in flounder exposed to the water soluble fraction of crude oil.** *Journal of Fish Biology.* December 1996; 49(6):1291-1305; ISSN: 0022-1112.
Researchers exposed flounder (*Pleuronectes flesus*) with an implanted vascular catheter to a 50% dilution of the water soluble fraction of crude oil, and from serial blood samples determined their endocrine status and the resultant physiological disturbances.

Alvarez Pineiro, M. E.; et al. **Aliphatic hydrocarbon levels in turbot and salmon farmed close to the site of the *Aegean Sea* oil spill.** *Bulletin of Environmental Contamination and Toxicology.* 1996; 57(5):811-815; ISSN: 0007-4861.
On December 3, 1992, the supertanker *Aegean Sea* ran aground outside the northern Spanish port of La Coruna spilling 60,000 tons of Brent oil. Researchers report on the variations over time of aliphatic hydrocarbon levels in turbot (*Scophthalmus maximus* L.) and the Atlantic salmon (*Salmo salar*) obtained from fish farms in close proximity to the site of this spill.

Amadi, A.; Abbey, S. D.; Nma, A. **Chronic effects of oil spill on soil properties and microflora of a rainforest ecosystem in Nigeria.** *Water Air and Soil Pollution.* January 1996; 86(1-4):1-11; ISSN: 0049-6979.

Anderson, D. A.; Gress, F.; Fry, D. M. **Survival and dispersal of oiled brown pelicans after rehabilitation and release.** *Marine Pollution Bulletin.* October 1996; 32(10):711-718; ISSN: 0025-326X.
Researchers studied the success of rehabilitating (cleaning and giving veterinary care) and releasing California brown pelicans exposed to oil spills. It was concluded that the oil and rescue treatments result in long-term injury, and that current efforts are not effective in restoring the pelicans to normal survivability.

Anderson, J. W.; Bothner, K.; Edelman, D.; Vincent, S.; Vu, T. P., and Tukey, R. H. **The use of human 101L cells as a biomarker, P450 RGS, for assessing the potential risk of environmental samples.** In: Blancato, J. N.; Brown, R. N.; Dary, C. C., and Saleh, M. A. Biomarkers for Agrochemicals and Toxic Substances. Washington, D.C.: American Chemical Society c1996 pp. 150-168. ISBN: 0-8412-3449-3.
The use of a reporter gene system as a rapid screening technique to estimate the Toxic Equivalent Factors (TEFs) for dioxins, PCBs, and PAHs in environmental samples is presented.

BIOLOGY

Anderson, J. W.; Rossi, S. S.; Tukey, R. H.; Vu, T.; Quattrochi, L. C. **A biomarker, P450 RGS, for assessing the induction potential of environmental samples.** *Environmental Toxicology and Chemistry.* July 1995; 14(7):1159-1169; ISSN: 0730-7268.
The authors describe the use and success of a transgenic cell line (reporter gene system from a human liver cancer cell) for the identification of toxic compounds in test solutions and various environmental samples.

Anderson, M. J.; Miller, M. R.; Hinton, D. E. **In vitro modulation of 17-B-estradiol-induced vitellogenin sythesis: effects of cytochrome P4501A inducing compounds on rainbow trout (*Oncorhynchus mykiss*) liver cells.** *Aquatic Toxicology.* April 1996; 34(4):327-350; ISSN: 0166-445X.
Various compounds with varying CYP1A1-inducing ability were tested for their effects on 17-B-estradiol induced Vg synthesis in primary cultures of rainbow trout liver cells. Researchers reported that estrogen responsiveness of the liver could be affected based on a CYP1A1-inducing compounds structure and/or concentration, which may cause fish to fail in normal sexual maturation or spawning periodicity, or fish to produce high levels of contaminated eggs.

Ankley, Gerald T.; Erickson, Russell J.; Sheedy, Barbara R.; Kosian, Patricia A.; Mattson, Vincent R.; Cox, Julie S. **Evaluation of models for predicting the phototoxic potency of polycyclic aromatic hydrocarbons.** *Aquatic Toxicology.* January 1997; 37(1):37-50. ISSN: 0166-445X.
Researchers evaluated previously developed models to predict the relative phototoxicity potency of polycyclic aromatic hydrocarbons (PAHs) through SARs and the interactive effects of variable light intensity and PAH dose on phototoxicity. *Lumbriculus variegatus* was exposed to various concentrations of pyrene, anthracene, fluorene, and fluoranthene for 96 hours. It was reported that based on tissue residue concentrations, anthracene and pyrene were four-fold more potent than fluoranthene, while fluorene was not phototoxic. These results agreed with the SAR model and the interactive toxicity model.

Antrim, L. D. and others. **Effects of petroleum products on bull kelp (*Nereocystis luetkeana*).** *Marine Biology.* 1995; 122(1):23-31.
The effects of three petroleum products (diesel fuel, intermediate fuel oil (IFO), crude oil) were tested before and after weathering on N. luetkeana. Experiments verified the susceptibility of the bull kelp tissue to the damaging effects of direct exposure to several oil types. Based on these experiments the relative ranking of the damaging effects are weathered diesel>unweathered IFO>unweathered diesel>weathered IFO>unweathered crude>weathered crude.

Armstrong, T. W.; Pearlman, E. D.; Schnatter, A. R.; Bowes, S. M.; Murray, N.; Nicolich, M. J. **Retrospective benzene and total hydrocarbon exposure assessment for a petroleum marketing and distribution worker epidemiology study.** *American Industrial Hygiene Association Journal.* April 1996; 57(4):333-343; ISSN: 0002-8894.
Researchers developed a quantitative exposure-estimating algorithm for benzene and total hydrocarbons, which is designed to quantify exposure retrospectively, for a case control study of workers associated with petroleum.

Atlas, R. M.; Cerniglia, C. E. **Bioremediation of petroleum pollutants - diversity and environmental aspects of hydrocarbon biodegradation.** *BioScience.* May 1995; 45(5):332-338; ISSN: 0006-3568.
The authors present a general description and historical treatment of the bioremediation of petroleum pollutants.

Atlas, Ronald. **Bioremediation of petroleum pollutants.** *International Biodeterioration and Biodegradation.* 1995; 35(1-3):317-327.
The author discusses and illustrates the state of petroleum bioremediation.

Banat, I. M. **Biosurfactants production and possible uses in microbial enhanced oil recovery and oil pollution remediation: a review.** *Bioresource Technology.* 1995; 51(1):1-12; ISSN: 0960-8524.
Biosurfactants are becoming increasingly prominent because of their biodegradability, production on renewable resources, and functionality under extreme conditions. However, conflicting reports exist concerning their efficacy and cost. The author presents a technological review of the successes and applications of biosurfactant production, recovery, use in oil control and clean-up.

BIOLOGY

Barber, Willard E. and others. **Effect of *Exxon Valdez* oil spill on intertidal fish: a field study**. *Transactions of the American Fisheries Society*. July 1995; 124461-476.
Researchers investigated the impact of the 1989 *Exxon Valdez* spill and cleanup activities on density, biomass, and species diversity of fish in Prince William Sound. In 1990 and 1991, fish were sampled from randomly-selected pairs of oiled-cleaned sites stratified by 3 habitat types. The presence of oil and subsequent cleanup activities had a negative impact on intertidal fishes in 1990, but there was evidence of recovery in 1991.

Baumann, P. C.; Harshbarger, J. C. **Decline in liver neoplasms in wild brown bullhead catfish after cooking plant closes and environmental PAHs plummet**. *Environmental Health Perspectives*. February 1995; 103(2):168-170; ISSN: 0091-6765.
Researchers studied the link between prevalence of liver cancer and polycyclic aromatic hydrocarbon (PAH) contamination. PAH in both sediment and brown bullhead catfish declined by 65% and 93%, respectively, between 1980 and 1982 in the Black River (Ohio). As a result of this, liver cancer in 3-4 year old brown bullhead catfish declined to 25% of the 1982 (39%) by 1987 (10%), while the percentage of livers without lesions double

Beckmann, M.; Hardege, J. D.; Zeeck, E. **Effects of the volatile fraction of crude oil on spawning behavior of nereids (*Annelida, polychaeta*)**. *Marine Environmental Research*. 1995; 40(3):267-276; ISSN: 0141-1136.
Volatile organic substances (VOS) in the volatility range inclusive of n-nonane and n-dodecane derived via fractionated distillation from crude oil and their effects were studied on *Platynereis dumerilii* and *Nereis succinea*. The authors reported that in behavioral tests, ripe male heteronereids of both species were effected (induced spawning behavior), while no behavioral effects were observed in females.

Beiras, R.; His, E. **Toxicity of fresh and freeze-dried hydrocarbon-polluted sediments to *Crassostrea gigas* embryos**. *Marine Pollution Bulletin*. January 1995; 30(1):47-49; ISSN: 0025-326X.
Fresh and freeze-dried sediments from a hydrocarbon-polluted site were used in liquid and suspended phase bioassays with *Crassostrea gigas* oyster embryos. Results indicated fresh sediments had no effect on embryogenesis while freeze-dried sediments did halt embryogenesis. Freeze-dried sediments were also found to be innocuous in the liquid phase bioassay, but appeared to reduce embryogenesis success in the suspended phase bioassay.

Belkin, S.; Stieber, M.; Tiehm, A.; Frimmel, F. H.; Abeliovich, A.; Werner, P.; Ulitzur, S. **Toxicity and genotoxicity enhancement during polycyclic aromatic hydrocarbons biodegradation**. *Environmental Toxicology and Water Quality*. November 1994; 9(4):303-309; ISSN: 1053-4725.
Several laboratory column percolators were utilized to study the bioremediation potential of polycyclic aromatic hydrocarbons-contaminated soils. In each case, the elimination of the original contaminants was accompanied by an increase in genotoxic activity of the column effluents as determined by the Mutatox assay. Researchers concluded that when the biodegradation is incomplete, it is possible for toxicity and genotoxicity enhancement, with the latter not necessarily predictable by short-term toxicity assays.

Bener, A.; Gomes, J.; Hamouda, M. F. B. **Hypertension among workers occupationally exposed to hydrocarbons and organic solvents**. *Journal of Environmental Science and Health Part A - Environmental Science and Engineering & Toxic and Hazardous Substance Control*. 1996; 31(2):291-303; ISSN: 1077-1204.
Researchers determined the possible risk factors associated with hypertension among workers occupationally exposed to gasoline vapors. Results indicated that dizziness, weakness, tiredness, and general malaise was more frequently reported in the exposed group (chronic hydrocarbon exposure) than the control group. Also, 71.4% of the exposed group and 28.6% of the control group were reported to have taken some form of medication from high blood pressure.

BIOLOGY

Bertrand, J. C.; Bonin, P.; Goutx, M.; Mille, G. **Biosurfactant production by marine microorganisms: potential application to fighting hydrocarbon marine pollution.** *Journal of Marine Biotechnology.* 1993; 1(3):125-129; ISSN: 0941-2905.
Authors present a discussion on the role of biosurfactants produced by bacterial strains in hydrocarbon biodegradation at sea, including the environmental and financial implications of their use.

Bilger, B. **Gut reaction: a remedy for oil spills may live inside the stomach of a whale.** *Sciences.* November-December 1994; 34(6):12-13; ISSN: 0036-861X.
A brief discussion of Morrie Craig's (Oregon State University) research regarding the oceanic pollution-neutralizing bacteria found in whale stomachs, which could be highly useful in oil spill cleanup.

Birtwell, I. K.; Fink, R.; Alexander, R.; Bengeyfield, W.; McAllister, C. D. **Survival of pink salmon** (*Oncorhynchus gorbuscha*) to adult following 10-d exposure of fry to the water soluble fraction of North Slope crude oil. *Canadian Technical Report of Fisheries and Aquatic Sciences.* 1996; 57 p.; ISSN: 0706-6457.

Bjork, M. **Bioavailability and uptake of hydrophobic organic contaminants in bivalve filter-feeders.** *Annales Zoologici Fennici.* 1995; 32(3):237-245; ISSN: 0003-455X.
The author presents a review of the many factors involved in the uptake of polycyclic aromatic hydrocarbons and polychlorinated biphenyls in bivalve filter-feeders, including the environmental distribution of these contaminants.

Blancato, J. N.; Brown, R. N.; Dary, C. C., and Saleh, M. A. **Biomarkers for Agrochemicals and Toxic Substances.** Washington, D.C.: American Chemical Society c1996 282 p. ISBN: 0-8412-3449-3.
Developed from work presented at the 1995 meeting of the American Chemical Society, this monograph focuses on measurement techniques, applications, and the interpretation of results.

Bleckmann, C. A.; Rabe, B.; Edgmon, S. J.; Fillingame, D. **Aquatic toxicity variability for fresh- and saltwater species in refinery wastewater effluent.** *Environmental Toxicology and Chemistry.* 1995; 14(7):1219-1223; ISSN: 0730-7268.
Test requirements for toxicity reduction or toxicity identification evaluation (TIE) of wastewater effluents have been established. Researchers report the results of an investigation of potential freshwater surrogate species, and Microtox registered, for use in TIE. Five species were tested with mysid shrimp being the most sensitive, although the two marine species specified in the effluent permit were more sensitive to the effluent toxicants than the freshwater species.

Borchert, J.; Karbe, L.; Westendorf, J. **Uptake and metabolism of benzo(a)pyrene absorbed to sediment by the freshwater invertebrate species *Chironomus riparius* and *Sphaerium corneum*.** *Bulletin of Environmental Contamination and Toxicology.* January 1997; 58(1):158-165. ISSN: 0007-4861.
Researchers demonstrated that sediment bound benzo(a)pyrene is bioavailable to the European fingernail clam *S. corneum* and the midge larvae *C. riparius*, two sediment inhabiting organisms, and benzo(a)pyrene is metabolized to potentially genotoxic substances.

Borowsky, B.; Aitkenander, P.; Tanacredi, J. T. **Changes in reproductive morphology and physiology observed in the amphipod crustacean, *Melita nitida* Smith, maintained in the laboratory on polluted estuarine sediments.** *Journal of Experimental Marine Biology and Ecology.* July 1, 1997; 214(1-2):85-95. ISSN: 0022-0981.
A controlled comparison study was conducted on amphipod crustacean *Melita nitida* Smith, with sediments contaminated with petroleum by-products, crankcase oil, and other toxic substances. This experiment was used to determine female physiological and morphological abnormalities. Brood production was reduced on polluted sediments, and a greater percentage of females on polluted sediments produced abnormal brood plate setae.

BIOLOGY

Borseth, J. F. and others. **Transmembrane sodium energy gradient and calcium content in the adductor muscle of *Mytilus edulis L.* in relation to the toxicity of oil and organic chemicals.** *Aquatic Toxicology*. March 1995; 31(3):263-276; ISSN: 0166-445X.
The electrochemical potential difference of sodium (sodium gradient) across cell membranes is the source of energy for many cellular functions. The authors report that a number of organic chemical compounds (oil, oil dispersants, formaldehyde, and benzene) can cause the value of the gradient to decrease below normal, which can lead to death among animals.

Bowman, T. D.; Schempf, P. F.; Bernatowicz, J. A. **Bald eagle survival and population dynamics in Alaska after the *Exxon Valdez* oil spill.** *Journal of Wildlife Management*. April 1995; 59(2):317-324; ISSN: 0022-541X.
Age-specific annual survival rates for 159 bald eagles (*Haliaeetus leucocephalus*) radiotagged from 1989 - 1992 in Prince William Sound (PWS) were investigated. Researchers found no difference in the survival rates of eagles tagged in the oiled vs. the unoiled areas of PWS, and no indication that survival of bald eagles radiotagged less than 4 months after the oil spill was directly influenced by the spill. Also, researchers predicted the bald eagle population would return to its pre-spill numbers by 1992.

Bowyer, R. T.; Testa, J. W.; Faro, J. B. **Habitat selection and home ranges of river otters in a marine environment: effects of the *Exxon Valdez* oil spill.** *Journal of Mammalogy*. February 1995; 76(1):1-11; ISSN: 0022-2372.
The habitat selection and home ranges of river otters (*Lutra canadensis*) along the coast of Prince William Sound following the *Exxon Valdez* oil spill were examined. Researchers reported: the amount of feces at heavily oiled latrine sites by otters were significantly less than for non-oiled sites in Herring Bay in June and July, but not in August 1989; habitat selection differed significantly on oiled and non-oiled study areas in 1990; and home ranges of otters residing in the oiled areas were twice the size of those in the non-oiled areas.

Bowyer, R. T.; Testa, J. W.; Faro, J. B.; Schwartz, C. C.; Browning, J. B. **Changes in diets of river otters in Prince William Sound, Alaska: effects of the *Exxon Valdez* oil spill.** *Canadian Journal of Zoology*. June 1994; 72(6):970-976; ISSN: 0008-4301.
Studied were the effects of the *Exxon Valdez* oil spill on the diets of the river otters, **Lutra canadensis**, from oiled and non-oiled areas of Prince William Sound in 1989 and 1990. Using prey remains in the feces, the researchers reported significant diet changes resulting from declines in richness and diversity of prey species.

Braddock, J. F.; Lindstrom, J. E.; Brown, E. J. **Distribution of hydrocarbon-degrading microorganisms in sediments from Prince William Sound, Alaska, following the *Exxon Valdez* oil spill.** *Marine Pollution Bulletin*. February 1995; 30(2):125-132; ISSN: 0025-326X.
Over a three year period following the *Exxon Valdez* oil spill, researchers counted the number of hydrocarbon-degrading microorganisms in the intertidal and subtidal sediments in the area of the spill. Found were significantly higher numbers of hydrocarbon-degrading microorganisms in the oil spill areas than at other reference points. Also, a temporal increase in hydrocarbon-degrading microorganisms were found in offshore surface sediments.

Bradley, Paul M.; Chapelle, Francis H. **Rapid toluene mineralization by aquifer microorganisms at Adak, Alaska: implications for intrinsic bioremediation in cold environments.** *Environmental Science and Technology*. 1995; 29(11):2778-2781; ISSN: 0013-936X.
Compared were petroleum hydrocarbon-contaminated aquifers in Adak, Alaska (5°C) and Hanahan, SC (20°C). Results indicated toluene was mineralized at a comparable rate at both locations. This, argue the authors, should provide the impetus to reevaluate the notion that biodegradation rates are depressed in colder groundwater systems.

BIOLOGY

Bresler, V.; Fishelson, L. **Microfluorometrical study of bioaccumulation of benzo<a>pyrene and marker xenobiotics in the bivalve *Donax trunculus* from clean and polluted sites along the Mediterranean shore of Israel**. *Diseases of Aquatic Organisms*. August 25, 1994; 19(3):193-202; ISSN: 0177-5103.
Studied was the bioaccumulation of benzo(a)pyrene [B(a)P] from a polluted environment and two xenobiotic markers [acridine orange (AO), fluorescein (FLU)] in organs of the marine bivalve *Donax trunculus*. Molluscs were collected at three sites of varying pollution levels along the Israeli Mediterranean shore and tested under experimental conditions. The authors concluded the observed bioaccumulation of B(a)P, AO and FLU reflects the environmental quality; therefore can be utilized for biomonitoring.

Bridges, T. S.; Levin, L. A.; Cabrera, D.; Plaia, G. **Effects of sediment amended with sewage, algae or hydrocarbons on growth and reproduction in two opportunistic polychaetes**. *Journal of Experimental Marine Biology and Ecology*. 1994; 177(1):99-119.
The reproductive and growth responses of *Streblospio benedicti* and *Capitella sp.* to immersion in three varieties of amended sediments were studied.

Brody, A. J.; Ralls, K.; Siniff, D. B. **Potential impact of oil spills on California sea otters: implications of the *Exxon Valdez* spill in Alaska**. *Marine Mammal Science*. January 1996; 12(1):38-53; ISSN: 0824-0469.
Researchers studied the survival rate of otters by developing two models of otter mortality -- one based on distance from the spill and the other based on time from the spill origin. Using these models, researchers simulated an oil spill (*Exxon Valdez* size) at various locations along the California coast. From these simulations researchers reported that attempts to rehabilitate otters after a spill should cease 20-30 d after a spill. Also, a spill at the Monterey Peninsula would have the largest impact (exposing 90% of the California sea otter population to oil and killing at least 50%).

Brown, E. D.; Norcross, B. L.; Short, J. W. **An introduction to studies on the effects of the *Exxon Valdez* oil spill on early life history stages of Pacific herring, *Clupea pallasi*, in Prince William Sound, Alaska**. *Canadian Journal of Fisheries and Aquatic Sciences*. October 1996; 53(10):2337-2342. ISSN: 0706-652X.
A review of Pacific herring damage assessment studies designed to investigate the effects of the *Exxon Valdez* oil spill.

Burgeot, T.; Bocquene, G.; Pingray, G.; Godefroy, D.; Legrand, J.; Dimeet, J.; Marco, F.; Vincent, F.; Henocque, Y.; Jeanneret, H. O.; Galgani, F. **Monitoring biological effects of contamination in marine fish along French coasts by measurement of ethoxyresorufin-o-deethylase activity**. *Ecotoxicology and Environmental Safety*. November 1994; 29(2):131-147; ISSN: 0147-6513.
A description of the use of the biomarker ethoxyresorufin-0-deethylase (EROD), an enzymatic biomarker to monitor and assess the effects on the marine ecosystem during prolonged exposure to specific pollutants such as polyaromatic hydrocarbons.

Burgeot, T.; Bocquene, G.; Porte, C.; Dimeet, J.; Santella, R. M. **Bioindicators of pollutant exposure in the northwestern Mediterranean Sea**. *Marine Ecology Progress Series*. February 1996; 131(1-3):125-141; ISSN: 0171-8630.
At sites exposed to industrial wastes, researchers tested the bioindicators recommended by the International Council for the Exploration of the Sea and MED-POL for monitoring the environment.

Burgeot, T.; Galgani, F. **La surveillance des effects biologiques des polluants sur les cotes Francaises (Monitoring of pollutants biological effects along the French coasts)**. *Oceanis*. 1994; 20(3):79-88.
A discussion on the use of ethoxyresorufin-O-deethylase (EROD) activity in several species of fish as a monitor for pollutants in the Baie de Seine and Fos-sur-Mer/Marseille.

BIOLOGY

Burridge, Trevor R.; Shir, Mary-Anne. **The comparative effects of oil dispersants and oil/dispersant conjugates on germination of the marine macroalga *Phyllospora comosa* (*Fucales: Phaeophyta*).** *Marine Pollution Bulletin.* April-December 1995; 31(4-12):446-452; ISSN: 0025-326X.
Germination inhibition of the *macroalga P. comosa* was used to examine and compare the effects of four oil dispersants and dispersed diesel fuel and crude oil combinations. Results indicated that inhibition by the WSF of diesel fuel increased after the addition of each dispersant. However, with crude oil, the addition of two dispersants enhanced the germination rate .

Cajaraville, M. P.; Abascal, I.; Etxeberria, M.; Marigomez, I. **Lysosomes as cellular markers of environmental pollution: time-dependent and dose-dependent responses of the digestive lysosomal system of mussels after petroleum hydrocarbon exposure.** *Environmental Toxicology and Water Quality.* February 1995; 10(1):1-8; ISSN: 1053-4725.
Researchers examine the effects of petroleum hydrocarbons on lysosomes in mussel (*Mytilus galloprovincialis*) digestive cells with respect to exposure dosage and length of exposure. Results indicate that the effect of the exposure dose on lysosomic structure is variable and without linear relationship to dosage amount. Regarding the effect of exposure time, two responses were reported: (a) a short-term response with decrease in lysosomic size and numbers and (b) a long-term response with an increase in lysosomic size and a decrease in numbers.

Caldwell, C. A. **Aromatic hydrocarbon pathology in fish following a large spill into the Nemadji River, Wisconsin, USA.** *Bulletin of Environmental Contamination and Toxicology.* April 1997; 58(4):574-581. ISSN: 0007-4861.
In June of 1992, 114,000 L of aromatic hydrocarbons spilled into the Nemadji River causing extensive damage to aquatic life. Fishes that survived the spill were examined 7 days post-exposure and compared to fishes collected from a reference site. Histopathological analyses concluded that exposed fishes displayed an increase in basal hyperplasia, fusion of lamellar epithelia, excess mucous production, and swollen lamellae. Such abnormalities were not present in fish from the reference site. However, no differences were found in the liver, spleen, and head kidney when comparing the exposed fish to fish from the reference site.

Cameron, P.; Berg, J.; Von Westernhagen, H. **Biological effects monitoring of the North Sea employing fish embryological data.** *Environmental Monitoring and Assessment.* 1996; 40(2):107-124.
Developed is a method to use live, naturally spawned fish embryos from plankton samples for biological effects monitoring. Researchers sampled and examined fish eggs from surface waters from 1985-92. Elevated embryo malformation rates were detected in the plume of the Elbe and Rhine, and along the eastern coast of England. This suggests that the malformations are most-likely pollution-related, and therefore can be utilized to identify areas of environmental contamination.

Carman, K. R. and others. **Experimental Investigation of the Effects of Aromatic Hydrocarbons on a Sediment Food Web.** New Orleans: Minerals Management Service; 1994; OCS Study, MMS 94-0033. 89 p.

Carman, K. R.; Todaro, M. A. **Influence of polycyclic aromatic hydrocarbons on the meiobenthic-copepod community of a Louisiana salt marsh.** *Journal of Experimental Marine Biology and Ecology.* June 1, 1996; 198(1):37-54; ISSN: 0022-0981.
Utilizing microcosms of sediment containing natural marine faunal assemblages, researchers examined the effects of PAH-contaminated sediment on the meiobenthic copepod community of a Louisiana salt marsh. Results indicated that relatively low levels of PAH contamination may impact copepod community structure, which may not be detected at the level of higher taxon.

BIOLOGY

Carman, Kevin R.; Fleeger, John W.; Means, Jay C.; Pomarico, Steven M.; McMillin, Debra J. **Experimental investigation of the effects of polynuclear aromatic hydrocarbons on an estuarine sediment food web.** *Marine Environmental Research.* 1995; 40(3):289-318; ISSN: 0141-1136.
Using a microcosm system, researchers examined the effects polynuclear aromatic hydrocarbons (PAHs) have on a benthic sedimentary salt-marsh food web. Sub-lethal concentrations of PAH-contaminated sediment were added to the microcosms. Results indicated that bacterial activity, physiological condition and abundance were not affected, but microalgal activity and physiological conditions were. Overall, however, sublethal effects of PAH were not pronounced at the concentrations examined. Researchers suggested that this result may have been caused by the chronic contamination of the test area (coastal Louisiana) where sedimentary microbial/meiofaunal community may have adapted to the high levels of PAH

Carr, R. S.; Chapman, D. C.; Presley, B. J.; Biedenbach, J. M.; Robertson, L.; Boothe, P.; Kilada, R.; Wade, T.; Montagna, P. **Sediment porewater toxicity assessment studies in the vicinity of offshore oil and gas production platforms in the Gulf of Mexico.** *Canadian Journal of Fisheries and Aquatic Sciences.* November 1996; 53(11):2618-2628. ISSN: 0706-652X.
Researchers conducted sediment chemical analyses and porewater toxicity tests in areas surrounding five offshore platforms. Using data from sea urchin fertilization and embryo development tests, researchers reported that toxicity was observed from four of the five platforms. However, the majority of the toxic samples were collected within 150 meters of the platforms, thus suggesting that the toxic impacts of the platforms may be localized to areas immediately surrounding the platforms.

Celander, Malin; Broman, Dag; Förlin, Lars; Näf, Carina. **Effects of petroleum hydrocarbons on the hepatic cytochrome P450 1A system in rainbow trout.** *Marine Environmental Research.* 1995; 39(1-4):61-65; ISSN: 0141-1136.
Investigated were the effects of kerosene, light gas oil or heavy gas oil on the hepatic cytochrome P450 1A system of juvenile rainbow trout. Kerosene treatment resulted in no effect, light gas oil caused a weak induction of ethoxyresorufin-0-deethylase (EROD), and heavy gas oil resulted in a significant induction of EROD activities as well as an accumulation of CYP1A mRNA and P450 1A protein levels. These effects of heavy gas oil were then compared with effects of a-napthoflavone on the P450 1A system and important discrepencies were found.

Cheah, D. M. Y.; Wright, P. F. A.; Holdway, D. A.; Ahokas, J. T. **Octopus pallidus cytochrome P-450: characterization and induction studies with á-naphthoflavone and Aroclor 1254.** *Aquatic Toxicology.* October 1995; 33(3-4):201-214; ISSN: 0166-445X.
Investigators examined cytochrome P-450 and related enzyme activity in Octopus pallidus to assess their potential for use as a biomarker of contaminant exposure.

Cherr, G. N. and others. **Assessment of Chronic Toxicity of Petroleum and Produced Water Components to Marine Organisms**, Final Study Report, Project 6. Camarillo, California: Minerals Management Service; 1993; OCS Study, MMS 94-0035. 129 p.

Christiansen, J. S.; George, S. G. **Contamination of food by crude oil affects food selection and growth performance, but not appetite, in an Arctic fish, the polar cod (*Boreogadus saida*).** *Polar Biology.* 1995; 15(4):277-281.
Researchers used x-radiography to test the effects of crude oil on the food consumption of sexually mature polar cod. Results indicated that although the contaminated foods did not reduce the overall appetite levels of the fish, factors such as sex and individual appetite did influence the food selection -- male fish selected uncontaminated food when appetite was low, whereas females selected both contaminated and uncontaminated foods equally, regardless of appetite level. It was also reported (a) the ingestion of contaminated food resulted in a significant reduction in growth in both sexes, (b) food contaminated with a concentration greater than 550 ppm was completely rejected.

BIOLOGY

Christie, H.; Berge, J. A. **In situ experiments on recolonization of intertidal mudflat fauna to sediment contaminated with different concentrations of oil.** *Sarsia.* 1995; 80(3):175-185; ISSN: 0030-1388.
On a mudflat in Norway, researchers tested the recolonization response of intertidal mudflat fauna to oil contaminated sediment. It was reported that the majority of the most common species showed diminishing densities as the oil concentration increased. Also, differences in tolerances were found among different species.

Chu, F. L. E.; Hale, R. C. **Relationship between pollution and susceptibility to infectious disease in the eastern oyster, *Crassostrea virginica*.** *Marine Environmental Research.* 1994; 38(4):243-256; ISSN: 0141-1136.
The effect of a complete mixture of sediment derived pollutants on the susceptibility of the eastern oyster, *Crassostrea virginica*, to the infectious disease caused by the protozoan parasite *Perkinsus marinus* was studied. Researchers found that pollutant exposure enhanced preexisting infections and increased the oysters' susceptibility to experimentally induced infections.

Controversy over the *Nakhodka* oil spill. *Marine Pollution Bulletin.* April 1997; 34(4):225. ISSN: 0025-326X.
The effects of the break up of the Russian tanker, *Nakhodka*, off the coast of Japan's Oik Island are still being disputed. The Japanese Science & Technology Agency estimated 6000 t of oil spilled in the sea. Although the small tidal range in this region limited oil damage to the intertidal zone, the Japanese Wildlife Organization still concluded that waterfowl species found dead, or died later at rescue centers, were victims of the spill. Effects on scallops, oysters and seaweed were reported at mariculture facilities. The Japanese Government has not prohibited fishing in this area. However, the local fishermen implemented a voluntary ban.

Coppock, R. W.; Mostrom, M. S.; Khan, A. A.; Semalulu, S. S. **Toxicology of oil field pollutants in cattle: a review.** *Veterinary and Human Toxicology.* December 1995; 37(6):569-576; ISSN: 0145-6296.

Cripps, G. C.; Priddle J. **Hydrocarbon content of an Antarctic infaunal bivalve - historical record or life cycle changes.** *Antarctic Science.* 1995; 7(2):127-136.
Researchers assessed the use of the Antarctic bivalve *Yoldia eightsi* as a hydrocarbon monitor species. Results indicated that the bivalve was not suitable to monitor low levels of polycyclic aromatic hydrocarbons (PAH). This was based on inconsistencies in PAH concentration as a result of seasonal variations and age of the bivalve.

D'Adamo, R.; Pelosi, S.; Trotta, P.; Sansone, G. **Bioaccumulation and biomagnification of polycyclic aromatic hydrocarbons in aquatic organisms.** *Marine Chemistry.* February 1997; 56(1-2):45-49. ISSN: 0304-4203.
Researchers assessed polycyclic aromatic hydrocarbon uptake and degradation in the laboratory using tanks consisting of microalga (*Dunaliella tertiolecta*), mussel (*Mytilus galloprovincialis*), and seabass (*Dicentrarchus labrax*). Benzo(a)pyrene and *7,12*-dimethyl benz(a)anthracene were added to the tanks and samples were taken on 10 day intervals to obtain bioaccumulation levels of the toxicants and the physiological response of the enzymatic systems of each organism. Results indicated that in mussels both toxicants are bioaccumulated, whereas in seabass, little, if any, quantities were found.

Daan, Rogier; Mulder, Maarten;Van Leeuwen, Anja. **Differential sensitivity of macrozoobenthic species to discharges of oil-contaminated drill cuttings in the North Sea.** *Netherlands Journal of Sea Research.* December 1994; 33(1):113-127.
Since 1985 in the Dutch sector of the North Sea, eleven surveys were conducted at well sites where oil-based drilling muds had been used, and four where water-based muds had been used. The authors present results of a data analysis of these, illuminating how a number of macrobenthic species respond to either of the two types of muds, and which species are most sensitive indicators of environmental stress resulting from oil-based drilling mud discharge.

BIOLOGY

Danovaro, R.; Fabiano, M.;Vincx, M. **Meiofauna response to the *Agip Abruzzo* oil spill in subtidal sediments of the Ligurian Sea.** *Marine Pollution Bulletin.* February 1995; 30(2):133-145; ISSN: 0025-326X.
The effects of the *Agip Abruzzo* oil spill on meiofauna in the Gulfo Marconi were investigated. Researchers sampled the structure of meiofaunal assemblages before (January 1991) and after (January 1992) the April 1991 oil spill. Results indicated meiofaunal sensitivity to hydrocarbon stress, as an observable decrease in density was seen following the spill. Specifically, nematode, turbellarian, and foraminiferan densities significantly declined, while copepod densities were not affected by the spill.

Day, Robert H.; Murphy, Stephen M.; Wiens, John A.; Hayward, Gregory D.; Harner, E. James; Smith, Louise N. **Effects of the *Exxon Valdez* oil spill on habitat use by birds in Pince William Sound, Alaska.** *Ecological Applications.* May 1997; 7(2):593-613. ISSN: 1051-0761.
A 2.5 year study on the use of oil affected habitats followed the *Exxon Valdez* oil spill in Prince William Sound, Alaska, documenting clear initial negative impacts, extensive ecological overlaps, and a significant relationship between the abundance of a species and values along the oiling gradient.

De Vogelaere, A. P.; Foster, M. S. **Damage and recovery in intertidal Fucus gardneri assemblages following the *Exxon Valdez* oil spill.** *Marine Ecology Progress Series.* 1994; 106(3):263-271.
After the *Exxon Valdez* oil spill in Prince William Sound, Alaska, in 1989, initial damage and subsequent recovery of the upper margin of the *Fucus gardneri* assemblage was examined. The *F. gardneri* assemblage sites were compared with other sites with various levels of oil contamination and those that were either cleaned intensively or less intensively.

Dhabi Abu. The role of state oil companies. *Oil and Gas Journal.* August 1993; 92(33):62-65; ISSN: 0030-1388.
An overview of Abu Dhabi National Oil Company (Adnoc) is presented.

Dott, W.; Feidieker, D.; Steiof, M.; Becker, P. M.; Kampfer, P. **Comparison of ex situ and in situ techniques for bioremediation of hydrocarbon-polluted soils.** *International Biodeterioration and Biodegradation.* 1995; 35(1-3):301-316; ISSN: 0964-8305.
A summary of the results from three field studies: an in situ bioremediation on a hydrocarbon-contaminated site, an on-site ex situ treatment of subsoil on this site, and an in situ reclamation of a site contaminated with chlorinated organic compounds.

Dubinsky, Z.; Stambler, N. **Marine pollution and coral reefs.** *Global Change Biology.* 1996; 2(6):511-526; ISSN: 1354-1013.
The major anthropogenic inputs into coral reef ecosystems, the evidence of coral reef damage resulting from these inputs, as well as the mechanisms of action are reviewed. Inputs discussed include nutrient enrichment, sewage disposal, sedimentation, oil-related pollution, metal and thermal pollution.

Dujimov, J.; Sucevic, P.; Tonkovic, M. **Ratio between PAH content in fish -- striped mullet and sediments in the eastern Adriatic Sea.** *Toxicological and Environmental Chemistry.* 1994; 46(1-2):73-80; ISSN: 0277-2248.
Researchers analyzed samples of striped mullet and sediments gathered along the eastern Adriatic coast for polycyclic aromatic hydrocarbon content. The ratio between the values found in the sediments and in the striped mullet was calculated to obtain an indication of the fate of these contaminants.

Dyrynda, E. A.; Law, R. J.; Dyrynda, P. E. J.; Kelly, C. A.; Pipe, R. K.; Graham, K. L.; Ratcliffe, N. A. **Modulations in cell-mediated immunity of *Mytilus edulis* following the *Sea Empress* oil spill.** *Journal of the Marine Biological Association of the United Kingdom.* February 1997; 77(1):281-284. ISSN: 0025-3154.
Researchers compared the immunity and hydrocarbon levels in the mussel, *Mytilus edulis*, from unoiled sites and sites contaminated by the *Sea Empress* spill. Comparisons revealed significant modulations in cell-mediated immunity. However, after 11 weeks the immune response of the contaminated organisms returned to a level comparable to those collected at unoiled sites and by then the total hydrocarbon content declined by 70-90%, while the PAH content declined by more than 90%.

BIOLOGY

Eberhardt, L. L.; Garrott, R. A. **Sea otter mortality from the *Exxon Valdez* oil spill: Evaluation of an estimate from boat-based surveys - response.** *Marine Mammal Science.* April 1997; 13(2):351-354. ISSN: 0824-0469.
This paper reports on the discrepancies in both the data and treatment of data that were used to estimate spill-related otter mortality before and after the *Exxon Valdez* oil spill. The paper provides recommendations for future efforts in obtaining and managing data.

Eie, Knut. **Using ELASTOL for cleaning oil invested birds.** *Spill Science and Technology Bulletin.* March 1995; 2(1):79-80; ISSN: 1353-2561.
The author reports on the use of ELASTOL on 53 birds infested with fuel oil and concluded that the use of ELASTOL is far more effective than soaps and detergents, primarily because ELASTOL binds to the oil only and can be rinsed out by showering without reducing the natural impregnation of the feathers.

Ekundayo, J. A.; Benka-Coker, M. O. **Effects of exposure of aquatic snails to sublethal concentrations of waste drilling fluid.** *Environmental Monitoring and Assessment.* 1994; 30(2):291-297.
Static bioassays were carried out using two aquatic snails (*Pilia sp. and Lanistes sp.*) in soft natural dilution water and waste drilling fluid as the test material. Comparison of results for the control and varying concentrations of the waste drilling fluid were made by utilizing the F-statistic method. Results indicated that the waste drilling fluid had no toxic effects on the snails.

Electric fish monitors pollution. *Marine Pollution Bulletin.* May 1996; 32(5):389; ISSN: 0025-326X.
Le Centre de l'Eau de Nancy (NANCIE) in France has developed a method of using the tropical fish Apteronotus albifrons, which monitors its environment by emitting electric pulses, as a surface water pollution detector.

Ellis, M. S.; Wilson-Ormond, E. A.; Powell, E. N. **Effects of gas-producing platforms on continental shelf macroepifauna in the northwestern Gulf of Mexico: abundance and size structure.** *Canadian Journal of Fisheries and Aquatic Sciences.* November 1996; 53(11):2589-2605. ISSN: 0706-652X.
Researchers studied the macroepifauna collected at sites near (50-100 m) and distant (3 km) to three active gas-producing platforms in the Gulf of Mexico. It is reported that general responses to the presence of platform structures were not observed, and the catch-per-unit-effort was site specific; that is, the macroepifauna responded to each site unique to the physical and chemical characteristics of that site.

Emery, V. L. Jr.; Dillon, T. M. **Chronic toxicity of phenanthrene to the marine polychaete worm, *Nereis (Neanthes) arenaceodentata*.** *Bulletin of Environmental Contamination and Toxicology.* 1996; 56(2):265-270; ISSN: 0007-4861.
Researchers investigated the chronic sublethal effects of phenanthrene on the polychaete worm. Growth and reproduction data were gathered over an 8 week period of chronic exposure. Results indicated that phenanthrene significantly affected worm growth and reproduction through reduced feeding induced by non-specific narcosis.

Espeche, Maria E.; MacCormack, Walter P.; Fraile, Elda R. **Factors affecting growth of an n-hexadecane degrader Acinetobacter species isolated from a highly polluted urban river.** *International Biodeterioration and Biodegradation.* 1994; 33187-196; ISSN: 0964-8305.
Researchers isolated 33 strains of Gram negative bacteria with the ability to grow on n-hexadecane from a hydrocarbon-polluted river. One of these strains (B2-2) was evaluated using several factors (temperature, pH, inoculum size, effect of the presence of yeast extract and n-hexadecane). Researchers reported the optimal conditions as: pH 7.5, 25°C and an initial concentration of .5% of n-hexadecane. This resulted in 82% of the hydrocarbon degraded after 50 hours and 90% degraded after 124 hours.

BIOLOGY

Ewa-Oboho, I. O.; Abby-Kalio, N. J. **Effects of simulated oil exposure on two intertidcl macrozoobenthos: Tympanotonus fuscata (L.) and Uca tangeri (Eydoux, 1935) in a tropical estuarine ecosystem.** *Ecotoxicology and Environmental Safety* . 1994; 28(3):232-243; ISSN: 0147-6513.
The effects *of Nigerian light crude oil on mud fnat periwinkles (T. fuscata) and fiddler crabs (U.* tangeri) were examined through field experiments conducted in the Bonny estuary on the Niger Delta (southern Nigeria). The authors reported that drastic changes in the densities of each organism observed immediately after the spills were attributed to the effects of the oil, not salinity or temperature, which showed little fluctuation through the study. Also, the migration of oil via tidal percolation was observed as much as 11 cm beneath the sediment surface.

Fan, C. Y.; Krishnamurthy, S. **Enzymes for enhancing bioremediation of petroleum-contaminated soils: a brief review.** *Journal of the Air & Waste Management Association.* June 1995; 45(6):453-460; ISSN: 1047-3289.
The authors examine the biological treatment technologies for cleaning up petroleum-contaminated soils, with an emphasis on microbial enzyme systems for increasing the rate of biodegradation of petroleum hydrocarbons. In addition examined are the weathering effect on biodegradation, the different types of hydrocarbon-degraders, enzyme usage, enzyme extraction, and future research needs.

Fayad, N. M.; El-Mubarak, A. H.; Edora, R. L. **Fate of oil hydrocarbons in fish and shrimp after major oil spills in the Arabian Gulf.** *Bulletin of Environmental Contamination and Toxicology.* 1996; 56(3):475-482; ISSN: 0007-4861.
Following the 1983 *Nowruz* oil spill and the 1991 Gulf War oil spills, a comprehensive study was conducted to assess the effects of the spill on fish from the Gulf. The authors present a summary of both studies to assess the extent of petroleum contamination of various commercially-valuable fish species, and conclude that it appears as if the 1983 and 1991 oil spills did not affect the edibility of the fish caught near the Saudi Arabian coastline of the Arabian Gulf. However, long-term impacts were found to be associated with low energy areas of the shoreline, marshes, mud flats, sandy and rocky beaches, and subtidal benthic communities such as seagrass beds or soft-bottom areas.

Fazio, G. **Pollution of hydrocarbons in fish products: inspective considerations.** *Industrie Alimentari.* February 1995; 34(334):123-129; ISSN: 0019-901X.

Fisher, W. S.; Foss, S. S. **Toxicity and pathogenicity tests using grass shrimp embryos.** *Journal of Shellfish Research.* 1994; 13(1):292; ISSN: 0077-5711.
The use of grass shrimp embryos, *Palaemonetes pugio*, to determine oil toxicity, commercial oil dispersants, oil biodegradation products and pest control agents was discussed. The test system has some clear advantages for testing: embryos are held separately in glass tubes, they do not require feeding, they are easy to examine, they require low volumes of test toxicant, and they are extremely responsive to oil products, with high sensitivity and low variability. Also, *P. pugio* can be cultured through successive reproductive cycles year-around in the lab and embryo tests can be conducted away from the marine environment.

Fournie, John W.; Summers, J. Kevin. **Prevalence of gross pathological abnormalities in estuarine fishes.** *Transactions of the American Fisheries Society.* July 1996; 125 (4):581-590; ISSN: 0002-8487.
By examining 24,291 fish representing 143 species in the mid-Atlantic and Gulf Coast region, researchers provide a regional-scale perspective on the prevalence of gross pathological disorders (15 types) in fish for these two areas in the United States. Researchers estimate that the background prevalence is 0.7% in the Gulf Coast and 0.5% in the mid-Atlantic. It was also concluded that the prevalence for abnormalities was 3X higher for demersal fish than pelagic fish, and 8X higher at sites with high sediment contaminant concentrations.

BIOLOGY

Fowler, G. S.; Wingfield, J. C.; Boersma, P. D. **Hormonal and reproductive effects of low levels of petroleum fouling in Magellanic Penguins (*Spheniscus magellanicus*).** *The Auk.* April 1995; 112(2):382-389; ISSN: 0004-8038.
The levels of circulating hormones (reproductive and adrenocortical) in Magellanic Penguins that were exposed to oil after a marine oil spill off the coast of Patagonia were measured. Results indicated that luteinizing hormone, androgens and estradiol, but not progesterone, were at lower levels in the oil-contaminated penguins than the un-oiled group. In addition, corticosterone was found to be higher in the females of the oiled group, but little difference was detected in the males.

Fries, G. F. **Ingestion of sludge applied organic chemicals by animals.** *Science of the Total Environment.* June 21, 1996; 185(1-3):93-108; ISSN: 0048-9697.

Fucik, K. W. and others. **Dispersed Oil Toxicity Tests with Biological Species Indigenous to the Gulf of Mexico.** New Orleans: Minerals Management Service; 1994; OCS Study, MMS 94-0046. 180 p.

Fur Seals Oiled in Uruguay. *Marine Pollution Bulletin.* May 1997; 34(5):pg. 286. ISSN: 0025-326X.
Controversy concerning the grounding of the Panamanian oil Tanker *San Jorge*, in Uruguay, and its effect on fur seal pup mortalities are discussed. Malnutrition was the indirect result of the oil spill, which caused hundreds of seal pup mortalities. Adult females returning to feed their young were unable to detect the odor of their pups because of their oiled bodies.

Gajbhiye, S. N.; Mustafa, S.; Mehta, P.; Nair, V. R. **Assessment of biological characteristics on coastal environment of Murud (Maharashtra) during the oil spill (17 May 1993).** *Indian Journal of Marine Sciences.* December 1995; 24(4):196-202; ISSN: 0379-5136.
Researchers studied the impact of a crude oil spill (3000-8000 tons) on the biota of the Murud shores. Results indicated that (a) few phytoplankton species were damaged with a coating of polycyclic hydrocarbons around the cell, (b) in general, zooplankton were not severely affected, though a few species of copepods (*Lucifer*, *Sagitta bedoti*, and *S. enflata* were damaged, (c) a drastic reduction in the population density of chaetognaths was observed, and (d) there were no adverse effects on fish and other marine life.

Gallego, A.; Cargill, L. H.; Heath, M. R.; Hay, S. J.; Knutsen, T. **An assessment of the immediate effects of the *Braer* oil-spill on the growth of herring larvae using Otolith microstructure analysis.** *Marine Pollution Bulletin.* August 1995; 30(8):536-542; ISSN: 0025-326X.
Around the Shetland Isles, herring larvae were sampled. Otolith microstructure analysis was used to study the short term effect of the oil pollution from the *Braer* oil spill (5 January 1993) on the growth rate of the larvae. Results indicated that no difference was found in growth between larvae taken from areas heavily affected oil and those outside of the affected area. Also, little difference in Otolith growth before and after the oil spill was observed in samples from the same area .

George, S. G. and others. **Dietary crude oil exposure during sexual maturation induces hepatic mixed function oxygenase (CYP1A) activity at very low environmental temperatures in Polar cod, *Boreogadus saida*.** *Marine Ecology Progress Series.* June 15, 1995; 122307-312; ISSN: 0171-8630.
The study validates the effectiveness of CYP1A measurements in Polar cod, *Boreogadus saida*, in biomonitoring oil exploration and production in the Arctic.

Geurin, William F.; Boyd, Stephen A. **Maintenance and induction of naphthalene degradation activity in *Pseudomonas putida* and an *Alcaligenes sp.* under different culture conditions.** *Applied and Environmental Microbiology.* November 1995; 61(11):4061-4068; ISSN: 0099-2240.
Researchers studied the maintenance of naphthalene utilization activity in *Pseudomonas putida* and an *Alcaligenes sp.* under different conditions. Compared to half-lives in the stationary phase, activity half-lives were 2.7 and 5.3 times longer, respectively, in starved cultures. The treatment of starved cultures with chloramphenicol caused a loss of activity more rapidly than untreated starved cultures. Following growth in a nutrient medium, *Alcaligenes sp.* ceased activity to undetectable levels, but *Pseudomonas putida* continued detectable activity even up to 9 months.

BIOLOGY

Gitschlag, Gregg R.; Herczeg, Bryan A. **Sea turtle observations at explosive removals of energy structures.** *Marine Fisheries Review.* 1994; 56(2):1-8; ISSN: 0090-1830.
Data collected monitoring sea turtles during explosive removals of 106 oil and gas structures in the Gulf of Mexico off the coast of Louisiana and Texas provided sea turtle distribution information. Authors reported that during more than 6500 hours of monitoring, 18 individuals were observed.

Glegg, G. A.; Rowland, S. J. **The *Braer* oil spill - hydrocarbon concentrations in intertidal organisms.** *Marine Pollution Bulletin.* June 1996; 32(6):486-492; ISSN: 0025-326X.
Researchers determined the concentrations of toluene, naphthalene, and phenanthrene in specimens of limpets (*Patella vulgata*) and razor shells (*Ensis spp.*) collected from Shetland at the time of the *Braer* oil spill and after the oil spill (3, 6, 15 months).

Gold-Bouchot, G.; Sim-Alvarez, R.; Zapata-Prez, O. G.; Emez- Ricalde, J. **Histopathological effects of petroleum hydrocarbons and heavy metals on the American oyster (*Crassostrea virginica*) from Tabasco, Mexico.** *Marine Pollution Bulletin.* April-December 1995; 31(4-12):439-445; ISSN: 0025-326X.
Oyster populations from three coastal lagoons in southern Gulf of Mexico were sampled June, September and November (1992) and May 1993. Researchers correlated the soft-tissue concentrations of trace metals and petroleum hydrocarbons with the presence of histological effects in *C. virginica* from the samples.

Goodin, J. D.; Webber, M. D. **Persistence and fate of anthracene and benzo(a)pyrene in municipal sludge treated soil.** *Journal of Environmental Quality.* 1995; 24271-278.
Studies using pots and microcosms were conducted to ascertain the persistence and fate of PAH in municipal treated soils and the amount of PAH uptake into crops.

Grundy, M. M.; Moore, M. N.; Howell, S. M.; Ratcliffe, N. A. **Phagocytic reduction and effects on lysosomal membranes by polycyclic aromatic hydrocarbons, in *haemocytes* of *Mytilus edulis*.** *Aquatic Toxicology.* April 1996; 34(4):273-290; ISSN: 0166-445X.
Researchers examined the effects of certain polycyclic aromatic hydrocarbons (PAHs) on the immune reactivity of *haemocytes* from *Mytilus edulis*. Cells were exposed to varying levels (8.3, 16.6, 25, or 50 ppm) of anthracene, fluoranthene or phenanthrene, while whole animals were exposed to various PAH combinations. These PAHs were found to inhibit phagocytosis and the membrane stability of the lysosomes within these cells was disrupted.

Gueven, K. C.; Uenlue, S.; Okus, E.; Dogan, E. **Oil contamination of *Mytulis galloprovincialis* after the *Nassia* accident.** *Turkish Journal of Marine Science.* 1995; 1(2-3):67-79; ISSN: 1300-7122.
Using UVF and GC/MS analysis methods, researchers investigated oil contamination in the mussel *Mytulis galloprovincialis* following the *Nassia* tanker spill on the Istanbul Strait. By using the pristane and phytane ratio, researchers determined the source of the contamination was, in fact, oil spilled from the tanker.

Hall, A. J.; Watkins, J.; Hiby, L. **The impact of the 1993 *Braer* oil spill on grey seals in Shetland.** *Science of the Total Environment.* 1996; 186(1-2):119-125. ISSN: 0048-9697.
Following the *Braer* oil spill on Lady's Holm Shetland, in January 1993, acute respiratory distress was reported in molting grey seals (*Halichoerus grypus*). Nasal mucus discharges were proportionally higher in animals at the northern control site (Papa Stour), while no symptoms were observed at a seal molt site on the east coast of England. Respiratory distress in affected animals increased up to a month following the spill. However, without sufficient data on respiratory distress, it's difficult to determine how much of the oil affected the grey seals versus other causes.

Hansen, Donald J. **Potential effects of oil spills on marine mammals that occur in Alaskan waters.** Anchorage, AK: US Department of the Interior, Minerals Management Service, Alaska OCS Region; 1992; OCS Report MMS 92-0012.
The potential effects of damage to marine mammals as the result of oil spills is examined in light of observations to date.

BIOLOGY

Hellou, J.; Payne, J. F.; Upshall, C.; Fancey, L. L.; Hamilton, C. **Bioaccumulation of aromatic hydrocarbons from sediments: a dose-response study with flounder (*Pseudopleuronectes americanus*).** *Archives of Environmental Contamination and Toxicology.* November 1994; 27(4):477-485; ISSN: 0090-4341.
Pseudopleuronectes americanus was exposed to Hibernia crude oil in sediments over a four month period.

Hellou, J.; Upshall, C. **Fate of hydrocarbons in *Pseudopleuronectes americanus* exposed to *Hibernia* crude oil.** *Canadian Technical Report of Fisheries and Aquatic Sciences.* 1995; 20505-12; ISSN: 0706-6457.
Researchers exposed winter flounder to varying concentrations of *Hibernia* crude oil during four winter months. After exposure, muscle, liver and gall bladder bile were analyzed for different hydrocarbon compounds using a multispectroscopic approach (uv/f and GC/MS). A dose response was observed in muscle and the gall bladder bile .

Hellou, Jocelyne; Mackay, Donald; Fowler, Brian. **Bioconcentration of polycyclic aromatic compounds from sediments to muscle of finfish.** *Environmental Science and Technology.* 1995; 29(10):2555-2560; ISSN: 0013-936X.
Researchers exposed winter flounder (*Pseudopleuronectes americanus*) to various amounts of *Hibernia* crude oil in sediments during 4 months in the winter to describe and model the uptake of polycyclic aromatic compounds in the muscle of finfish.

Hellou, Jocelyne; Warren, William G. **Polycyclic aromatic compounds and saturated hydrocarbons in tissues of flatfish: insight on environmental exposure.** *Marine Environmental Research.* February 1997; 43(1/2):11-25; ISSN: 0141-1136.
In an effort to determine the baseline level of polycyclic aromatic compounds (PAC) in northwest Atlantic flatfish, researchers investigated the PAC concentration in the muscle, liver and gonad of the American plaice and the yellowtail flounder. Researchers reported: (a) a wider range of PACs were observed in liver than muscle or gonad; (b) lower levels of PACs were found in ovaries than testes of the same size fish; (c) the following concentration trend was consistently found in muscle: NA > C-1NA > C-2NA > C-3NA $\geq$ C-4NA. Also, researchers analyzed saturated hydrocarbons (*n*-alkanes) in tissues of yellowtail flounder and found that muscle and gonads had undetectable concentrations, while livers showed a fingerprint.

Holdway, D. A.; Breenan, S. E.; Ahokas, J. T. **Use of hepatic MFO and blood enzyme biomarkers in sand flathead (Platycephalus bassensis) as indicators of pollution in Port Phillip Bay, Australia.** *Marine Pollution Bulletin.* 1994; 28(11):683-695; ISSN: 0025-326X.
Hepatic ethyoxycoumarin O-deethylase (ECOD) and ethoxyresorufin O-deethylase (EROD) activities, and serum sorbitol dehydrogenase (s-SDH) were measured over three years in sand flathead collected from Port Phillip Bay, Australia. The researchers reported that enzyme induction of significance generally occurred in highly industrialized areas, suggesting polycyclic aromatic hydrocarbons as a possible cause.

BIOLOGY

Hose, J. E.; McGurk, D.; Marty, G. D.; Hinton, D. E.; Brown, E. D.; Baker, T. T. **Sublethal effects of the *Exxon Valdez* oil spill on herring embryos and larvae: morphological, cytogenetic, and histopathological assessments, 1989-1991.** *Canadian Journal of Fisheries and Aquatic Sciences*. October 1996; 53(10):2355-2365. ISSN: 0706-652X.
Following the *Exxon Valdez* oil spill, researchers evaluated Pacific herring (*Clupea pallasi*) for sublethal damage by collecting egg masses from oiled and unoiled areas and incubating the eggs to hatch. Morphological and cytogenetic anomalies, and histopathological lesions were assessed on the newly hatched herring larvae. Researchers reported that herring larvae collected in 1989 from oiled areas showed significantly more morphological and cytogenetic anomalies than those collected from the unoiled location. Also reported, these oil-related deformities were undetectable in larvae collected in 1990 and 1991.

Ingersoll, Christopher G. and others. **Toxicity and bioaccumulation of sediment-associated contaminants using freshwater invertebrates: a review of methods and applications.** *Environmental Toxicology and Chemistry*. November 1995; 14(11):1885-1894; ISSN: 0730-7268.
The authors present a review of recent developments in methods for evaluating the toxicity and bioaccumulation of contaminants (including polycyclic aromatic hydrocarbons) associated with freshwater sediments, and summarize example case studies demonstrating the application of these methods.

Iqbal, S.; Khalid, Z. M.; Malik, K. A. **Enhanced biodegradation and emulsification of crude oil and hyperproduction of biosurfactants by a gamma ray-induced mutant of *Pseudomonas aeruginosa*.** *Letters in Applied Microbiology*. September 1995; 21(3):176-179; ISSN: 0266-8254.
Researchers enhanced biodegradation and emulsification of crude oil and production of biosurfactant using a gamma-ray induced mutant of *Pseudomonas aeruginosa* named EBN-8. The mutant showed 3-4 times greater hydrocarbon conversion as compared to the parent when grown of crude oil in minimal medium, as well as an increase in biosurfactant production and hydrocarbon utilization during growth on heptadecane in minimal medium. An enhanced growth rate of EBN-8 when compared to the parent was also reported.

Ishizuka, M.; Hoshi, H.; Minamoto, N.; Masuda, M.; Kazusaka, A.;Fujita, S. **Alterations of cytochrome P450-dependent monooxygenase activities in *Eriocheir japonicus* in response to water pollution.** *Environmental Health Perspectives*. July 1996; 104(7):774-778; ISSN: 0091-6765.
Researchers investigated freshwater crabs obtained from rivers and estuaries in Japan to assess the relationship between cytochrome P450 (CYP)-dependent drug-metabolizing enzyme activities and the river pollution gradient. Results indicated that the crabs collected from the river with the highest concentrations of hydrocarbon exhibited the highest level of CYP. However, the correlation between hydrocarbon levels and drug-metabolizing enzyme activities in female crabs were not as marked as in male crabs.

Iwabuchi, T.; Venkateswaran, K.; Harayama, S.;Tanaka, H. **Low growth yield of a marine *Pseudomonas* grown of phenanthrene: a general phenomenon in bacteria grown of polycyclic aromatic hydrocarbons.** *Journal of Marine Biotechnology*. 1995; 2(1):11-14; ISSN: 0941-2905.
Researchers isolated *Pseudomonas sp.* AJ1 (a phenanthrene-degrading bacteria) from seawater and reported that its growth yield during degradation was very low. The use of a mass balance analysis found that 1.5 of the 14 phenanthrene carbon atoms were incorporated into the cell, and two to five carbon atoms were secreted into the culture medium; thus causing the low growth yield.

Jacob, Jurgen. **The significance of polycyclic aromatic hydrocarbons as environmental carcinogens.** *Pure and Applied Chemistry*. 1996; 68(2):301-308.
Recent experiments have shown that polycyclic aromatic hydrocarbons are potent carcinogens and, therefore, hazardous to humans. The author reviews the current research in this area and assesses their risk.

Jacob, P. G.; Al-Muzaini, S. **Marine plants of the Arabian Gulf and effects of oil pollution.** *Mahasagar*. 1995; 28(1-2):83-101.
Authors discuss the effects of oil pollution from spills in the Arabian Gulf on the primary producers.

Jarvenpaa, E.; Huopalahti, R.; Tapanainen, P. **Use of supercritical fluid extraction-high performance liquid chromatography in the determination of polynuclear aromatic hydrocarbons from smoked and broiled fish.** *Journal of Liquid Chromatography & Related Technologies.* 1996; 19(9):1473-1482; ISSN: 1082-6076.

Jauniaus, T.; Brosens, L.; Farnir, F.; Manteca, C.; Losson, B.; Tavernier, J.; Vindevogel, H.;Coignoul, F. **Seabird mortality during the 1992-1993 winter along the Belgian coast.** *Annales De Medecine Veterinaire.* May-June 1996; 140(3):149; ISSN: 0003-4118.

Jenssen, B. M. **An overview of exposure to, and effects of, petroleum oil and organochlorine pollution in grey seals (*Halichoerus grypus*).** *Science of the Total Environment.* July 16, 1996; 186(1-2):109-118; ISSN: 0048-9697.

Jenssen, B. M. **Review article: effects of oil pollution, chemically treated oil, and cleaning on the thermal balance of birds.** *Environmental Pollution.* 1994; 86(2):207-215; ISSN: 0269-7491.
The effects of oil pollution on the thermal balance of birds, the possibilty of restoring the water-repelling and insulating properties of the plumage, the chemical treatment of oil, and the urgent need for more information is discussed.

Kayal, S. Connell, D. W. **Polycyclic aromatic hydrocarbons in biota from the Brisbane River estuary.** *Estuarine, Coastal and Shelf Science.* May 1995; 40(5):475-493; ISSN: 0272-7714.
Sampled and analyzed for polycyclic aromatic hydrocarbons (PAHs) were six species of aquatic organisms. Results indicated that significant biomagnetification of PAHs in the sampled environment was unlikely, and chracteristics such as the trophic level, size, and age were not significant factors when examining PAH levels. Tissue lipid content was reported to be a primary factor in determining the PAH concetrations in fish species.

Kennicut, M. C. II; Green, R. H.; Montagna, P.; Roscigno, P. F. **Gulf of Mexico Offshore Operations Monitoring Experiment (GOOMEX), phase I: sublethal responses to contaminant exposure - introduction and overview.** *Canadian Journal of Fisheries and Aquatic Sciences.* November 1996; 53(11):2540-2553. ISSN: 0706-652X.
A description of the first phase of the GOOMEX study is presented. GOOMEX is a three-phase study to evaluate biological, chemical, and biochemical methods used to detect and assess chronic sublethal biological impacts associated with oil and gas exploration in the Gulf of Mexico. The methods evaluated include: contaminant analysis in sediments, porewaters, and tissues; assemblage analysis of *meiofauna*, *infauna*, and *epifauna*, community health assessment based on life history and reproduction studies; and biological detox responses.

Kennicutt, M. C. and others. **Gulf of Mexico offshore operations monitoring experiment, final report, phase I: sublethal responses to contaminant exposure.** New Orleans, LA: US Department of the Interior, Mineral Management Service; 1995749 p.(OCS Study; MMS 95-0045).

Khan, M. A. Q.; Alghais, S. M.; Almarri, S. **Petroleum hydrocarbons in fish from the Arabian Gulf.** *Archives of Environmental Contamination and Toxicology.* November 1995; 29(4):517-522; ISSN: 0090-4341.
Researchers sampled two fish species to assess their aromatic petroleum hydrocarbon (PAH) concentration and storage potential. Samples of these species from the Arabian Gulf showed 3 to 4 micrograms of PAHs per g of wet weight. Minnows from contaminated Dubai Harbor stored PAHs for two weeks despite a transfer to uncontaminated water. However, mullets raised in uncontaminated water and later exposed to crude oil depurated PAH more readily. Researchers suggest that the contamination of fish and seafood in coastal UAE (United Arab Emirates) may be more common than expected, and some species, such as minnows and fatty fish, may be storing PAHs and transferring them to higher trophic levels.

Kingston, P. F.; Dixon, I. M. T.; Hamilton, S.; Moore, D. C. **The impact of the *Braer* oil spill on the macrobenthic infauna of the sediments off the Shetland Islands.** *Marine Pollution Bulletin.* 1995; 30(7):445-459.
Researchers examined the benthic fauna in oil contaminated sea-bed areas following the *Braer* oil spill. Although the results showed no significant alterations in the benthic community structure (species richness, abundance and diversity), researchers did report that the levels of petroleum hydrocarbons in the high contaminated areas were sufficiently elevated to have eliminated the most sensitive species (*Amphipoda*).

Kireyeva, N. A.;Galimzyanova, N. F. **Influence of soil pollution by oil and petroleum products on the population and species composition of micromycetes.** *Eurasian Soil Science.* April 1996; 28(4):96-105; ISSN: 1064-2293.

Kocan, R. M.; Marty, G. D.; Okihiro, M. S.; Brown, E. D.; Baker, T. T. **Reproductive success and histopathology of individual Prince William Sound Pacific herring 3 years after the *Exxon Valdez* oil spill.** *Canadian Journal of Fisheries and Aquatic Sciences.* October 1996; 53(10):2388-2393. ISSN: 0706-652X.
Researchers reported that Pacific herring collected in 1992 from an *Exxon Valdez* contaminated site exhibited a lower percent hatch and produced fewer morphologically normal larvae than herring collected from an unoiled site.

Kocan, Richard M.; Hose, Jo Ellen; Brown, Evelyn D.; Baker, Timothy T. **Pacific herring (*Clupea pallasi*) embryo sensitivity to Prudhoe Bay petroleum hydrocarbons: laboratory evaluation and *in situ* exposure at oiled and unoiled sites in Prince William Sound.** *Canadian Journal of Fisheries and Aquatic Sciences* . October 1996; 53(10):2366-2375. ISSN: 0706-652X.
In artificial seawater, Pacific herring embryos were exposed to oil-water dispersions of Prudhoe Bay crude oil. Researchers reported that genetic damage was the most sensitive biomarker for oil exposure, followed by physical deformities, reduced mitotic activity, lower hatch weight, and premature hatching. Researchers also reported that oil had its greatest effect on the blastodisc and gastrula stages, and embryos collected at oiled sites three years after the oil spill were found to include a higher percentage of abnormal and lower weight larvae than those collected at unoiled sites.

Kong, Z. M. and others. **Mutagenicity of organic pollutants and their active components in the Xi River water at Shenyang.** *Bulletin of Environmental Contamination and Toxicology.* May 1996; 56(5):803-808; ISSN: 0007-4861.
The development of the petrochemical industry in Northeast China has led to increased environmental pollution. The authors utilized the mouse bone marrow micronucleus test to assess the mutagenicity of concentrated organic pollutants and their active components in the Xi River.

Kushmaro, A.; Henning, G.; Hofmann, D. K.; Benayahu, Y. **Metamorphosis of *Heteroxenia fuscescens* Planulae (Cnidaria: Octocorallia) is inhibited by crude oil: a novel short term toxicity bioassay.** *Marine Environmental Research.* June 1997; 43(4):295-302. ISSN: 0141-1136.
An artificial inducer for metamorphosis (TPA) was used to determine the effects of crude oil on the settlement and metamorphosis of planulae of the soft coral *H. fuscescens*. In the unoiled control group, TPA induced metamorphosis in 97% of the planulae. In contrast, 50% of the planulae grown in vessels with crude oil concentration of 0.1 ppm covering the walls and bottom metamorphosed, and only 3% metamorphosed with the oil concentration at 100 ppm. In addition, it is reported that oil film on the water is less toxic to film on the vessel walls and bottom. This sensitivity to oil suggests that *H. fuscescens* may be a good bioindicator to use to detect and assess oil pollution in the tropical environment.

Landrum, P. F.; Faust, W. R. **The role of sediment composition on the bioavailability of laboratory-dosed sediment-associated organic contaminants to the amphipod, Diporeia (spp).** *Chemical Speciation and Bioavailability.* 1994; 6(2-3):85-92; ISSN: 0954-2299.
Researchers determined uptake clearances by exposing amphipods to five Lake Michigan sediments and one Florissant, MO, soil each spiked with selected polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs). Uptake clearance is the volume or mass of the source compartment scavenged of contaminant per mass of organism per time. Results indicated that the PAHs were less bioavailable than the PCBs. In addition, the contaminants were more bioavailable from the Florissant soil than from the Lake Michigan sediments.

Lange, C. R.; Scott, S. R.; Tanner, M. **Biomonitoring**. *Water Environment Research*. 1996; 68(4):801-818; ISSN: 1061-4303.
Authors present a review and summary of the developments in biomonitoring techniques, models, and applications published over the previous year.

Lash, J. and Raaymakers, S. **Workshop on oiled seabird cleaning and rehabilitation**. Townsville, Queensland: Great Barrier Reef Marine Park Authority; 1994;(Workshop Series of the Great Barrier Reef Marine Park Authority. ISBN: 0-642-12012-9.

Lauenstein, Gunnar G. **Comparison of organic contaminants found in mussels and oysters from a current mussel watch project with those from archived mollusc samples on the 1970s**. *Marine Pollution Bulletin*. December 1995; 30(12):826-833; ISSN: 0025-326X.
Concentrations of contaminating compounds in mussels and oysters were compared from samples of the Mussel Watch Project in the 1970s and samples recently collected by NOAA's National Status and Trends Program. Comparisons indicate significant decreases in chlorinated pesticides and polyaromatic hydrocarbons between the 1970s and the 1990s; and increases in PCBs and butyltins through 1986, but decreases in both since 1986.

Law, A. T.; Readman, J. W.; Tolosa, I., and Bartolucci, J. **Distribution of hydrocarbons and sterols in coral: a preliminary study**. In: Snidvongs, A.; Utoomprukporn, W., and Hungspreugs, M. NRCT-JSPS Joint Seminar on Marine Science. Bangkok, Thailand: Chulalongkorn University; 1994; pp. 255-256.

Leppunen, Matti. **The role of feeding behavior in bioaccumulation of organic chemicals in benthic organisms**. *Annales Zoologici Fennici*. 1995; 32(3):247-255; ISSN: 0003-455X.
The author discusses and describes bioaccumulation of organic chemicals, including the factors affecting chemical sorption and bioavailability, and how feeding behavior of benthic organisms affects bioaccumulation.

Levin, L.; Caswell, H.; Bridges, T.; Dibacco, C.; Cabrera, D.; Plaia, G. **Demographic responses of estuarine polychaetes to pollutants: life table response experiments**. *Ecological Applications*. November 1996; 6(4):1295-1313; ISSN: 1051-0761.
Life table response experiments were conducted in the lab on *Capitella* sp. I and *Streblospio benedicti* (infaunal, deposit-feeding polychaetes of estuaries and littoral wetlands) in an effort to compare the demographic responses of these species to three common contaminants: sewage (*Milorganite*), blue-green algae (*Spirulina* sp.) and hydrocarbons. Results indicated that overall survival was high in all treatments except the blue-green algae, where oxygen depletion occured. However, treatments had significant effects on age at maturity, fertility, and generation time, which differed by species and among contaminants.

Levings, S. C.; Garrity, S. D. **Effects of oil spills on fringing red mangroves (*Rhizophora mangle*): losses of mobile species associated with submerged prop roots**. *Bulletin of Marine Science*. May 1994; 54(3):782-794; ISSN: 0007-4977.
Researchers investigated the direct effects of an oil spill on fringing red mangroves, *Rhizophora mangle*, and estimated the effects of the spill on associated mobile species using the direct measures of abundance of wood-boring isopods, and losses of epibiota used as shelter, settlement and juvenile habitat by non-boring species. For boring isopods in sheltered channels and lagoons, no significant difference in abundance was seen at oiled and unoiled sites; however, suitable submerged prop roots were less abundant at oil sites. For non-boring species reductions in habitat were recorded.

Li, Z. F.; Obika, H.; Kamishima, H.; Fukuoka, S.; Kakita, H.; Kobayashi, Y.;Higashihara, T. **Improvement of immobilization conditions for biodegradation of floating oil by a bio-system co-immobilizing marine oil-degrading yeast *candida sp* and nutrients**. *Seibutsu - Kogaku Kaishi - Journal of the Society for Fermentation and Bioengineering*. 1995; 73(4):295-299; ISSN: 0919-3758.

BIOLOGY

Lin, Qianxin; Mendelssohn, Irving A. **A comparative investigation of the effects of south Louisiana crude oil on the vegetation of fresh, brackish and salt marshes**. *Marine Pollution Bulletin.* February 1996; 32(2):202-209; ISSN: 0025-326X.
The effects of south Louisiana crude oil on *Spartina alterniflora*, *Spartina patens*, and *Sagittaria lancifolia* were investigated in a greenhouse setting. Researchers reported that the application of oil significantly impairs only the two *Spartina* species, and that this variation in oil sensitivity was, in part, related to the difference in soil organic matter, suggesting that the soil organic matter plays a key role in accelerating the sorption of oil into the soil.

Love, M.; Hyland, J.; Ebeling, A.; Herrlinger, T.; Brooks, A.; Imamura, E. **A pilot study of the distribution and abundances of rockfishes in relation to natural environmental factors and an offshore oil and gas production platform off the coast of southern California**. *Bulletin of Marine Science.* September 1994; 55(2-3):1062-1085; ISSN: 0007-4977.
Investigators examined the distribution and abundance of rock fishes around Platform Hildago and eight adjacent natural reefs. Both multivariate cluster analysis and univariate ANOVA indicated that species composition and abundance of rockfish around Hildago differs from those over the natural reefs.

Luoma, Samuel N. **The developing framework of marine ecotoxicology: Pollutants as a variable in marine ecosystems?** *Journal of Experimental Maarine Biology and Ecology.* 1996; 200(1-2):29-55. ISSN: 0022-0981.
Multi-disciplined field and laboratory studies along with the knowledge of basic processes have reduced ambiguities in interpreting a few physiological/organismic pollunt responses. Similar advances can be made by recognition of pollution-induced patterns in population responses. Ecotoxicology is developing, but further advancement depends on the integration of ecotoxicology with basic marine ecology and biology.

Ma, W. C.; Immerzeel, J.;Bodt, J. **Earthworm and food interactions on bioaccumulation and disappearance in soil of polycyclic aromatic hydrocarbons: studies on phenanthrene and fluoranthene**. *Ecotoxicology and Environmental Safety.* December 1995; 32(3):226-232; ISSN: 0147-6513.
Earthworms were used to study the fate of polycyclic aromatic hydrocarbons in the terrestrial soil environment. Results indicated that the removal of phenanthrene and fluoranthene in soil is enhanced by the presence of earthworms. Also reported, earthworms may accumulate fluoranthene and, to a lesser extent, phenanthrene in their body tissues.

Maccarone, Alan D.; Brzorad, John N. **Effects of an oil spill on the prey populations and foraging behavior of breeding wading birds**. *Wetlands.* December 1995; 15(4):397-407; ISSN: 0277-5212.
Presented is an examination of the changes in the foraging habits of three species of wading birds and in populations of small fishes and shrimp ingested by these birds during the nesting season (1990) following oil spills in a narrow tidal strait that separates New York City and New Jersey.

Mackay, A. P.; Hodgkinson, M. **Assessment of the impact of naphthalene contamination on mangrove fauna using behavioral bioassays**. *Bulletin of Environmental Contamination and Toxicology.* 1996; 56(2):279-286; ISSN: 0007-4861.
Researchers used the intertidal gastropod, *Ophiscardelus quoyi*, from the mangrove swamps in eastern Australia to investigate via behavioral bioassays the effects of naphthalene in the subtropical environment. The data were analyzed by regression models and coefficients. The long-term and short-term effects were determined and discussed.

Malallah, G.; Afzal, M.; Gulshan, S.; Abraham, D.; Kurian, M.;Dhami, M. S. I. **Vicia faba as a bioindicator of oil pollution**. *Environmental Pollution.* 1996; 92(2):213-217; ISSN: 0269-7491.
Researchers investigated the use of Vicia faba as a bioindicator of oil pollution and found that the level of oil pollution can be assessed examining and comparing a variety of V. faba characteristics, most notably the ratio of fatty acid esters C20:1/C18:1.

BIOLOGY

Marchand, M.; Caprais, J. C.; Corre, S.; Jacq, E.; Hussein, D. **Microbial utilization of occurring hydrocarbons by the sediment microbiota of Guaymas Basin hydrothermal site (Gulf of California).** *Oceanologica Acta.* 1994; 17(2):177-189; ISSN: 0399-1784.
The potential for hydrocarbon degradation by microbiota was examined. Degradation of petroleum and phenanthrene was observed in aerobic conditions for a hydrothermal mineral deposit and some surface sediments. Mesophilic hydrocarbon-utilizing bacterial communities were not capable of growing on hydrocarbons as the sole growing source.

Marshall, Kimberly R.; Coull, Bruce C. **PAH effects on removal of meiobenthic copepods by juvenile spot (*Leiostomus xanthurus*: Pisces).** *Marine Pollution Bulletin.* January 1996; 32(1):22-26; ISSN: 0025-326X.
Researchers examined the difference in copepod removal by juvenile spot consumption in sediments exposed to polycyclic aromatic hydrocarbons (PAHs) and in uncontaminated sediments (control). Results indicated that although consumption was found in all areas, there were significant differences between copepod removal in the contaminated vs. uncontaminated sediments. The authors add that this type of examination may provide a baseline for making hazard assessments in areas of spills and discharges.

Marty, P.; Martin, Y. **The use of oleophilic fertilizer and selected bacterial communities to enhance biodegradation of crude oil in seawater.** *Journal of Marine Biotechnology.* 1993; 1(1):27-32; ISSN: 0941-2905.
To crude oil (Arabian light), researchers added oleophilic fertilizers (INIPOL EAP 22) alone and in combination with laboratory selected hydrocarbonoclastic marine bacteria to assess the biodegradation ability in each case. Quantitative analysis of hydrocarbon concentration at the conclusion of the experiments indicated that the combination of bacteria and fertilizers did not enhance biodegradation compared to fertilizer alone. In both cases, biodegradation reached 50% in 8-15 days with very similar C sub(17)/pristane and C sub(18)/phytane ratios.

Mazet, Jonna A. K.; Gardner, Ian A.; Jessup, David A., and Rittenburg, James H. **A field technique for the detection of petroleum products on sea otter fur.** In. Program and Abstracts of Papers Presented at the 43rd Annual Conference of the Wildlife Disease Association, 17 to 22 July, Held at the Asilomar Conference Center, Monterey California. Monterey, CA: Wildlife Disease Association; 1994; pp. 54-55.

McCain, B. B.; et. al. **Chemical contaminant exposure and effects in four fish species from Tampa Bay, Florida.** *Estuaries.* 1996; 19(1):86-104.
Researchers measured the concentrations of selected anthropogenic chemical contaminants and levels of pollution-related effects in *Arius felis*, *Fundulus grandis*, *F. majalis*, and *Scieaenops ocellatus*. It was reported that overall the concentrations in the target species reflected contaminants found in sediment. Also reported: the Hillsborough Bay vicinity (highly industrialized area) was found to have a significantly high enough contaminant concentration to cause adverse effects in indigenous fish species.

Mcdonald, S. J.; Kennicutt, M. C.; Liu, H.; Safe, S. H. **Assessing aromatic hydrocarbon exposure in Antarctic fish captured near Palmer and Mcmurdo Stations, Antarctica.** *Archives of Environmental Contamination and Toxicology.* August 1995; 29(2):232-240; ISSN: 0090-4341.
The effects of polynuclear aromatic hydrocarbons on Antarctic fish were examined. Fish captured near Palmer Station exhibited induced ethoxyresorufin O-deethylase (EROD) and heightened levels of PAH metabolites compared to fish from control sites, and fish captured near McMurdo Station had significantly higher levels of naphthalene and phenanthrene compared to fish from remote sites in McMurdo Sound.

BIOLOGY

McDonald, S. J.; Willet, K. L.; Thomsen, J.; Beatty, K. B.; Conner, K.; Narasimhan, T. R.; Erickson, C. M.; Safe, S. H. **Sublethal detoxification responses to contaminant exposure associated with offshore production platforms.** *Canadian Journal of Fisheries and Aquatic Sciences.* November 1996; 53(11):2606-2617. ISSN: 0706-652X.
Researchers sampled several species of fish and invertebrates at, near (100 m), and far from (3000 m) three platforms in the Gulf of Mexico. Results of detox response tests indicated that no significant near/far differences in invertebrates were found in aryl hydrocarbon hydroxylase (AHH) activity and no near/far differences were observed the EROD and AHH activity, CYP1A mRNA levels, and PAH metabolite concentrations in sixteen species of fish. However, it was noted that species-dependent differences in EROD activity and biliary PAH metabolite levels were detected.

McGurk, M. D.; Brown, E. D. **Egg-larval mortality of Pacific herring in Prince William Sound, Alaska, after the *Exxon Valdez* oil spill.** *Canadian Journal of Fisheries and Aquatic Sciences.* October 1996; 53(10):2343-2354. ISSN: 0706-652X.
Investigated were instantaneous daily rates of egg-larval mortality of the Pacific herring from two oil-exposed sites and two unoiled sites. When comparing unoiled vs. oiled sites, researchers reported significant differences in egg density, small differences in mean larval length, and no difference in the rates of larval growth and loss. Also, mean egg-larval mortality in the oiled sites were found to be twice that of the unoiled sites, and larval growth rates were roughly half those measured in populations from other areas of the north Pacific Ocean.

Meador, J. P.; Casillas, E.; Sloan, C. A.; Varanasi, U. **Comparative bioaccumulation of polycyclic aromatic hydrocarbons from sediment by two infaunal invertebrates.** *Marine Ecology Progress Series.* July 1995; 123(1-3):107-124; ISSN: 0171-8630.
Researchers examined the bioaccumulation of polycyclic aromatic hydrocarbons (PAHs) from field-contaminated sediments by two infaunal invertebrates, *Rhepoxynius abronius* and *Armandia brevis.*

Merlin, F. X.; Lee, K.; Swannel R.; Oudot, J.; Basseres, A; Reilly, T.; Chaumery, C.; Dalmazzone, C., and Sveum, P. **Protocol for experimental assessment of bioremediation agents on a petroleum polluted shoreline. In. Proceedings: Seventeenth Arctic and Marine Oil Spill Program Technical Seminar.** Ottawa: Environment Canada; 1994; 1 pp. 469-478.
The authors developed an experimental protocol for monitoring the effectiveness of bioremediation agents in the treatment of oil-contaminated sediments, which is intended as a framework for the design of experimental field trials .

Michel, X. R.; Beasse, C.; Narbonne, J. F. **In vivo metabolism of benzo(a)pyrene in the mussel Mytilus galloprovincialis.** *Archives of Environmental Contamination and Toxicology.* February 1995; 28(2):215-222; ISSN: 0090-4341.
Researchers investigated the ability of the mussel Mytilus galloprovincialis to metabolize benzo(a)pyrene in vivo. Results suggested the mussel is able to develop a well balanced phase I and phase II xenobiotic metabolism limiting the accumulation of petroleum metabolites.

Michel, X.; Salaun, Jean-Pierre; Galgani, Francois; Narbonne, Jean-Francois. **Benzo(a)pyrene Hydroxylase activity in the marine mussel Mytilus galloprovincialis: a potential marker of contamination by polycyclic aromatic hydrocarbon-type compounds.** *Marine Environmental Research.* 1994; 38257-273; ISSN: 0141-1136.
The researchers aim to optimize and standardize the incubation conditions necessary to determine benzo(a)pyrene hydroxylase activity in mussel microsomes. Presented is evidence that the reaction is dependent on NADPH and linear with time.

Mohammed, S. Z.; Alssadh, S. **Coral reef grounds and its associated biota in the western side of the Arabian Gulf (ROPME sea area) with respect to 1991 Gulf War oil spill.** *Indian Journal of Marine Sciences.* March 1996; 25(1):35-40; ISSN: 0379-5136.

BIOLOGY

Moldowan, J. Michael; McCaffrey, Mark A. **A novel microbial hydrocarbon degradation pathway revealed by hopane demethylation in a petroleum reservoir.** *Geochimica Et Cosmochimica Acta.* May 1995; 59(9):1891-1894; ISSN: 0016-7037.
The authors suggest an unknown biodegradation mechanism involving 25-norhopanes, an abundant component in many biodegraded oils.

Moles, A; Rice, S.; Norcross, B. L. **Non-avoidance of hydrocarbon laden sediments by juvenile flatfishes.** *Netherlands Journal of Sea Research .* 1994; 32(3-4):361-367; ISSN: 0077-7579.
Investigators observed the behavior of juvenile rock sole (*Pleuonectes bilineatus*), juvenile yellowfin sole (*P. apser*), and juvenile Pacific halibut (*Hippoglossus stenolepis*) to determine if they are capable of detecting and avoiding hydrocarbon-rich sediments. Results indicated that although the flatfishes did avoid heavily oiled sediments (2%), grain size was a more important factor for sediment avoidance. This observed lack of avoidance at concentrations likely to occur in the environment may lead to long-term exposure to contaminants following a spill.

Montagna, P.; Harper, D. E. Jr. **Benthic infaunal long-term response to offshore production platforms in the Gulf of Mexico.** *Canadian Journal of Fisheries and Aquatic Sciences.* November 1996; 53(11):2567-2588. ISSN: 0706-652X.
Sublethal effects of exposure to long-term oil and gas production were assessed in meiofaunal and macroinfaunal communities near three gas platforms in the Gulf of Mexico. Boxcores were collected from various distances (30-3000 m) from each platform over two years. It was reported that total polychaete and non-selective deposit feeding nematode density increased near platforms and amphipod and harpacticoid density and diversity declined near platforms. From these results a pattern of community change can be inferred: density increases of polychaetes and nematodes indicate organic enrichment, while a decline in amounts of harpacticoids and amphipods indicate toxicity.

Moore, M. J.; Stegeman, J. J. **Hepatic neoplasms in winter flounder Pleuronectes americanus from Boston Harbor, Massachusetts, USA.** *Diseases of Aquatic Organisms.* October 13, 1994; 20(1):33-48; ISSN: 0177-5103.
Researches describe the relative frequency and histology of different tumor types in a sample of 29 winter flounder (with 60 neoplasms) obtained from Deer Island Flats, an area in Boston Harbor that is heavily contaminated with organic and inorganic chemicals.

Murphy, Steven M.; Day, Robert H.; Wiens, John A.; Parker, Keith R. **Effects of the *Exxon Valdez* oil spill on birds: Comparisons of pre-and post-spill surveys in Prince William Sound, Alaska.** *Condor.* May 1997; 99(2):299-313. ISSN: 0010-5422.
Pre- and post-spill data were used to evaluate oil impact changes in abundance and distribution of birds that crossed unoiled/lightly oiled bays versus moderately/heavily oiled bays in Prince William Sound, Alaska. In 1989, the year of the spill, oiling effects were most evident on abundance and distribution in birds. Signs of recovery for all taxa that showed initial oiling impacts were evident by 1991.

Nagelkerken, Ivan A.; Debrot, Adolphe O. **Mollusc communities of tropical rubble shores of Curaçao: long-term (7+ years) impacts of oil pollution.** *Marine Pollution Bulletin.* September 1995; 30(9):592-598; ISSN: 0025-326X.
Compared were mollusc communities of unpolluted and tar polluted rubble shore areas in Curaçao. Results indicated that average mollusc densities at sites massively impacted with crude oil in the long-term past (not since 1986) were 20% of those found at the unoiled sites, while mollusc species richness was 63.8% of the unoiled sites. Also, mollusc densities and species richness turned out to be log-linearly and linearly correlated with percent tar cover.

Newton, L. C.; McKenzie, J. D. **Echinoderms and oil pollution: a potential stress assay using bacterial symbionts.** *Marine Pollution Bulletin.* April-December 1995; 31(4-12):453-456; ISSN: 0025-326X.
Researchers examined the response of echinoderms containing symbiotic sub-cuticular bacteria to oil pollution in laboratory experiments, mesocosms and in situ. Sublethal stress was monitored by assessing the alterations in tissue loading of the symbiotic sub-cuticular bacteria. Results indicated that an increase of hydrocarbon exposure resulted in a decline in the number of bacteria. This outcome and its potential uses are discussed.

Norcross, B. L.; Hose, J. E.; Frandsen, M.; Brown, E. D. **Distribution, abundance, morphological condition, and cytogenetic abnormalities of larval herring in Prince William Sound, Alaska, following the *Exxon Valdez* oil spill.** *Canadian Journal of Fisheries and Aquatic Sciences.* October 1996; 53(10):2376-2387. ISSN: 0706-652X.
Two, three and four months following the *Exxon Valdez* oil spill, researchers collected Pacific herring larvae inside and outside of oiled areas in Prince William Sound to determine the distribution, abundance, and size of the herring larvae and postlarvae It was reported that many of the larvae exhibited deformities associated with oil spills; growth between 2 to 3 months after the spill was the lowest ever reported for field-caught larval herring; jaw and genetic deformations were highest two months after the spill and were elevated throughout the western area of the Sound; and three months after the spill, though jaw development was normal, genetic damage continued.

O'Hare, D. B.; Robotham, P. W. J.; Gill, R. **EROD measurement using post mitochondrial supernatant (PMS) in roach (Rutilus rutilus L.), a possible biomonitor for PAH contamination in the freshwater environment.** *Chemosphere.* January 1995; 30(2):257-264; ISSN: 0045-6535.
Investigators injected the roach, *Rutilus rutilus* L., with á-naphthoflavone and examined the hepatic post-mitochondrial supernatant (pms) for monooxygenase activity. Results indicated that pms was three times less active than microsomes, although the level of induction was the same; no effect of dicumarol on EROD measurement using pms was recorded; and EROD induction in the roach peaked 2-4 days after the injection. The researchers suggested that given the pollution tolerance of roach, their hepatic pms may serve as a biomonitor of PAH contamination in a freshwater environment.

Okpokwasili, G. C.; Nnubia, C. **Effects of drilling fluids on marine bacteria from a Nigerian offshore oilfield** . *Environmental Management.* November/December 1995; 19(6):923-929; ISSN: 0364-152X.
Bacteria (*Staphylococcus sp.* and *Bacillus sp.*) isolated from drill mud cuttings were aerobically cultured in the presence of varying concentrations (0, 25, 50, 75 µg/ml) of drilling fluids to determine the effects of the concentrations on their growth. Results showed that during exponential growth, *Bacillus sp.* was depressed by all test chemicals except Clairsol, Enviromul, and Baroid mineral oil. Additionally, all test chemicals except Clairsol had no effect on *Bacillus sp.* during the lag phase of growth. With *Staphylococcus sp.*, the exponential growth phase was depressed by all test chemicals. Also, there was an increase in of both growth rate and generation times of *Staphylococcus sp.* and a decrease of those in *Bacillus sp.* with increasing concentrations of drilling fluids.

BIOLOGY

Olsgard, Frode; Gray, John. **A comprehensive analysis of the effects of offshore oil and gas exploration and production on the benthic communities of the Norwegian continental shelf.** *Marine Ecology Progress Series.* June 15, 1995; 122(1-3):277-306; ISSN: 0171-8630.
Researchers investigated contamination and its effects on benthic fauna, and evaluated measures (diversity indices, indicator species, multivariate analysis) in pollution assessment in oil and gas fields where oil-based drilling mud was used. Among other things, researchers concluded that pollution initially causes severe reductions in ecologically important benthic organisms. The fauna which replaces the previous one is an infauna of small individuals, probably less valuable as food for fish than the preceding fauna.

Ort, M. P.; Finger, S. E.; Jones, J. R. **Toxicity of crude-oil to the mayfly, Hexagenia bilineata (Ephemeroptera: Ephemeridae).** *Environmental Pollution.* 1995; 90(1):105-110; ISSN: 0269-7491.
The effects of crude oil on the survival and behavior of the mayfly were assessed. Researchers exposed mayfly nymphs to the water soluble and oil residue fractions of crude oil. Results indicated that at 96 hours, the mayfly survival rate did not decrease. However, a significant mortality rate occurred from a 21 day exposure to oil mixed with sediment at concentrations as low as 500 μg/g. Mortality rates also increased after a 21 day exposure to oil-contaminated sediments (1905 μg/g) obtained 6 weeks after an oil spill in the Chariton River, Missouri. Results from the behavioral tests showed that the mayfly nymphs did not avoid contact with sediment containing oil residue (50-800μg/g).

Ostrander, G. K.; Kuehn, R. L.; Berlin, K. D.; Hawkins, W. E. **Anthropogenic contaminants and fish health along an urban waterway.** *Environmental Toxicology and Water Quality.* 1995; 10(3):207-215; ISSN: 1053-4725.

Paszczynski, A.; Crawford, R. L. **Potential for bioremediation of xenobiotic compounds by the white-rot fungus Phanerochaete chrysosporium.** *Biotechnology Progress.* July-August 1995; 11(4):368-379; ISSN: 8756-7938.
The authors discuss and assess the potential of using white-rot fungi as a bioremediation agent for use in the restoration of environments contaminated by xenobiotic molecules including polycyclic aromatic hydrocarbons.

Payne, J. F.; Fancey, L. L.; Hellou, J.; King, M. J.; Fletcher, G. L. **Aliphatic hydrocarbons in a chronic toxicity study with winter flounder (*Pleuronectes americanus*) exposed to oil well drill cuttings.** *Canadian Journal of Fisheries and Aquatic Sciences.* December 1995; 52(12):2724-2735; ISSN: 0706-652X.
Using winter flounder and sediments contaminated with drill cuttings (aliphatic hydrocarbons), researchers studied dose-response relationships for a variety of indices in a chronic toxicity study. Indices included: organ/body condition, muscle and liver energy reserves, mixed-function oxygenase detoxification enzymes, blood parameters, and liver and gill histopathology. It was concluded that there was no evidence of dose-response relationships even at highest level of exposure.

Pena, E.; Conde, J. E.; Montelongo, F. G. **Polycyclic aromatic hydrocarbons and *n*-alkanes in *Osilinus attratus* from the coast of Tenerife (Canary Islands).** *Bulletin of Environmental Contamination and Toxicology.* 1996; 57(5):803-810; ISSN: 0007-4861.
As part of a global monitoring project, researchers examined the level of *n*-alkanes and polycyclic aromatic hydrocarbons in specimens of the marine winkle (*Osilinus attratus*) found along the Tenerife coast.

Peterson, C. H.; Kennicut, M. C. II; Green, R. H.; Montagna, P.; Harper, D. E. Jr.; Powell, E. N.; Roscigno, P. F. **Ecological consequences of environmental perturbations associated with offshore hydrocarbon production: a perspective on long-term exposures in the Gulf of Mexico.** *Canadian Journal of Fisheries and Aquatic Sciences.* November 1996; 53(11):2637-2654. ISSN: 0706-652X.
Presented are an original synthetic review of benthic response to pollution in ways that may allow discrimination among multiple causes; a sythesis of the results of GOOMEX Phase I to interpret GOOMEX patterns; and a comparison of GOOMEX results and conclusions to previously published data on the effects of offshore oil and gas exploration and production.

Peven, C. S.; Uhler, A. D.; Hillman, R. E.; Steinhauer, W. G. **Concentrations of organic contaminants in *Mytilus edulis* from the Hudson-Raritan estuary and Long Island Sound.** *Science of the Total Environment.* January 26, 1996; 179(1-3):135-147; ISSN: 0048-9697.

Phan, V. N.; et. al. **[Toxicity assessment of an effluent derived of petroleum in *Promysis atlantica* (Crustacea: Mysidacea)].** *Boletim Do Instituto Oceanografico Sao Paulo.* 1994; 42(1/2):129-141; ISSN: 0373-5524.

Pinto, B.; Pellegrini, Gabellini M.; Ausili, A. **Harbour and coastal sediment chemistry and toxicity: a preliminary assessment of dredging activities.** *Journal of Aquatic Ecosystem Health.* 1995; 4(4):249-255.
In the Northern Tyrrhenian Sea, concentrations of heavy metals (Cd, Pb, Cr, Hg) and polycyclic aromatic hydrocarbons were determined and toxicity tests were carried out using the sea urchin, *Paracentrotus lividus*. Results indicated that concentrations of PAH and Cd were generally higher in the harbor sediments than offshore sediments; and no significant reductions in fertilization were observed. However, effects on the embryonic development were evident.

Proffitt, C. Edward; Devlin, Donna J.; Lindsey, Mark. **Effects of oil on mangrove seedlings grown under different environmental conditions.** *Marine Pollution Bulletin* . December 1995; 30(12):788-793; ISSN: 0025-326X.
Researchers examined the effects of lubricating oil on mangrove seedlings (*Rhizophora mangle* and *Avicennia germinans*) to determine the extent of negative effects under varying environmental conditions (heat and light). Results indicated that no *A. germinans* survived longer than a few weeks, and both one-time and weekly oiling depressed survival, stem growth, leaf production and leaf-size in *R. mangle*.

Racine, C. H. **Long-term recovery of vegetation on two experimental crude oil spills in interior Alaska black spruce taiga.** *Canadian Journal of Botany [Revue Canadienne De Botanique].* August 1994; 72(8):1171-1177; ISSN: 0008-4026.
The author reports on vegetation sampling on two black spruce taiga sites, fifteen and twenty years after crude oil was applied as low-volume or high-volume point spills. The low-volume spray caused initial damage, but after 20 years the understory was almost complete; high-volume point spills created small areas with dead vegetation and little sign of recovery, but spread out mostly below ground with little or no effect on the rooted vegetation after 20 years; and winter spills were associated with increased surface oil, resulting high mortality and continuing chronic effects after 15 years with only *Eriophorum vaginatum* tussocks surviving.

Raimondi, Peter T.; Barnett, Arthur M.; Krause, Paul R. **The effects of drilling muds on marine invertebrate larvae and adults.** *Environmental Toxicology and Chemistry.* June 1997; 16(6):1218-1228. ISSN: 0730-7268.
Red abalone were used to determine the effects of drilling muds in the fertilization, early development, survivorship, and settlement of marine invertebrate larvae and on adults from an active platform off southern California . Test were conducted on adult brown cup corals for effects on adult survivorship viability, and tissue loss. Drilling muds exposure had no effect on abalone fertilization or early development; however; it did result in weak, but significant, positive effects on competent larvae settlement. The Brown cup corals survivorship and viability were adversely impacted by exposure to drilling muds concentrations; effects likely caused by increased tissue mortality of the coral polyps.

Ralls, K.; Demaster, D. P.; Estes, J. A. **Developing a criterion for delisting the southern sea otter under the U.S. Endangered Species Act.** *Conservation of Biology.* 1996; 10(6):1528-1537. ISSN: 0888-8892.
The U.S. Endangered Species Act devised a descriptive delisting criterion defining a size at which it would consider the southern sea otter population endangered and/or threatened in the event of a major oil spill, the otter's most serious population threat.

Ramanathan, A.; Burks, S. L. **Hazard evaluation of soil contaminants with aquatic animals and plant toxicity tests.** *Bulletin of Environmental Contamination and Toxicology.* June 1996; 56(6):956-963; ISSN: 0007-4861.
Researchers evaluated the potential hazards of contaminants at an abandoned oil refinery (Cyril, Oklahoma) on the adjacent aquatic environment. A variety of toxicity tests were used to investigate the effects of soil contaminants and leachates on rice seed germination and root growth, *Ceriodaphnia* survival, fathead minnow survival, Microtox acute response, 7 d *Ceriodaphnia* reproduction and survival, and 7 d fathead minnow growth and survival.

Ramanathan, A.; Ownby, J. D.; Burks, S. L. **Protein biomarkers of phytotoxicity in hazard evaluation**. *Bulletin of Environmental Contamination and Toxicology*. June 1996; 56(6):926-934; ISSN: 0007-4861.
Researchers examined the changes in proteins in rice plants (Oryza sativa) that were exposed to contaminated soil collected from selected areas at an abandoned oil refinery site. Results indicated that the rice plants responded to the soil contaminants by inducing and suppressing polypeptides in the roots and leaves after exposure to the refinery soil.

Rayburn, J. R.; Glas, P. S.; Foss, S. S.; Fisher, W. S. **Characterization of grass shrimp (*Palaemonetes pugio*) embryo toxicity tests using the water soluble fraction of number 2 fuel oil**. *Marine Pollution Bulletin*. December 1996; 32(12):860-866; ISSN: 0025-326X.
Palaemonetes pugio, the grass shrimp, were exposed to the water soluble fraction of number 2 fuel oil during 4-day and 12-day tests in plastic tissue culture plates. This procedure was compared to an original test, a 12-day embryo exposure in glass tubes, and the results indicated no significant change in results.

Readman, J. W. and others. **Discrete bands of petroleum hydrocarbons and molecular organic markers identified within massive coral skeletons**. *Marine Pollution Bulletin*. May 1996; 32(5):437-443; ISSN: 0025-326X.
Corals deposit an aragonite exoskeleton beneath their outer living film, which results in seasonal banding. Researchers analyzed the molecular organic markers within the bands of *Porites lutea* from the Gulf coasts of Kuwait and Saudi Arabia in effort to record contamination from oil.

Rebar, A. H.; Lipscomb, T. P.; Harris, R. K.; Ballachey, B. E. **Clinical and clinical laboratory correlates in sea otters dying unexpectedly in rehabilitation centers following the *Exxon Valdez* oil spill**. *Veterinary Pathology*. July 1995; 32(4):346-350; ISSN: 0300-9858.
Researchers analyzed the clinical records of 21 otters (*Enhydra lutris*) that died during the first 10 days of rehabilitation after the *Exxon Valdez* oil spill to identify the clinical syndromes and abnormalities syndromes associated with these deaths. The most common syndrome was shock, with symptoms including hypothermia, lethargy, and hemorrhagic diarrhea. Accompanying abnormalities included leukopenia with increased numbers of hyperkalemia, hypoproteinemia, elevations of serum transaminases, and hypoglycemia. Researchers concluded that heavily oiled otters developed shock more readily and had increased numbers of abnormalities, suggesting that oil exposure was a significant factor.

Reed D. C.; Lewis, R. J.; Anghera, M. **Effects of an open-coast oil-production outfall on patterns of giant kelp (*Macrocystis pyrifera*) recruitment**. *Marine Biology*. 1994; 12025-31.
Experiments were conducted to investigate the spatial scale of benthic effects of an active nearshore produced-water (aqueous wastes of oil/gas production) outfall on the recruitment in the giant kelp, *Macrocystis pyrifera*. Results showed that effects on all parameters measured were limited to the areas in close proximity to the outfall.

Reid, K. **Oiled penguins observed at Bird Island, South Georgia**. *Marine Ornithology*. 1995; 23(1):47-53; ISSN: 1018-3337.
Presented are data on the first observations of oiled seabirds (*Pygocelis* spp.) at Bird Island, South Georgia since the British Antarctic Survey station was initiated in 1971.

Reilley, K. A.; Banks, M. K.; Schwab, A. P. **Dissipation of polycyclic aromatic hydrocarbons in the rhizosphere** . *Journal of Environmental Quality*. March-April 1996; 25(2):212-219; ISSN: 0047-2425.
Researchers investigated the effects of vegetation on the dissipation of polycyclic aromatic hydrocarbons (anthracene and pyrene) in soil contaminated with petroleum products. It was concluded that the presence of plants may enhance the clean-up of PAH-contaminated soils during in situ remediation.

Richardson, W. J. **Acoustic effects of oil production activities on bowhead and white whales visible during spring migration near Pt. Barrow, Alaska -1991 and 1994 phases: sound propagation and whale responses to playbacks of icebreaker noise**. Anchorage, AK: US Department of the Interior, Mineral Management Service; 1995 539 p. (OCS Study; MMS 95-0051).

Roos, P. H.; van Afferden, M.; Strotkamp, D.; Tappe, D.; Pfeifer, F.; Hanstein, W. G. **Liver microsomal levels of cytochrome P450IA1 as biomarker for exposure and bioavailability of soil-bound polycyclic aromatic hydrocarbons**. *Archive of Environmental Contamination and Toxicology*. 1996; 30107-113.
Rats feeding on a diet of contaminated soil were used to assess the bioavailability of soil-bound polycyclic aromatic hydrocarbons (PAHs). Results indicated that cytochrome P450IA1 (CYP1A1) induction in the liver correlated with amount of 5- and 6- ring PAHs in the soil samples but not with the total PAH content. A sample containing 274 mg of 5- and 6- ring PAH/kg soil resulted in the highest induction of CYP1A1, nearly 360-fold increase in EROD activity.

Rotchell, J. M.; Stagg, R. M.; Craft, J. A. **Chemically-induced genetic damage in fish: isolation and characterization of the dab (Limanda limanda) ras gene**. *Marine Pollution Bulletin*. 1995; 31(4-12):457-459.
Researchers identified two ras genes of the North Sea flatfish using polymerase chain reaction (PCR) and suggest that this sequence information will enable future identification of mutated dab ras alleles in fish obtained from areas of high polycyclic aromatic hydrocarbon contamination and in fish artificially contaminated under laboratory conditions.

Roy, S.; Sen, C. K.; Hanninen, O. **Monitoring of polycyclic aromatic hydrocarbons using 'moss bags'**. *Chemosphere*. June 1996; 32(12):2305-2315; ISSN: 0045-6535.

Sadiq, M. **Arabian gulf shrimp quality: some problems and probable solutions**. *Papers Presented at the Technical Consultation on Shrimp Management in the Arabian Gulf*. 1995; 1-12.
The author summarizes the data accumulated by the Research Institute of King Fahd University of Petroleum and Minerals concerning the levels of metal and oil (from spills and platforms) contamination in shrimp collected in the Arabian Gulf. The author also provides recommendations for further research.

Saisho, K.; Hasegawa, Y.; Saeki, M.; Toyoda, M.; Saito, Y. **Bioaccumulation of volatile chlorinated hydrocarbons in blue mussel, *Mytilus edulis*, and killifish, *Oryzias latipes***. *Japanese Journal of Toxicology and Environmental Health*. June 1994; 40(3):274-278; ISSN: 0013-273X.
Volatile chlorinated hydrocarbons (VCHs), 1,1,1-trichloroethane, carbon tetrachloride, trichloethylene, and tetrachloroethylene (PCE) were tested for their ability of bioconcentration in blue mussel and killifish. Results showed both organisms have a large bioaccumulation potency of PCE.

Sanders, M. **Distribution of polycyclic aromatic hydrocarbons in oyster (*Crassostrea virginica*) and surface sediment from two estuaries in South Carolina**. *Archives of Environmental Contamination and Toxicology*. 1995; 28(4):397-405; ISSN: 0090-4341.
A minimum of 30 stations in two high salinity estuaries in South Carolina were used as collection sites to determine the polycyclic aromatic hydrocarbon (PAH) levels in oysters and sediments. Results showed that the highest PAH concentration in oysters was located in narrow creeks, where urban shore intermixed with tidal creeks and the lowest at the mouth of the estuary. With respect to the sediments, a similar gradient was found.

Sawyer, D. C.; Williams, T. D. **Chemical restraint and anesthesia of sea otters affected by the oil spill in Prince William Sound, Alaska**. *Journal of the American Veterinary Medical Association*. June 1, 1996; 208(11):1831-1834; ISSN: 0003-1488.
Described are the procedures and chemical agents used to immobilize rescued sea otters.

BIOLOGY

Sayler, G. S.; Layton, A.; Lajoie, C.; Bowman, J.; Tschantz, M.; Fleming, J. T. **Molecular site assessment and process monitoring in bioremediation and natural attenuation.** *Applied Biochemistry and Biotechnology.* July-September 1995; 54(1-3):277-290; ISSN: 0273-2289.
A review of the fundamental developments and potentials in applying genetic engineering and molecular technology for bioremediation

Sericano, J. L.; Wade, T. L.; Brooks, J. M. **Accumulation and depuration of organic contaminants by the American oyster (*Crassostrea virginica*).** *Science of the Total Environment.* January 26, 1996; 179(1-3):149-160; ISSN: 0048-9697.

Sharp, B. E.; Cody, M.; Turner, R. **Effects of the *Exxon Valdez* oil spill on the black oystercatcher.** *Proceedings of the Exxon Valdez Oil Spill Symposium.* 1996; 18:748-758. ISSN: 0892-2284.
The reproduction and behavior of black oystercatcher (*Haematopus bachmani)* was studied at oiled and at non-oiled control sites to determine the effects from the *Exxon Valdez* oil spill. The study reported a higher mortality rate and lower reproduction at the oiled site.

Shchekaturina, T. L. and others. **Carcinogenic polycyclic aromatic hydrocarbons in mussels from the Black Sea.** *Marine Pollution Bulletin.* 1995; 30(1):38-40; ISSN: 0025-326X.
As filter feeding organisms, mussels may accumulate benzo[a]pyrene (B(a)P), a potent carcinogenic polycyclic aromatic hydrocarbons (PAHs). This study linked B(a)P in a direct statistical manner with pollution by oil and oil products.

Shuttleworth, K. L.; Cerniglia, C. E. **Environmental aspects of PAH biodegradation.** *Applied Biochemistry and Biotechnology.* July-September 1995; 54(1-3):291-302; ISSN: 0273-2289.
A review of the environmental aspects of polycyclic aromatic hydrocarbon (PAH) biodegradation, with a special emphasis on illuminating research needs and gaps in our current knowledge on the subject.

Simonich, S. L.; Hites, R. A. **Organic pollutant accumulation in vegetation.** *Environmental Science & Technology.* December 1995; 29(12):2905-2914; ISSN: 0013-936X.
The authors present a review of organic pollutant accumulation in vegetation. Included are topics such as (a) uptake mechanisms, (b) vegetation as an indicator of contamination, and (c) vegetation as a pollution sink. The authors also provide recommendations for future research.

Singer, M. M. and others. **Acute toxicity of the oil dispersent Corexit 9554 to marine organisms.** *Ecotoxicology & Environmental Safety.* 1995; 32(1):81-86.
Researchers examined and identified the acute toxicity of a surfactant-based oil dispersent, Corexit 9554, to the early life stages of four marine species (*Haliotis rufescens*, *Atherinops affinis*, *Holmesimysis costata*, *Macrocystis pyrifera*). Using a closed flow-through exposure system, researchers reported that the Haliotis test was the most sensitive, followed by *Macrocystis, Atherinops*, and *Holmesimysis.*

Siron, R.; Pelletier, E.; Roy, S. **Effects of dispersed and absorbed crude oil on macroalgal and bacterial communities of cold seawater.** *Ecotoxicology.* 1996; 5(4):229-251.
Using mesocosms to simulate oil treatments (chemical dispersion, adsorption by immersed substrate, and an untreated control), researchers investigated the effects of crude oil on macroalgal and bacterial communities. Results indicated: phytoplankton growth was inhibited early in the tanks with dispersed oil and adsorbed oil; species composition was significantly different when comparing the treated tanks to the control; the growth of heterotrophic bacteria was stimulated immediately in the treated tanks; and no significant bacterial enhancement was detected in the control.

Smith, S. D. A.; Simpson, R. D. **Effects of the *Nella Dan* oil spill on the fauna of *Durvillaea antarctica* holdfasts.** *Marine Ecology Progress Series.* May 25, 1995; 12173-89; ISSN: 0171-8630.
Non-metric multidimensional scaling of various taxa was used to study community structure of invertebrates inhabiting *Durvillacea antarctica* holdfasts in sub-Antarctic environments. Oiled sites were characterized by heavy sediment loads, dominance of capitellid, cirratulid and spinoid polychaetes, and rarity of the herbivorous isopod Limnoria stephenseni. Study suggests that rarity of L. stephenseni at oiled sites may result in sediment accumulation within internal chambers of the holdfast, producing a habitat more favorable for polychaetes.

Solé, M.; Porte, C.; Albaig, S. J. **Seasonal variation in the mixed-function oxygenase system and antioxidant enzymes of the mussel Mytilus galloprovincialis.** *Environmental Toxicology and Chemistry.* January 1995; 14(1):157-164; ISSN: 0730-7268.
Investigated are the seasonal variations in the mixed-function oxygenase (MFO) system components and antioxidant enzymes of the mussel. In general, low MFO and antioxidant enzyme activities were found during the period February - March, a peak in late April, then a gradual decrease to a minimum in June. Researchers suggested that this variation may be related to the metabolic status of the animal.

Solé, M.; Porte, C.; Albaigs, J. **The use of biomarkers for assessing the effects of organic pollution in mussels.** *Science of the Total Environment.* January 10, 1995; 159(2-3):147-153; ISSN: 0048-9697.
Researchers collected wild mussels from two locations with differing pollution loads. Mussels were examined for both polycyclic aromatic hydrocarbon and polychlorinated biphenyl content. Researchers determined the mixed function oxidase system components (from first stage of xenobiotic metabolism) and the antioxident defenses in the digestive gland, and the extent of biochemical responses relative to the pollutant tissue levels. A comparison of mussels from each location detected significant differences in hydrocarbon content, with smaller differences in biological response.

Solé, M.; Porte, C.; Biosca, X.; Mitchelmore, C. L.; Chipman, J. K.; Livingstone, D. R.; Albaiges, J. **Effects of the *Aegean Sea* oil spill on biotransformation enzymes, oxidative stress and DNA-adduct in digestive gland of the mussel (*Mytilus edulus* L.).** *Comparative Biochemistry and Physiology C.* 1996; 113C(2):257-265. ISSN: 0742-8413.
The results of molecular biomarkers of impact by organic pollution, from the *Aegean Sea* oil spill, were applied to mussel samples collected from five different sites along the Galician coast, Induction of cytochrome P450(s) and oxidative damage in mussels exposed to oil was indicated.

Sorkhoh, N. A.; Al-Hasan, R. H.; Khanafer, M.; Radwan, S. S. **Establishment of oil-degrading bacteria associated with cyanobacteria in oil-polluted soil.** *Journal of Applied Bacteriology.* February 1995; 78(2):194-199; ISSN: 0021-8847.
Reported is a unique microbial mixture with promising potential for remediating oil-polluted desert in the Arabian Gulf region. The oil-degrading micro-organisms biodegraded 50% of the oil within 10-20 weeks. Nocardioforms in the genus *Rhodococcus* dominated the degradation intially, but after 22 weeks *Pseudomonas spp.* increased to share dominance. Other oil-utilizing bacterial genera included Bacillus and Arthrobacter.

Sotsky, J. B.; Greer, C. W.; Atlas, R. M. **Frequency of genes in aromatic and aliphatic hydrocarbon biodegradation pathways within bacterial populations from Alaskan sediments.** *Canadian Journal of Microbiology.* November 1994; 40(11):981-985.
Researchers report that the genotypes of hydrocarbon-degrading populations reflected the composition of the hydrocarbons to which they were exposed.

Spies, Robert B. and others. **Biomarkers of hydrocarbon exposure and sublethal effects in embiotocid fishes from a natural petroleum seep in the Santa Barbara Channel.** *Aquatic Toxicology.* March 1996; 34(3):195-219; ISSN: 0166-445X.
Using the surfperch *Hypsurus caryi* and *Rachochilus toxodes*, researchers measured several markers of hydrocarbon exposure and sublethal effects by examining surfperch characteristics such as fluorescent compounds in the bile, cytochrome P4501A induction, and histopathological change.

Stagg, R. M.; Mcintosh, A. **Hydrocarbon concentrations in the northern North Sea and effects on fish larvae.** *Science of the Total Environment.* July 30, 1996; 186(3):189-201; ISSN: 0048-9697.

Stekoll, M. S.; Deysher, L. **Recolonization and restoration of upper intertidal *Fucus gardneri* (*Fucales, Phaeophyta*) following the *Exxon Valdez* oil spill.** *Hydrobiologia.* July 26, 1996; 327311-316; ISSN: 0018-8158.
In an effort to asses the environmental damage on the intertidal seaweed community caused by the 1989 *Exxon Valdez* oil spill, researchers determined the geographic extent of the regions displaying a slow recovery of the seaweed *F. gardneri*, determined the various factors causing this slow recovery, and determined if, in-fact, any cost-effective measures can be taken to restore the seaweed communities.

Stubblefield, William A.; Hancock, Gregg A.; Ford, William H.; Ringer, Robert K. **Acute and subchronic toxicity of naturally weathered *Exxon Valdez* crude oil in mallards and ferrets.** *Environmental Toxicology and Chemistry.* November 1995; 14(11):1941-1950; ISSN: 0730-7268.
Mallards (*Anas platyrhynchos*) and ferrets (*Mustela putorius*) were used to assess the toxic properties of naturally weathered crude oil from the *Exxon Valdez* spill. Researchers describe studies that evaluated the effects resulting from acute (short-term) oral exposure to large quantities of oil. Tests conducted on mallards included acute oral toxicity tests, a subacute dietary toxicity test, a food avoidance test, and a 14-d dietary feeding study. Effects of oil on ferrets were evaluated using a 5-d oral toxicity test.

Stubblefield, William A.; Hancock, Gregg A.; Prince, Harold H.; Ringer, Robert K. **Effects of naturally weathered *Exxon Valdez* crude oil on mallard reproduction.** *Environmental Toxicology and Chemistry.* November 1995; 14(11):1951-1960; ISSN: 0730-7268.
Researchers conducted a one-generation reproductive toxicity study and a direct eggshell application toxicity study on the mallard Anas platyrhynchos in an effort to assess the toxicity of naturally weathered North Slope Crude Oil following the *Exxon Valdez* oil spill.

Suchanek, T. H. **Oil impacts on marine invertebrate populations and communities.** *American Zoologist.* 1993; 33(6):510-523; ISSN: 0003-1569.
A general review of the physiological, behavioral, and reproductive effects and influences of oil on marine invertebrates is given.

Suedel, B. C.; Rodgers, J. H. Jr. **Toxicity of fluoranthene to *Daphnia magna, Hyalella azteca, Chironomous tentans*, and *Stylaria lacustris* in water-only and whole sediment exposures.** *Bulletin of Environmental Contamination and Toxicology.* July 1996; 57(1):132-138; ISSN: 0007-4861.
Researchers determined relative sensitivities and relative responses of *Daphnia magna, Hyalella azteca, Chironomous tentans*, and *Stylaria lacustris* to fluoranthene.

Talaska, G.; Underwood, P.; Maier, A.; Lewtas, J.; Rothman, N.;Jaeger, M. **Polycyclic aromatic hydrocarbons (PAHs), nitro-PAHs and related environmental compounds: biological markers of exposure and effects.** *Environmental Health Perspectives.* October 1996; 104(Supplement 5):901-906; ISSN: 0091-6765.

Thomas, Peter;Budiantara, Lestarini. **Reproductive life history stages sensitive to oil and naphthalene in Atlantic croaker.** *Marine Environmental Research.* 1995; 39(1-4):147-150; ISSN: 0141-1136.
Examined were the reproductive effects of chronic exposure to water-soluble fractions of diesel fuel oil and naphthalene in the female Atlantic croaker during critical periods of its reproductive life history. Results indicated that both pollutants blocked sexual maturation in some fish and impaired ovarian recrudescence in others. Also, the majority of the oocytes in the exposed fish were undeveloped and widespread oocyte atresia was evident at higher concentrations.

Traunspurger, W.; Drews, C. **Toxicity analysis of freshwater and marine sediments with meio- and macrobenthic organisms: a review.** *Hydrobiologia.* August 16, 1996; 328(3):215-261; ISSN: 0018-8158.
The authors present an overview of the species of benthic metazoans used for assessing the toxicity in freshwater and marine sediments, as well as the main applications of these organisms.

Van Brummelen, T. C.; van Straalen, N. M. **Uptake and elimination of benzo[a]pyrene in the terrestrial isopod *Porcellio scaber*.** *Archives of Environmental Contamination and Toxicology.* August 1996; 31(2):277-285; ISSN: 0090-4341.
The uptake and elimination rates of benzo[a]pyrene were estimated for the isopod *Porcellio scaber* by feeding the isopod contaminated food (100 μg of benzo[a]pyrene/g dwt) for seven weeks followed by four weeks of untreated food. A one-compartment model fitted to the isopod concentrations estimated an assimilation rate of 2.9 μg benzo[a]pyrene/g dwt day, an elimination rate constant of 1.1/day and an equilibrium concentration of 2.5 μg benzo[a]pyrene/g dwt. In addition, 68% of the isopod population was found to have an equilibrium concentration between 1.0 and 7.2 μg with a half-life of ranging from 0.4 to 1.3 days. The assimilation efficiency was estimated at 20-40% of the ingested benzo[a]pyrene.

Van Dyke, F.; Klein, W. C. **Response of elk to installation of oil wells.** *Journal of Mammalogy.* November 1996; 77(4):1028-1041; ISSN: 0022-2372.
Seasonal and annual use of range and habitat in the population of elk (*Cervus elaphus*) in south central Montana were compared before, during, and after the installation of an oil well. Results indicated that elk compensated for the disturbance by shifts in the use of range, centers of activity, and use of habitat rather than abandonment of range.

Van Pelt, T. I.; Piatt, J. F. **Deposition and persistence of beachcast seabird carcasses.** *Marine Pollution Bulletin.* December 1995; 30(12):794-802; ISSN: 0025-326X.
In the winter of 1993, 121,000 starving *guillemots* (Uria aalge) died en masse with more than 3500 washing ashore in the Gulf of Alaska. This event provided a chance to examine rates of carcass deposition and removal under natural conditions. From this data, researchers present mathematical models of carcass deposition and removal, and present a method of extrapolating from a single count of carcasses deposited on surveyed beaches, which could be utilized to better assess seabird mortality from oil spill events.

Van Vlaardingen, P. L. A.; Steinhoff, W. J.; Devoogt, P.; Admiraal, W. A. **Property-toxicity relationships of azaarenes to the green alga *Scenedesmus acuminatus*.** *Environmental Toxicology and Chemistry.* November 1996; 15(11):2035-2042; ISSN: 0730-7268.
Researchers asses the toxicity of three two-ring and five three-ring azaarenes (PAH in which one carbon atom is substituted by a nitrogen) on the green algae *Scenedesmus acuminatus*.

Vazquez, G. F.; Reyes, M. C.; Fernandez, G.; Aguayo, J. E. C.; Sharma, V. K. **Contamination in marine turtle (*Dermochelys coriaca*) egg shells of Playon de Mexiquillo, Michoacan, Mexico.** *Bulletin of Environmental Contamination and Toxicology.* February 1997; 58(2):326-333. ISSN: 0007-4861.
Researchers collected samples of seawater, sand, and marine turtle egg shells from a coastal preservation area near the mouth of the Rio la Manzanilla and examined the samples for concentrations of oil, grease and metals. Researchers concluded that high levels of oil and grease found in seawater and metals found in sand may be responsible for the levels of contaminants in the turtle egg shells.

Venkateswaran, K.; Hoaki, T.; Kato, M.; Maruyama, T. **Microbial degradation of resins fractionated from arabian light crude oil.** *Canadian Journal of Microbiology.* April-May 1995; 41(4-5):418-424; ISSN: 0008-4166.
Researchers reported that a mixed population of microorganisms that could degrade 35% of 5000 ppm resin components of crude oil in 15 days was obtained from Japanese coastal areas. This population also metabolized 50% of the saturates and aromatics present in crude oil (5000 ppm) in 7 days, and a *Pseudomonas sp.* isolated from the mixture degraded 30% of the resins and 30% of the saturates and aromatics present in crude oil (5000 ppm).

Vogt, H. P. **Coral reefs in Saudi Arabia: 3.5 years after the Gulf War oil spill**. *Coral Reefs*. November 1995; 14(4):271-273; ISSN: 0722-4028.
Researchers investigated the effects of the release of 6-8 million barrels of oil and the burning of 1.12 billion barrels of oil during the 1991 Gulf War on the live coral cover in the Arabian Gulf. Utilizing three sets of video recordings taken between 1992 and 1993 to compare coral cover, investigators reported significant increases in live coral cover. Therefore, it was concluded that the Gulf War contributed no visible immediate or late effects on the coral.

Wagrowski, D. M.; Hites, R. A. **Polycyclic aromatic hydrocarbon accumulation in urban, suburban, and rural vegetation**. *Environmental Science & Technology*. January 1997; 31(1):279-282; ISSN: 0013-936X.
Researchers report on the movement of atmospheric polycyclic aromatic hydrocabon (PAH) to the vegetation in the northeastern United States. Researchers estimate that of the total PAH emitted, vegetation in this region scavenges roughly 160 t or 4%.

Warhurst, A. M.; Fewson, C. A. **Biotransformations catalyzed by the genus *Rhodococcus***. *Critical Reviews in Biotechnology*. 1994; 14(1):29-73; ISSN: 0738-8551.
A diverse range of capabilities displayed by *Rhodococci* makes them excellent candidates for bioremediation treatments. Discussed are their ability to degrade hydrocarbons and numerous aromatic compounds, catalyze biotransformations (steriod modification, enantioselective synthesis, and the transformation of nitriles to amides and acids), as well as their environmental persistance.

Weinstein, J. E. **Fluoranthene-induced histological alterations in oysters, *Crassostrea virginica*: seasonal field and laboratory studies**. *Marine Environmental Research*. May 1997; 43(3):201-218; ISSN: 0141-1136.
Monitored were the stress-related histological parameters (digestive epithelial thickness, gonadal area, incidences of helminth parasites and hemocytic infiltration, and parasite intensity) in oysters obtained from an undeveloped site and two urbanized sites contaminated by fluoranthene. Results indicated that epithelial thinning proved useful as a histological indicator of fluoranthene-induced stress.

Widbom, B.; Oviatt, C. A. **The World Prodigy oil spill in Narragansett Bay, Rhode Island: acute effects on macrobenthic crustacean populations**. *Hydrobiologia*. October 14, 1994; 291(2):115-124; ISSN: 0018-8158.
Studied were the effects on macrobenthic crustaceans within the first five weeks after the spill at five stations with a varying degree of oil exposure. Significant differences were noted for crustacean abundance and distribution, confirming the sensitivity to oil pollution of amphipods and ostracods.

Widdows, J.; Donkin, P.; Brinsley, M. D.; Evans, S. V.; Salkeld, P. N.; Franklin, A.; Law, R. J.; Waldock, M. J. **Scope for growth and contaminant levels in North Sea mussels *Mytilus edulis***. *Marine Ecology - Progress Series*. November 1995; 127(1-3):131-148; ISSN: 0171-8630.
Using the mussels *Mytilus edulis* obtained from 26 sites along the coast of the Shetland Islands to the Thames estuary, researchers demonstrated that by using the combined measurements of the physiological stress responses (scope for growth) and chemical contaminants in the tissues of mussels, they were able to detect, quantify and identify some major toxicants.

Wiens, J. A.; Crist, T. O.; Day, R. H.; Murphy, S. M.; Hayward, G. D. **Effects of the *Exxon Valdez* oil spill on marine bird communities in Prince William Sound, Alaska**. *Ecological Applications*. August 1996; 6(3):828-841; ISSN: 1051-0761.
Researchers investigated the effects of the March 1989 *Exxon Valdez* oil spill on marine bird communities at the community level by analyzing the data compiled from 11 survey cruises between June 1989 and August 1991. Results indicated that the oil spill had significant impacts on the community structure, though this impact was not evenly distributed among ecological guilds. However, by late 1991, none of the community measures indicated continuing negative effects, suggesting that at the community level recovery was underway.

BIOLOGY

Wiens, Johns A. **Oil, seabirds, and science: the effects of the *Exxon Valdez* oil spill.** *Bioscience.* September 1996; 46(8):591-597; ISSN: 0006-3568.
The author discusses the findings and consequences of the many studies on the effects of the *Exxon Valdez* oil spill conducted by researchers from the State of Alaska and various federal agencies. Included are discussions concerning the oil spill effects on population size and structure, reproductive performance, habitat occupancy and use, as well as seabird resiliency and effects of the spill on science.

Williams, T. M. ***Emergency care and rehabilitation of oiled sea otters: a guide for oil spills involving fur-bearing marine mammals.*** Camarillo, CA: US Department of the Interior, Mineral Management Service; 1995299 p.(OCS Study; MMS 95-0048).

Woodin, Bruce R.; Smolowitz, Roxanna M.; Stegeman, John J. **Induction of Cytochrome P4501A in the** intertidal fish *Anoplarchu purpurescens* by Prudhoe Bay crude oil and environmental induction in fish from Prince William Sound. *Environmental Science & Technology* . 1997; 31(4):1198-1205. ISSN: 0013-936X.
Oil present in sediments more than a year after the *Exxon Valdez* spill in Prince William Sound, Alaska, induced CYP1A levels in the intertidal fish (*Anoplarchus purpurescens*). The CYP1A levels collected from caged reference sites, and the sites oiled by the spill, were used as an indicator for geographical distribution, persistence of oil spill effects, and to monitor the recovery and restoration of areas where exposures to xenobiotics including petroleum hydrocarbons occur.

Yamato, O.; Goto, I.; Maeda, Y. **Hemolytic anemia in wild seaducks caused by marine oil pollution.** *Journal of Wildlife Diseases.* April 1996; 32(2):381-384; ISSN: 0090-3558.
Clinico-pathological investigations were conducted on *Melanitta fusca* (white-winged scoters) contaminated with fuel oil from a oil spill ocurring February 1993 in Japan. Results indicated that the contaminated seaduck erythocyte counts, hemoglobin concentrations and hematocrit values all decreased. Additionally, hemosiderosis was observed in the livers, kidneys and lungs of some seaducks. Researchers propose that ingestion of the oil occurs when the birds preen their oiled plumage, thus leading to hemolytic anemia.

Yang, C. Y.; Chiu, H. F.; Chiu, J. F.; Kao, W. Y.; Tsai, S. S.; Lan, S. J. **Cancer mortality and residence near petrochemical industries in Taiwan.** *Journal of Toxicology and Environmental Health.* February 21, 1997; 50(3):265-273. ISSN: 0098-4108.
Researchers examined the cancer risks of human residents living in communities adjacent to the petrochemical industry in Taiwan by comparing 16 residential counties with a heavy concentration of petrochemical industries to 16 demographically similar counties with non-petrochemical industries. It is reported that an excess rate of liver cancer among the males was found in the 16 petrochemical counties.

Yu, Y.; Wade, T. L.; Fang, J.; Mcdonald, S.; Brooks, J. M. **Gas chromatographic-mass spectrometric analysis of polycyclic aromatic hydrocarbon metabolites in Antarctic fish (*Notothenia gibberifrons*) injected with Diesel Fuel Arctic.** *Archives of Environmental Contamination and Toxicology.* August 1995; 29(2):241-246; ISSN: 0090-4341.
Diesel Fuel Arctic was injected into fish collected in pristine sites in the Antarctic. Gas chromatography and mass spectrometry were used to identify and quantify polycyclic aromatic hydrocarbons metabolites obtained from hydrolyzed fish bile. The results suggest that analysis of PAH metabolites is a valuable tool for monitoring the environment and assessing exposure to petroleum.

Zanger, M.; Graff, S.; Braunbeck, T.; Alberti, G.; Kohler, H.-R. **Detection and induction of cytochrome P450IA (CYP1A)-like proteins in *Julus scandinavius* (Diplopoda) and *Oniscus asellus* (Isopoda): a first analysis.** *Bulletin of Environmental Contamination and Toxicology.* April 1997; 58(4):511-517. ISSN: 0007-4861.
Numerous polycyclic aromatic hydrocarbons (PAHs), dioxins, furans, and other organics have been shown to be inducers of CYP1A genes. In this study, researchers reveal the presence of cytochrome P450 in terrestrial soil invertebrates (diplopods and isopods) and report that the induction potential is comparable to vertebrates.

Zhao, Zhen-Hua; Quan, Wenyi; Tian, Dehai. **Urinary 1-hydroxpyrene level as a biomarker: human exposure to ambient polycyclic aromatic hydrocarbons in China**. *Ambio*. June 1995; 24(4):226-230; ISSN: 0044-7447.
A study of young residents of Chinese cities revealed that significant variations in urinary 1-hydroxpyrene were highly correlated with the extent of air pollution by polycyclic aromatic hydrocarbons (PAHs). The study proposes that 1-hydroxpyrene be used as a biomarker for human exposure to environmental PAHs.

Zhou, S. and Ackman, R. G. **Deposition sites for hydrocarbons in Atlantic salmon muscle tissue**. In. Proceedings: Seventeenth Arctic and Marine Oil Spill Program Technical Seminar. Ottawa: Environment Canada; 1994; 1 pp. 479-489.
Presented is a review of studies involving the uptake of the water-soluble fraction of petroleum by Atlantic salmon (Salmo salar) and their depuration in the whole muscle.

Zhou, S.; Ackman, R. G.; Parsons, J. **Very long-chain aliphatic hydrocarbons in lipids of mussels (*Mytilus edulis*) suspended in the water column near petroleum operations off Sable Island, Nova Scotia, Canada**. *Marine Biology*. September 1996; 126(3):499-507; ISSN: 0025-3162.
By examining the hydrocarbon profiles of *Mytulis edulis* suspended in the water column off Sable Island, Nova Scotia, researchers suggest that the occurrence of an unusual phytoplankton bloom during the suspension period significantly interfered with the petrogenic-monitoring role of the mussels by altering the mussel hydrocarbon profiles.

CHEMISTRY/GEOCHEMISTRY/GEOLOGY

Abu, G. O.; Ogiji, P. A. **Initial test of a bioremediation scheme for the clean up of an oil-polluted waterbody in a rural community in Nigeria.** *Bioresource Technology*. October 1996; 58(1):7-12. ISSN: 0960-8524.
A monitored laboratory-scale study was undertaken to explore the application and workability of bioremediation technology for the clean up of an oil-polluted water body in Rivers State, Nigeria. Water and sediments were enriched with nutrients to enhance growth of bacterial populations. Measurements of heterotrophic bacterial activities, hydrocarbon-degrading activities and gravimetric loss of oil with time was monitored. Results indicate the great need for bioremediation technology to return oil-polluted ecosystems in Nigeria to their natural conditions.

Aelion, C. M. **Impact of aquifer sediment grain size on petroleum hydrocarbon distribution and biodegradation**. *Journal of Contaminant Hydrology*. March 1996; 22(1-2):109-121; ISSN: 0169-7722.
Using a jet-fuel contaminated site located in South Carolina, researchers examined microbial activity as a function of sediment type and the heterogeneity of subsurface sediment grain size and contaminant concentration on a small scale in a sandy aquifer.

Ahmad, S.; Ajmal, M.; Normani, A. A. **Organochlorines and polycyclic aromatic hydrocarbons in the sediments of Ganges River (India)**. *Bulletin of Environmental Contamination and Toxicology*. 1996; 57(5):794-802; ISSN: 0007-4861.
Researchers report on the monitoring of the Ganges River (India) for organochlorines and polycyclic aromatic hydrocarbons.

Ahn, I. S.; Lion, L. W.; Shuler, M. L. **Microscale-based modeling of polynuclear aromatic hydrocarbon transport and biodegradation in soil.** *Biotechnology and Bioengineering*. July 5, 1996; 51(1):1-14; ISSN: 0006-3592 .

Alberts, J. J.; Griffin, C.; Gwynne, K.; Leversee, G. J. **Binding of natural humic matter to polycyclic aromatic hydrocarbons in rivers of the southeastern United States**. *Water Science and Technology*. 1994; 30(10):199-205; ISSN: 0273-1223.
Researchers studied the binding ability of polycyclic aromatic hydrocarbons [anthracene, phenanthrene, pyrene, benzo(a)pyrene] to naturally-occurring organic matter (fulvic and humic acids) from five rivers in Georgia (USA) .

Alhaddad, A. A.; Salman, M.; Alyahya, F. **Factors affecting the rate of evaporation of the oil spilled on land during the Gulf War**. *Environmental Technology*. June 1995; 16(6):559-568; ISSN: 0959-3330.
Studies were performed in a laboratory to assess the factors influencing the rate of evaporation of two crude oils (API 28 & 38). Factors studied were temperature, API, depth of oil, exposed surface area, and wind speed. Results indicated that surface area and the API of the crude oil had no influence on the rate of evaporation.

Al-Hadhrami, M. N.; Lappin-Scott, H. M.; Fisher, P. J. **Effects of the addition of organic carbon sources on bacterial respiration and n-alkane biodegradation of Omani crude oil**. *Marine Pollution Bulletin*. April 1996; 32(4):351-357; ISSN: 0025-326X.
Researchers examined whether the addition of organic carbon sources such as surfactants (Corexit 9527 and Corexit 9130) and molasses will increase bacterial respiration of oil-degrading bacteria, Pseudomonas aeruginosa, isolated from the Gulf of Oman. Results indicated that the addition of each markedly increased respiration and was associated with significant n-alkane breakdown.

Ali, L. N. and others. **The dissolution and photodegredation of Kuwaiti crude oil in seawater. Part 1: Quantitative dissolution and analysis of the seawater-soluble fraction**. *Marine Environmental Research*. 1995; 40(1):1-17; ISSN: 0141-1136.
Describes a reliable method for the preparation of a solution of Kuwaiti crude oil in seawater, and for determining concentrations of its components. The dissolved organic carbon (DOC) and ultraviolet fluorescence (UVF) spectrophotometry techniques are suitable for monitoring dissolution, but do not provide accurate estimates of true oil concentrations. More accurate measures of DOCs in seawater were obtained for samples taken from a dissolution apparatus five days after stirring, by addition of deuterated internal standards, extraction with n-pentane, controlled evaporation and gas chromatography-mass spectrometry.

CHEMISTRY/GEOCHEMISTRY/GEOLOGY

Ali, L. N.; Mantoura, R. F.; Rowland, S. J. **The dissolution and photodegradation of Kuwaiti crude oil in seawater. Part 2: a laboratory photodegradation apparatus and photodegradation kinetics of a model seawater soluble hydrocarbon (phenanthrene).** *Marine Environmental Research.* 1995; 40(4):319-335; ISSN: 0141-1136.
Described is a laboratory photodegradation apparatus, utilizing a calibrated xenon lamp with a parabolic mirror for uniform irradiation and temperature control of samples of seawater solutions of phenanthrene, developed to allow reproducible measurements of the pseudo-first order photodegradation rate constant (kp).

Allen-King, R. M.; Gillham, R. W.; Barker, J. F.; Sudicky, E. A. **Fate of dissolved toluene during steady infiltration through unsaturated soil. II. Biotransformation under nutrient-limited conditions.** *Journal of Environmental Quality.* March-April 1996; 25(2):287-295; ISSN: 0047-2425.
Researchers determined the rate constants appropriate for describing biotransformation of dissolved toluene under nutrient-limited conditions. In addition, the effects of toluene exposure on the soil microorganisms were described.

Al-Lihaibi, S. S.; Al-Omran, L. **Petroleum hydrocarbons in offshore sediments from the Gulf.** *Marine Pollution Bulletin.* January 1996; 32(1):65-69; ISSN: 0025-326X.
In an effort to assess petroleum hydrocarbon (PAHs) in the Gulf of Oman and to assess the role and influence of major sedimentary characteristics, researchers utilized fluorescence spectrophotometry to measure the PAHs in offshore sediments from the central portions of the Gulf. Results showed that concentrations varied between 4.0 - 56.2 μg/g wet sediment, averaging 12.3 μg/g. Although elevated concentrations were found in the northwest sector, no correlations were seen between the PAHs and sedimentary organic carbon, mud content, sand content, or gravel content. Therefore, the researchers proposed that the distributions of oil relate more closely to the current and the localized pollution sources.

Andersson, B. E.; Henrysson, T. **Accumulation and degradation of dead-end metabolites during treatment of soil contaminated with polycyclic aromatic hydrocarbons with five strains of white-rot fungi.** *Applied Microbiology and Biotechnology.* December 1996; 46(5-6):647-652. ISSN: 0175-7598.
Researchers investigated white-rot fungi (*Trametes versicolor* PRL 572, *Trametes versicolor* MUCL 28407, *Pleurotus ostreatus* MUCL 29527, *Pleurotus sajor-caju* MUCL 29757 and *Phanerochaete chrysosporium* DSM 1556) for their ability to degrade anthracene, benz[*a*]anthracene, and dibenz[*a,h*]anthracene in soil. Results indicate that in heterogeneous soil, *Trametes* shows little to no accumulation of dead-end metabolites, and *Phanerochaete* and *Pleurotus* are able to convert completely anthracene to 9,10-anthracenedione. Also, *Phanerochaete* was able to degrade the accumulated 9,10-anthracenedione, while *Pleurotus* did not.

Ares, J. O. **Assessment of polynuclear aromatic hydrocarbons ecotoxicity threshold in marine sediments through in situ input/decay measurements.** *Ecotoxicology.* December 1994; 3(4):249-270; ISSN: 0963-9292.
A method and its results are presented to evaluate the decomposition rates of PAHs in coastal undisturbed marine sediments at varying levels of pollution input.

Arino, S.; Marchal, R.; Vandecasteele, J. P. **Identification and production of a rhamnolipidic biosurfactant by a *Pseudomonas* species.** *Applied Microbiology and Biotechnology.* March 1996; 45(1-2):162-168; ISSN: 0175-7598.
Researchers investigated the role of a glycolipid produced by a *P. aeruginosa* isolate obtained from soil contaminated with polycyclic aromatic hydrocarbons.

Ashok, B. T.; Saxena, S. **Biodegradation of polycyclic aromatic hydrocarbons: a review.** *Journal of Scientific & Industrial Research.* August 1995; 54(8):443-451; ISSN: 0022-4456.
The authors present a discussion covering the current state of polycyclic aromatic hydrocarbon biodegradation research.

CHEMISTRY/GEOCHEMISTRY/GEOLOGY

Ashok, B. T.; Saxena, S.; Musarrat, J. **Isolation and characterization of four polycyclic aromatic hydrocarbon degrading bacteria from soil near an oil refinery.** *Letters in Applied Microbiology.* October 1995; 21(4):246-248; ISSN: 0266-8254.
Researchers isolated and characterized four polycyclic aromatic hydrocarbon-degrading strains from soil near an oil refinery. Results indicated that the isolates belonged to the genera *Micrococcus* (2), *Pseudomonas*, and *Alcaligenes*. The researchers also reported that all strains showed appreciable growth in the presence of high salt concentrations (up to 7.5 % NaCl).

Ashok, B. T.; Saxena, S.; Singh, K. P.; Musarrat, J. **Biodegradation of polycyclic aromatic hydrocarbons in soil around Mathura oil refinery, India.** *World Journal of Microbiology & Biotechnology.* November 1995; 11(6):691-692; ISSN: 0959-3993.

Athersuch, J.; Banner, F. T.; Higgins, A. C.; Howarth, R. J.; Swaby, P. A. **The application of expert systems to the identification and use of microfossils in the petroleum industry.** *Mathematical Geology.* May 1994; 26(4):483-489; ISSN: 0882-8121.
Discussed is the efficacy of developing an expert system for microfossil identification and geological dating. The authors demonstrate that such systems can be utilized in the evaluation and interpretation of geological data.

Atlas, Ronald M. **Petroleum biodegradation and oil spill bioremediation.** *Marine Pollution Bulletin.* April-December 1995; 31(4-12):178-182; ISSN: 0025-326X.
The author presents a general outline of the processes involved with petroleum biodegradation and oil spill bioremediation, as well as discusses the current research in the field.

Banat, I. M. **Characterization of biosurfactants and their use in pollution removal state of the art (review).** *Acta Biotechnologica.* 1995; 15(3):251-267; ISSN: 0138-4988.
The author examines the characteristics of microbial biosurfactants and discusses the use of biosurfactants in soil bioremediation field tests and in combating oil pollution in the environment.

Banerjee, D. K.; Gray, M. R. **Analysis of hydrocarbon-contaminated soil by thermal extraction-gas chromatography.** *Environmental Science & Technology.* March 1997; 31(3):646-650. ISSN: 0013-936X.
Researchers determined the accuracy and detection limits for thermal desorption-gas chromatography and developed various methods and procedures for calibration.

Barcelona, M. J.; Lu, J.; Tomczak, D. M. **Organic acid derivatization techniques applied to petroleum hydrocarbon transformations in subsurface environments.** *Ground Water Monitoring and Remediation.* Spring 1995; 15(2):114-124; ISSN: 0277-1926.
The importance of identifying and analyzing the petroleum hydrocarbon degradation products is studied and discussed.

Barnabas, I. J.; Dean, J. R.; Owen, S. P. **Critical review: supercritical fluid extraction of analytes from environment samples: a review.** *Analyst.* November 1994; 119(11):2381-2394; ISSN: 0003-2654.
A description of the major areas of environmental supercritical fluid extraction research currently under investigation with emphasis on the type of matrix being considered.

Barrefors, G. **Monitoring of benzene, toluene and p-xylene in urban air with differential optical absorption spectroscopy technique.** *Science of the Total Environment.* October 28, 1996; 190287-292; ISSN: 0048-9697.

Beaudin, N.; Caron, R. F.; Legros, R.; Ramsay, J.; Lawlor, L.; Ramsay, B. **Cocomposting of weathered hydrocarbon-contaminated soil.** *Compost Science & Utilization.* Spring 1996; 4(2):37-45; ISSN: 1065-657X.

Beltran, J. L.; Ferrer, R.; Guiteras, J. **Determination of polycyclic aromatic hydrocarbons by HPLC with spectrofluorimetric detection and wavelength programming.** *Journal of Liquid Chromatography & Related Technologies.* 1996; 19(3):477-488; ISSN: 1082-6076.
High performance liquid chromatography with fluorescent detection was used to separate and determine the sixteen polycylic aromatic hydrocarbons classified as priority pollutants by the EPA. Researchers report that this method is more promising than the more common gas chromatography (FID or MS detection) and liquid chromatography with UV-Visible or fluormetric detection.

CHEMISTRY/GEOCHEMISTRY/GEOLOGY

Benkacoker, M. O.; Ekundayo, J. A. **Applicability of evaluating the ability of microbes isolated from an oil spill site to degrade oil.** *Environmental Monitoring and Assessment.* May 1997; 45(3):259-272. ISSN: 0167-6369.

Benka-Coker, M. O.; Olumagin, A. **Effects of waste drilling fluid on bacterial isolates from a mangrove swamp oilfield location in the Niger Delta of Nigeria.** *Bioresource Technology.* March 1996; 55(3):175-179; ISSN: 0960-8524.
Researchers determined the effects of waste drilling fluid obtained from a mangrove swamp oil well on four bacterial strains (*Micrococcus*, *Pseudomonas*, *Alcaligenes*, *Staphylococcus*) isolated from the oilfield ecosystem.

Bertrand, J. C.; Bonin, P.; Goutx, M.; Gauthier, M.; Mille, G. **The potential application of biosurfactants in combatting hydrocarbon pollution in marine environments.** *Research in Microbiology.* 1994; 145(1):53-55; ISSN: 0923-2508.
Discussed is the potential of using biosurfactants for the removal of adherent oil from solid surfaces and for dispersing oil in water (fragmentation up to solubilization) in order to facilitate biodegradation processes.

Bezalel, L.; Hadar, Y.; Cerniglia, C. E. **Mineralization of polycyclic aromatic hydrocarbons by the white rot fungus *Pleurotus ostreatus*.** *Applied and Environmental Microbiology.* January 1996; 62(1):292-295; ISSN: 0099-2240.
In the presence of polycyclic aromatic hydrocarbons, enzymatic activities were monitored during the growth of the white rot fungus. Researchers demonstrated that *P. ostretus* was able to mineralize catechol and a variety of PAHs, including the carcinogenic benzo(a)pyrene.

Bezalel, L.; Hadar, Y.; Fu, P. P.; Freeman, J. P.; Cerniglia, C. E. **Initial oxidation products in the metabolism of pyrene, anthracene, fluorene, and dibenzothiophene by the white rot fungus *Pleurotus ostreatus*.** *Applied and Environmental Microbiology.* July 1996; 62(7):2554-2559; ISSN: 0099-2240.
Researchers isolate and identify the metabolites produced by *Pleurotus ostreatus* cultures from pyrene, anthracene, fluorene, and a sulfur-containing polycyclic aromatic hydrocarbon (dibenzothiophene). In addition, the researchers determine the absolute configuration of the anthracene *trans*-1,2-dihydrodiol and pyrene *trans*-4,5-dihydrodiol metabolites.

Bezalel, L.; Hadar, Y.; Fu, P. P.; Freeman, J. P.; Cerniglia, C. E. **Metabolism of phenanthrene by the white rot fungus *Pleurotus ostreatus*.** *Applied and Environmental Microbiology.* July 1996; 62(7):2547-2553; ISSN: 0099-2240.
Researchers describe the isolation and characterization of metabolites produced from the degradation of phenanthrene by *Pleurotus ostreatus*, and provide evidence that a cytochrome P450 monooxygenase is involved in the degradation mechanism.

Bioremediation: a layman's guide to techniques and materials [World Wide Web]. 1995 URL=http://tigger.jvnc.net/ levins/microbes.html.
A World Wide Web site providing comprehensive background data on the current state of the art petroleum hydrocarbon bioremediation techniques.

Bishop, William F.; Debano, Godwin. **Mediterranean Sea potential seen in area south of Malta.** *Oil and Gas Journal.* July 5, 1993; 9160-63; ISSN: 0030-1388.
The potential for finding significant hydrocarbon reserves in Area 4 of the Mediterranean is described.

Bjerg, P. L.; Brun, A.; Nielsen, P. H.; Christensen, T. H. **Application of a model accounting for kinetic sorption and degradation to *in situ* microcosm observations on the fate of aromatic hydrocarbons in an aerobic aquifer.** *Water Resources Research.* June 1996; 32(6):1831-1841; ISSN: 0043-1397.
Investigated was the fate of seven aromatic hydrocarbons under aerobic conditions by an *in situ* microcosm in a sandy aquifer low in organic content.

Bogan, B. W.; Schoenike, B.; Lamar, R. T.; Cullen, D. **Manganese peroxidase mRNA and enzyme activity levels during bioremediation of polycyclic aromatic hydrocarbon-contaminated soil with *Phanerochaete chrysosporium*.** *Applied and Environmental Microbiology.* July 1996; 62(7):2381-2386; ISSN: 0099-2240.
Researchers used mRNA extraction from soil and quantitation by competitive reverse transcription-PCR to examine the expression of three manganese peroxidase genes during the removal of polycyclic aromatic hydrocarbons from cultures of *Phanerochaete chrysosporium* grown in sterilized soil.

CHEMISTRY/GEOCHEMISTRY/GEOLOGY

Bogan, Bill W.; Lamar, Richard T. **Polycyclic aromatic hydrocarbon-degrading capabilities of *Phanerochaete laevis* HHB-1625 and its extracellular ligninolytic enzymes.** *Applied and Environmental Microbiology*. May 1996; 62(5):1597-1603; ISSN: 0099-2240.
Researchers studied the hydrocarbon-degrading ability of *P. laevis* HHB-1625 in relation to its extracellular ligninolytic enzymes.

Bossert, I. D. and Compeau, G. C. **Cleanup of petroleum hydrocarbon contamination in soil.** In: Young, L. Y. and Cerniglia, C. E. *Microbial Transformation and Degradation of Toxic Organic Chemicals*: Wiley-Liss, Inc c1995 pp. 77-125. ISBN: 0-471-52109-4.
The authors present a review focusing on the fate and biodegradation of petroleum in the soil environment and the technologies for biological treatment.

Bowadt, S.; Hawthorne, S. B. **Supercritical fluid extraction in environmental analysis.** *Journal of Chromatography A*. May 26, 1995; 703(1-2):549-571; ISSN: 0021-9673.
A review article focusing on the supercritical fluid extraction (SFE) process and its applications in an effort to increase SFE recoveries of pollutants from environmental solids.

Bowlen, G. F. and Kosson, D. S. ***In situ* processes for bioremediation of BTEX and petroleum fuel products.** In: Young, L. Y. and Cerniglia, C. E. *Microbial Transformation and Degradation of Toxic Organic Chemicals*: Wiley-Liss, Inc c1995 pp. 515-542. ISBN: 0-471-52109-4.
Presented is a review of the current state of the art for *in situ* bioremediation of soils and groundwater contaminated with BTEX and petroleum fuels. Also discussed are the considerations and limitations of process design.

Bragg, J. R. and Owens, E. H. **Clay-oil flocculation as a natural cleansing process following oil spills: Part 1. Studies of shoreline sediments and residues form past spills.** In. *Proceedings: Seventeenth Arctic and Marine Oil Spill Program Technical Seminar*. Ottawa: Environment Canada; 1994; 1 pp. 1-23.
Researchers examined oil sediment samples from a variety of oil spills to document that clay-oil flocculation occurred after these oil spills had been investigated. Results indicated that the mineral sediments necessary to form clay-oil flocculate are present at most locations, yet the rate of flocculation and the removal of the flocculated oil is dependent on the oil viscosity and the energy available from water motion.

Bregnard, T. P. A.; Haner, A.; Hohener, P.; Zeyer, J. **Anaerobic degradation of pristane in nitrate-reducing microcosms and enrichment cultures.** *Applied and Environmental Microbiology*. May 1997; 63(5):2077-2081. ISSN: 0099-2240.
Microcosm studies were conducted under nitrate-reducing conditions with diesel fuel-contaminated aquifer material from a site treated by in situ bioremediation. This study demonstrated that pristane can no longer be regarded as recalcitrant under anaerobic conditions.

Brouwer, E. R.; Hermans, A. N.; Lingeman, H.; Brinkman, U. A. **Determination of polycyclic aromatic hydrocarbons in surface water by column liquid chromatography with fluorescence detection, using on-line micelle-mediated sample preparation.** *Journal of Chromatography A*. 1994; 669(1-2):45-57; ISSN: 0021-9673.
Column liquid chromatography with fluorescence and diode-array UV detection has been used for the trace-level determination of sixteen EPA-priority polycyclic aromatic compounds. The system has been used to for the analysis of surface water samples and detection limits typically at the low- to sub-ng/l level.

Bruheim, P.; Bredholt, H.; Eimhjellen, K. **Bacterial degradation of emulsified crude oil and the effect of various surfactants.** *Canadian Journal of Microbiology*. January 1997; 43(1):17-22. ISSN: 0008-4166.
The purpose of this research was to explore the use of a selected bacterium, *Rhodococcus sp.* 094, and test the effects of surfactants on the oxidation rates of alkanes in crude oil in various growth stages of bacteria. Oxidation rates were measured in a 3-h period by Warburg respirometry. Negative responses were observed in the oxidation rates by cells in the exponential growth phase. In some cases stimulatory effects were observed depending on both the chemical structure and the physicochemical properties of the surfactants in the cells of the stationary growth phase.

Bublitz, J.; Christophersen, A.; Schade, W. **Laser-based detection of PAHs and BTXE-aromatics in oil polluted soil samples.** *Fresenius Journal of Analytical Chemistry*. July 1996; 355(5-6):684-686; ISSN: 0937-0633.
Researchers applied time-resolved laser-induced fluorescence spectroscopy and fiber optics for the detection of hydrocarbons in oil contaminated water and soil samples.

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Bublitz, J.; Dickenhausen, M.; Gratz, M.; Todt, S.; Schade, W. **Fiber-optic laser-induced fluorescence probe for the detection of environmental pollutants.** *Applied Optics.* June 20, 1995; 34(18):3223-3233; ISSN: 0003-6935.
Laser-induced fluorescence (LIF) spectroscopy in combination with fiber optics is shown to be a powerful tool for qualitative and quantitative diagnostics of environmental pollution in water and soil.

Bucal , Vernica; Saito, Hiroshi; Howard, Jack B.; Peters, William A. **Thermal treatment of fuel oil-contaminated soils under rapid heating conditions.** *Environmental Science and Technology.* October 1994; 28(11):1801-1807; ISSN: 0013-936X.
Examined are temperature and related effects on soil decontamination under rapid heating conditions pertinent to treatment of finely divided soil particles with implications for application above-ground or *in situ.*

Burford, M. D.; Hawthorne, S. B.; Miller, D. J. **Analysis of volatile organics by supercritical fluid extraction coupled to gas chromatography. II. Quantitation of petroleum hydrocarbons from environmental sample.** *Journal of Chromatography A.* November 11, 1994; 685(1):95-111; ISSN: 0021-9673.
The authors report on a coupled supercritical fluid extraction-gas chromatography method that has been developed for the quantitative extraction and analysis of gasoline and diesel range organics from real world environmental samples.

Caldini, G.; Cenci, G.; Manenti, R.; Morozzi, G. **The ability of an environmental isolate of *Pseudomonas fluorescens* to utilize chrysene and other four ring polynuclear aromatic hydrocarbons.** *Applied Microbiology and Biotechnology.* December 1995; 44(1-2):225-229; ISSN: 0175-7598.
The ability of P. fluorescens to grow on the polycyclic aromatic hydrocarbons (4-ring) was investigated. Researchers reported that P. fluorescens was able to grow on and degrade chrysene, benz(a)anthracene, and benzo(b)naphthothiophene, but not benz(a)acridine.

Casellas, M.; Grifoll, M.; Bayona, J. M.; Solanas, A. M. **New metabolites in the degradation of fluorene by *Arthrobacter* sp. Strain F101.** *Applied and Environmental Microbiology.* March 1997; 63(3):819-826. ISSN: 0099-2240.
Researchers identify new metabolites and demonstrate enzymatic activities for the metabolism of fluorene by *Arthrobacter* sp. strain F101.

Cejpek, K.; Hajslova, J.; Jehlickova, Z.; Merhaut, J. **Simplified extraction and cleanup procedure for the determination of PAHs in fatty and protein-rich matrices.** *International Journal of Environmental Analytical Chemistry.* 1995; 61(1):65-80; ISSN: 0306-7319.

Chaineau, C. H.; Morel, J. L.; Oudot, J. **Land treatment of oil-based drill cuttings in an agricultural soil.** *Journal of Environmental Quality.* July-August 1996; 25(4):858-867; ISSN: 0047-2425.
Researchers investigated the biodegradation, mobility, and phytotoxicity of fuel oil hydrocarbons obtained from drill cuttings in a 28-month field experiment.

Chaineau, Claude-Henri; Morel, Jean-Louis; Oudot, Jean. **Microbial degradation in soil microcosms of fuel oil hydrocarbons from drill cuttings.** *Environmental Science and Technology.* 1995; 29(6):1615-1621.
Fuel oil hydrocarbon biodegradation in drill cuttings was examined in soil microcosms. It was reported that the decrease in hydrocarbon concentration was logarithmic with time. At the end of the 270-day experiment, the fuel oil was 75% degraded, the aromatic fraction was 71% degraded, the resin fraction was not affected by biodegradation, and in the saturated fraction, normal and branched alkanes were almost totally eliminated, while 22% of the cycloalkanes were not assimilated. Also reported, the inorganic part of the drill cuttings had no influence on the biodegradation rates and biogenic hydrocarbons and traces of degradable fuel oil hydrocarbons were protected from microbial activity by the soil and cuttings matrix.

Chandra, S. D.; Ward, C. H.; Hughes, J. B. **Biodegradation of sorbed fluorene in sediment slurries.** *Hazardous Waste & Hazardous Materials.* Fall 1996; 13(3):375-385; ISSN: 0882-5696.
Researchers examined the factors that control the rate and extent of biodegradation in sediment slurry systems using fluorene as the model compound.

Churchill, P. F.; Churchill, S. A. **Surfactant-enhanced biodegradation of solid alkanes.** *Journal of Environmental Science and Health Part A.* 1997; A32(1):293-306. ISSN: JESEDU.
The effect of two non-ionic bacterial strains surfactants, were investigated for the rate of biodegradation of octadecane. Mineralization without surfactant amendment occurred much faster. Cell surface hydrophobicites were measured using bacterial adherence to hydrocarbon assay. The results indicated *Acinetobacter* strains were very hydrophobic, while *Pseudomonas aeruginosa* and *Rhodococcus erythopolis* were hydrophilic, suggesting surfactant-enhanced bioremediation to be correlated with cell surface hydrophobicity.

Churchill, S. A.; Griffin, R. A.; Jones, L. P.; Churchill, P. F. **Biodegradation rate enhancement of hydrocarbons by an oleophilic fertilizer and a rhamnolipid biosurfactant.** *Journal of Environmental Quality.* January-February 1995; 24(1):19-28; ISSN: 0047-2425.
The oleophilic fertilizer Inipol EAP 22 and a microbial biosurfactant (rhamnolipid) were investigated for their ability to increase the rate of biodegradation of aromatic hydrocarbons by pure bacterial cultures.

Clayton, C. J.; Hay, S. J.; Baylis, S. A.; Dipper, B. **Alteration of natural gas during leakage from a North Sea salt diapir field.** *Marine Geology.* February 1997; 137(1-2):69-80. ISSN: 0025-3227.
Biodegradation from oil and gases leaking from a salt diapir field in the Norwegian Sector of the Central North Sea showed an increase in $\delta^{13}C$ for methane and ethane, with a lesser effect on propane, butane, and pentane. Isotopically light methane was found only in the very deepest samples, which is thought to be biogenic gas trapped in the salt at the time of deposition. No evidence was found that any "secondary" biogenic methane is being produced during gas seepage and biodegradation at the site.

Clement, R. E.; Eiceman, G. A.; Koester, C. J. **Environmental analysis.** *Analytical Chemistry.* June 15, 1995; 67(12):221R-255R; ISSN: 0003-2700.
A review covering developments in applied environmental analytical chemistry from January 1993 - October 1994 as found in the Chemical Abstracts Service CA Selects for gas chromatography, mass spectrometry, inorganic analytic chemistry, and pollution monitoring.

Coates, J. D.; Anderson, R. T.; Lovley, D. R. **Oxidation of polycyclic aromatic hydrocarbons under sulfate-reducing conditions.** *Applied and Environmental Microbiology.* March 1996; 62(3):1099-1101; ISSN: 0099-2240.
By examining the oxidation of naphthalene and phenanthrene under strict anaerobic conditions, researchers suggested that the self-purification ability of PAH-contaminated sulfate-reducing environments may be greater than previously recognized.

Coates, J. D.; Anderson, R. T.; Woodward, J. C.; Phillips, E. J. P.; Lovley, D. R. **Anaerobic hydrocarbon degradation in petroleum-contaminated harbor sediments under sulfate-reducing and artificially imposed iron-reducing conditions.** *Environmental Science & Technology.* September 1996; 30(9):2784-2789; ISSN: 0013-936X.
Researchers investigated the potential use of Fe(III) oxide to stimulate and increase *in situ* hydrocarbon degradation in anaerobic petroleum-contaminated harbor sediments. Researchers reported that although the addition of Fe(III) oxide did not stimulate hydrocarbon degradation, results demonstrated there may be significant degradation under sulfate-reducing conditions.

Collins, P. J.; Kotterman, M. J. J.; Field, J. A.; Dobson, A. D. W. **Oxidation of anthracene and benzo[a]pyrene by laccases from *Trametes versicolor*.** *Applied and Environmental Microbiology.* December 1996; 62(12):4563-4567; ISSN: 0099-2240.
Researchers present evidence that laccase plays a role in polycyclic aromatic hydrocarbon oxidation by white rot fungi.

Conde, J. E.; Pena, E.; Montelongo, F. G. **Sources of tar balls and oil slicks on the coasts of the Canary Islands.** *International Journal of Environmental Analytical Chemistry.* 1996; 62(1):77-84; ISSN: 0306-7319.
Researchers sampled and analyzed tar balls and oil slicks on several beaches in the Canary Islands for *n*-alkanes and polycyclic aromatic hydrocarbons by gas chromatography and spectrofluorimetry, respectively.

Conrad, M. E.; Daley, P. F.; Fischer, M. L.; Buchanan, B. B.; Leighton, R.; Kashgarian, M. **Combined ^{14}C and $\delta^{13}C$ monitoring of *in situ* biodegradation of petroleum hydrocarbons.** *Environmental Science & Technology.* May 1997; 31(5):1463-1469. ISSN: 0013-936X.
Measurements of the stable carbon isotope ratios ($\delta^{13}C$) of microbial metabolic end products presents a promising method for monitoring *in situ* bioremediation of petroleum hydrocarbons. This method was applied at a ^{14}C-free carbon gasoline station spill site. Low ^{14}C contents of high $\delta^{13}C$ CO_2 established that the soil gas CO_2 was derived from methanogenesis hydrocarbons, not shell dissolution. Low ^{14}C content along with a 16% drop in the $\delta^{13}C$ values of CO_2 beneath the gas station, confirmed microbial oxidation of methane was occurring within this zone.

Crawford, R. and Crawford, Don. **Bioremediation: principles and applications.** New York: Cambridge University Press; 1996;400 p.(Biotechnology Research; v. 6). ISBN: 0-521-47041-2.
This monograph examines the issues concerning the use of bioremediation technologies and presents the most recent viewpoints on the application of bioremediation of polluted soils and water.

Cutright, T. J. **Polycyclic aromatic hydrocarbon biodegradation and kinetics using *Cunninghamella echinulata var elegans*.** *International Biodeterioration & Biodegradation.* 1995; 35(4):397-408; ISSN: 0964-8305.
Presented is a study to determine the specific degradation rates for the bioremediation of PAH contaminated soils. More specifically, an investigation concerning the kinetics associated with *C. echinulata var elegans* with three supplemental nutrient solutions is included.

Cutright, T. J.; Lee, S. G. **Bioremediation kinetics for PAH contaminated soils.** *Fresenius Environmental Bulletin.* October 1994; 3(10):597-603; ISSN: 1018-4619.
The authors investigated the specific degradation rates for the bioremediation of soils contaminated with polycyclic aromatic hydrocarbons--specifically, the kinetics associated with *Achromobacter sp.* and *Mycobacterium sp.* in conjunction with three supplemental solutions.

Dave, H.; Ramakrishna, C.; Bhatt, B. D.; Desai, J. D. **Biodegradation of slop oil from a petrochemical industry and bioreclamation of slop oil contaminated soil.** *World Journal of Microbiology & Biotechnology.* November 1994; 10(6):653-656; ISSN: 0959-3993.

De Jonge, H.; Freijer, J. I.; Verstraten, J. M.; Westerveld, J.; Vanderwielen, F. W. M. **Relation between bioavailability and fuel oil hydrocarbon composition in contaminated soils.** *Environmental Science & Technology.* March 1997; 31(3):771-775. ISSN: 0013-936X.
By using a lysimeter experiment and laboratory incubations, researchers assess the fate of *n*-alkanes in oil. Results indicate that a shift in *n*-alkane ratios in the range of $n\text{-}C^{16}$:$n\text{-}C^{20}$ was observed around 4.0 g/kg; thus indicating that two mechanisms control the bioavailability of oil. At higher concentrations, solubilization from a non-aqueous-phase liquid to an aqueous soil-water-phase controls bioavailabilty, whereas at lower concentrations desorption and diffusion became rate-limiting factors.

De Meyer, Christian P.; Charlier, Roger H.; De Vos, Kristien; Malherbe, Bernard. ***In situ* bioremediation of contaminated sediments. Cultured micro-organisms improve natural microbiological degradation of organic pollutants, reduce mud volume in place.** *Sea Technology.* January 1997; 38(1):57-59. ISSN: 0093-3561.
To improve waterways and to clean coastal basins, a full-scale project was conducted in Zierikzee, Netherlands, using an improved procedure of *in situ* natural microbiological degradation that reduces the volume of disposal of organic pollutants such as mineral oils, PAHs, and others.

De Souza, M.-J. B. D.; Nair, S.; David, J. J.; Chandramohan, D. **Crude oil degradation by phosphate-solubilizing bacteria.** *Journal of Marine Biotechnology.* 1996; 4(2):91-95.
Researchers isolated and identified two phosphate-solubilizing bacteria from tropical areas of the Indian peninsula. *Klebsiella pneumoniae* and *Bacillus pumilus* were shown to degrade crude oils by 62% and 85%, respectively. In addition, cultures with both isolates showed a 91% degradation. In both cases, all fractions of crude oil were degraded.

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De Voogt, P. **Chromatographic clean-up methods for the determination of persistent organic compounds in aqueous environmental samples.** *Trends in Analytical Chemistry.* October 1994; 13(9):389-397; ISSN: 0165-9936.
A review of the clean-up methods for the determination of persistent organic compounds. Discussed are basic principles, techniques, and recent developments. Several promising new techniques, combining extraction and clean-up, are reported.

Dean-Ross, D.; Cerniglia, C. E. **Degradation of pyrene by *Mycobacterium flavescens*.** *Applied Microbiology and Biotechnology.* October 1996; 46(3):307-312; ISSN: 0175-7598.
The isolation and characterization of a strain of *Mycobacterium flavescens* capable of growth on the polycyclic aromatic hydrocarbon pyrene is described. Also presented are data on the initial metabolites of pyrene formed by *M. flavescens*.

Delgado, M. A. R.; Sanchez, M. J.; Gonzalez, V.; Montelongo, F. G. **Determination of polynuclear aromatic hydrocarbons in environmental samples by micellar liquid chromatography.** *Journal of High Resolution Chromatography.* February 1996; 19(2):111-116; ISSN: 0935-6304.
Described is a method for the separation of polycyclic aromatic hydrocarbons (PAHs) by high-performance liquid chromatography using a hybrid micellar mobile phase. PAH detection was carried out using the fluorescence method with programmable excitation and emission wavelength.

Delille, D.; Basseres, A.; Dessommes, A. **Seasonal variation of bacteria in sea ice contaminated by diesel fuel and dispersed crude oil.** *Microbial Ecology.* March-April 1997; 33(2):97-105. ISSN: 0095-3628.
Investigated are the long-term effects of diesel fuel and Arabian light crude oil contamination on microbial communities in land-fast ice in the Terre Adelie area (Antarctica). Results revealed a significant response to hydrocarbon contamination to the extent of three orders of magnitude increases in bacterial counts.

Deschénes, L.; Lafrance, P.; Villeneuve, J. P.; Sampson, R. **The effect of an anionic surfactant on the mobilization and biodegradation of PAHs in a creosote-contaminated soil.** *Journal Des Sciences Hydrologiques.* August 1995; 40(4):471-484.
In the presence of sodium dodecyl sulphate (SDS), the mobilization and biodegradation of 13 PAHs in a creosote-contaminated soil was assessed. Researchers concluded that SDS is an efficient PAH mobilizer, but in soil pore water or groundwater it will not increase PAH biodegradation.

Dewulf, J.; Dewettinck, T.; Devisscher, A.; Vanlangenhove, H. **Sorption of chlorinated C-1- and C-2-hydrocarbons and monocyclic aromatic hydrocarbons on sea sediment.** *Water Research.* December 1996; 30(12):3130-3138. ISSN: 0043-1354.
Researchers investigated the sorption of chlorinated C1- and C2-hydrocarbons and monocyclic aromatic hydrocarbons on sea sediment with a miscible displacement technique. Results suggest that sea sediment is not a significant sink for these compounds.

Deziel, E.; Paquette, G.; Villemur, R.; Lepine, F.; Bisaillon, J. G. **Biosurfactant production by a soil *Pseudomonas* strain growing on polycyclic aromatic hydrocarbons.** *Applied and Environmental Microbiology.* June 1996; 62(6):1908-1912; ISSN: 0099-2240.
Researchers investigated the ability and capacity of polycyclic aromatic hydrocarbon-utilizing bacteria to produce biosurfactants when growing on naphthalene and phenanthrene. In addition, a detailed examination of one of the isolates, *Pseudomonas aeruginosa* 19SJ, is presented.

Dickhut, Rebecca M.; Gustafson, Kurt E. **Atmospheric washout of polycyclic aromatic hydrocarbons in the Southern Chesapeake Bay Region.** *Environmental Science and Technology.* 1995; 29(6):1518-1525.
Vapor washout of selected polycyclic aromatic hydrocarbons (PAHs) was found to be controlled by the Henry's law constant for the compound at the temperature of deposition. For the various PAHs, particle washout was reported to be relatively constant, but to vary seasonally, with higher particle scavenging in the spring and summer. Vapor washout coefficients were also reported as being negatively correlated with rainfall intensity, and particle washout coefficients for PAHs were positively correlated with rainfall intensity.

CHEMISTRY/GEOCHEMISTRY/GEOLOGY

Donnay, E.; Jacques, T. G. Hiemaux G.; Quaghebeur, D. **SAMPLEX (1991-92): Testing of sampling techniques for hydrocarbon spilled at sea.** In. *Proceedings: Seventeenth Arctic and Marine Oil Spill Program Technical Seminar.* Ottawa: On Canada Environment; 1994; 1 pp. 261-276.
The authors examined and evaluated the current existing procedures for sampling pollutants dispersed in thin layers on the surface of water.

Douglas, Gregory S. and others. **Environmental stability of selected petroleum hydrocarbon source and weathering ratios.** *Environmental Science & Technology.* 1996; 30(7):2332-2339; ISSN: 0013-936X.
Researchers examined polycyclic aromatic hydrocarbon ratios (alkylated dibenzothiophenes and phenanthrenes) to document the stability of the ratios that have been used to identify sources in marine oil spills, and evaluated a quantitative approach for the measurement of oil weathering and biodegradation.

Duetz, W. A.; Marqués S.; Wind, B.; Ramos, J. L.; Van Andel, J. G. **Catabolite repression of the toluene degradation pathway in *Pseudomonas putida* harboring pWW0 under various conditions of nutrient limitation in chemostat culture.** *Applied and Environmental Microbiology.* February 1996; 62(2):601-606; ISSN: 0099-2240.
Researchers describe catabolite repression of the toluene and m- and p-xylene degradation pathway by succinate in chemostat cultures run at a low dilution rate under various conditions of inorganic-nutrient limitations.

Durell, G. S.; Ostazeski, S. A.; Uhler, A. D.; Almaas, I K.; Daling, P. S.; Strom-Kristiansen, T.; Nordvik, A. B. **Evaluation of the transfer of crude oil weathering technology. Interlaboratory comparison of physico-chemical characteristics of weathered oils and emulsions.** In. *Proceedings: Seventeenth Arctic and Marine Oil Spill Program Technical Seminar.* Ottawa: Environment Canada; 1994; 1 pp. 39-75.
A description of the transfer of technology needed for evaluating the weathering behavior of oil from IKU Petroleum Research of Trondheim, Norway to Battelle Ocean Sciences, Duxbury, Massachusetts.

Eisert, R.; Levsen, K. **Solid-phase microextraction coupled to gas chromatography: a new method for the analysis of organics in water.** *Journal of Chromatography A.* May 10, 1996; 733(1-2):143-157; ISSN: 0021-9673.
The authors review the methods developed for the analysis of organic compounds from aqueous samples by solid-phase microextraction coupled to gas chromatography.

Ellis, L.; Langworthy, T. A.; Winans, R. **Occurrence of phenylalkanes in some Australian crude oils and sediments.** *Organic Geochemistry.* January 1996; 24(1):57-69; ISSN: 0146-6380.
Researchers investigate the phenylalkane components of some Australian crude oils, sediment extracts, pyrolyzates and bacterial lipids in an effort to ascertain their origin.

El-Sayed, A. H. M. M.; Mahmoud, W. M.; Davis, E. M.; Coughlin, R. W. **Growth of hydrocarbon-utilizing isolates in chemically defined media.** *International Biodeterioration & Biodegradation.* January-March 1996; 37(1-2):61-68; ISSN: 0964-8305.
Researchers examined five bacterial strains isolated from soil for their ability to utilize Jet-A fuel, motor oil and brake fluid as sole sources of carbon and energy. Results indicate that Jet-A fuel and motor oil served as a sole source of carbon and energy for each of the five strains; however, brake fluid did not support growth on any of these strains.

Essaid, H. I.; Bekins, B. A.; Godsy, E. M.; Warren, E.; Baedecker, M. J.; Cozzarelli, I. M. **Simulation of aerobic and anaerobic biodegradation processes at a crude oil spill site.** *Water Resources Research.* December 1995; 31(12):3309-3327; ISSN: 0043-1397.
Researchers developed, tested, and used a two-dimensional, multispecies solute transport model, including multiple-substrate uptake, sequential terminal electron acceptor use, and cellular nutrient limitation of biomass, to analyze the evolution of a plume of groundwater contamination at a Bemidji, Minnesota, crude oil spill site.

Fan, C. Y.; Krishnamurthy, S.; Chen, C. T. **A critical review of analytical approaches for petroleum contaminated soil.** O'Shay, Tracey and Hoddinott, Keith B., Eds. *Analysis of Soils Contaminated with Petroleum Constituents.* Philadelphia, PA: American Society for Testing Materials; 1994; STP 1221120 p.
Petroleum hydrocarbon analytical techniques and their limitations are outlined.

Fayad, Nabil M.; Overton, Edward. **A unique biodegradation pattern of the oil spilled during the 1991 Gulf War.** *Marine Pollution Bulletin.* 1995; 30(4):239-246; ISSN: 0025-326X.
A laboratory degradation study of the oil spilled during the Gulf War showed very fast degradation rates of several polynuclear aromatic hydrocarbons and sulphur-containing PAH compounds compared with the saturated n-alkane fraction of the oil. The degradation pattern and rate of biodegradation were found to be dependent on the oil concentration and on the presence of nutrients, suggesting the presence of naturally occurring micro-organisms in the oil/water system which are very effective in rapidly biodegrading several PAH compounds.

Ferguson, J. D. III; Beekman, S. L.; Benoit, T. G. **Petroleum utilizing *Bacillus spp.* from soil at Oil Springs, Texas.** *The Texas Journal of Science.* February 1997; 49(1):73-75. ISSN: 0040-4403.
Hydrocarbon-utilizing *Bacillus* isolates from Oil Springs, Texas, an area of chronic exposure, were analyzed on their ability to grow on crude oil, mineral oil, benzene, toluene, xylene and cyclohexane. Researchers report that chronic exposure to all fractions of crude oil may have selected for increased metabolic capabilities when compared to isolates from aquatic seeps.

Fernandez, I.; Dachs, J.; Bayona, J. M. **Application of experimental design approach to the optimization of supercritical fluid extraction of polychlorinated biphenyls and polycyclic aromatic hydrocarbons.** *Journal of Chromatography A.* January 5, 1996; 719(1):77-85; ISSN: 0021-9673.

Ferrari, M. D.; Neirotti, E.; Albornoz, C.; Mostazo, M. R.; Cozzo, M. **Biotreatment of hydrocarbons from petroleum tank bottom sludges in soil slurries.** *Biotechnology Letters.* November 1996; 18(11):1241-1246; ISSN: 0141-5492.

Ferrer, R.; Guiteras, J.; Beltran, J. L. **Optimization of an on-line precolumn preconcentration method for the determination of polycyclic aromatic hydrocarbons (PAHs) in water samples (river and sea water).** *Analytical Letters.* 1996; 29(12):2201-2219; ISSN: 0003-2719.
Researchers developed a new on-line precolumn preconcentration method for determining the EPA priority pollutants in river and sea water. It is reported that this procedure, when combined with HPLC and spectrofluorimetric detection, reaches very low detection limits.

Field, J. A.; Baten, H.; Boelsma, F.; Rulkens, W. H. **Biological elimination of polycyclic aromatic hydrocarbons in solvent extracts of polluted soil by the white rot fungus, *Bjerkandera sp* strain BOS55.** *Environmental Technology.* March 1996; 17(3):317-323; ISSN: 0959-3330.

Fingas, M. **Studies on the evaporation of oil spills.** In. *Proceedings: Seventeenth Arctic and Marine Oil Spill Program Technical Seminar.* Ottawa: Environment Canada; 1994; 1 pp. 189-212.
Presented is a review of the literature and experimentation involved in studying oil evaporation during and after oil spills.

Fishelson, L. **Flat (Gulf of Aqaba) littoral: life on the red line of biodegradation.** *Israel Journal of Zoology.* 1995; 41(1):43-55; ISSN: 0021-2210.

Franzmann, P. D.; Patterson, B. M.; Power, T. R.; Nichols, P. D.; Davis, G. B. **Microbial biomass in a shallow, urban aquifer contaminated with aromatic hydrocarbons: analysis by phospholipid fatty acid content and composition.** *Journal of Applied Bacteriology.* June 1996; 80(6):617-625; ISSN: 0021-8847.
Using phospholipid fatty acid methyl ester analysis, researchers examined the microbial biomass in groundwater and sediment cores surrounding petroleum underground storage tanks, and within and outside a plume of hydrocarbon contamination.

Fu, G. M.; Kan, A. T.; Tomson, M. **Adsorption and desorption hysteresis of PAHs in surface sediment.** *Environmental Toxicology and Chemistry.* October 1994; 13(10):1559-1567; ISSN: 0730-7268.
Investigated was the desorption hysteresis of two PAHs (naphthalane and phenanthrene) from sediment materials. The researchers found the adsorption was rapid and predictable, but 30% to 50% of the absorbed amount resisted desorption.

Gearing, J.; Gearing, P. J.; Noel, M.; Smith, J. N. **Polycyclic aromatic hydrocarbons in sediment of the St. Lawrence Estuary.** Van Coillie, R. and others, (Eds.). *Proceedings of the Twentieth Annual Aquatic Toxicity Workshop.* 1994; 198958-64; ISSN: 0706-6457.
Quebec has the highest yearly influx of Polycyclic aromatic hydrocarbons (PAHs) in Canada, and these high levels have been reported since the early 1980s. The author reviews the literature on this subject and adds some recently collected data to present an overview of PAHs in the St. Lawrence system.

Geiselbrecht, A. D.; Herwig, R. P.; Deming, J. W.; Staley, J. T. **Enumeration and phylogenetic analysis of polycyclic aromatic hydrocarbon-degrading marine bacteria from Puget Sound sediments.** *Applied and Environmental Microbiology.* September 1996; 62(9):3344-3349; ISSN: 0099-2240.
Researchers enumerated, isolated, and preliminarily characterized naphthalene- and phenanthrene-degrading bacteria in sediments from a creosote-contaminated EPA superfund site (Puget Sound). Sediments contained from 10^4 to 10^7 hydrocarbon-degrading bacteria per g (dry weight) of sediment, whereas the concentration was found to be 10^3 to 10^4 per g of sediment.

Gersberg, R. M.; Korth, K. G.; Rice, L. E.; Randall, J. D.; Bogardt, A. H.; Dawsey, W. J.; Hemmingsen, B. B. **Chemical and microbial evaluation of *in-situ* bioremediation of hydrocarbons in anoxic groundwater enriched with nutrients and nitrate.** *World Journal of Microbiology & Biotechnology.* September 1995; 11(5):549-558; ISSN: 0959-3993.

Gilbert, F.; Stora, G.; Bertrand, J. C. ***In situ* bioturbation and hydrocarbon fate in an experimental contaminated Mediterranean coastal ecosystem.** *Chemosphere.* October 1996; 33(8):1449-1458; ISSN: 0045-6535.

Goto, M.; Kato, M.; Asaumi, M.; Shirai, K.; Venkateswaran, K. **TLC/FID method for evaluation of the crude-oil-degrading capability of marine microorganisms.** *Journal of Marine Biotechnology.* 1995; 2(1):45-50; ISSN: 0941-2905.
Researchers examined TLC/FID (thin-layer chromatography/flame ionization detector) as a method for quantitative analysis for monitoring microbial degradation of crude oil.

Greibrokk, T. **Applications of supercritical fluid extraction in multidimensional systems.** *Journal of Chromatography A.* May 26, 1995; 703(1-2):523-536; ISSN: 0021-9673.
A review of the applications where supercritical fluid extraction has been connected to on-line chromatography.

Grimberg, S. J.; Stringfellow, W. T.; Aitken, M. D. **Quantifying the biodegradation of phenanthrene by *Pseudomonas stutzeri* P16 in the presence of a nonionic surfactant.** *Applied and Environmental Microbiology.* July 1996; 62(7):2387-2392; ISSN: 0099-2240.
Researchers studied the influence of the surfactant Tergitol NP-10 on the biodegradation of solid-phase phenanthrene by *Pseudomonas stutzeri* P16.

Grosser, Robert J.; Warshawsky, David; Vestal J. Robie. **Mineralization of polycyclic and n-heterocyclic aromatic compounds in hydrocarbon-contaminated soils.** *Environmental Toxicology and Chemistry.* 1995; 14(3):375-382.
Researchers determined the indigenous mineralization of eight polycyclic aromatic compounds of varying carcinogenic activities in soil samples from a PAH contaminated area. The effects of microbiological and chemical soil characteristics on mineralization were also examined.

Guha, S.; Jaffe, P. R. **Biodegradation kinetics of phenanthrene partitioned into the micellar phase of nonionic surfactants.** *Environmental Science & Technology.* February 1996; 30(2):605-611; ISSN: 0013-936X.
Researchers report that depending on the type of surfactant and surfactant concentration, a fraction of hydrophobic substrates partitioned into the surfactants micellar phase are directly bioavailable.

Gunther, T.; Dornberger, U.; Fritsche, W. **Effects of ryegrass on biodegradation of hydrocarbons in soil.** *Chemosphere.* July 1996; 33(2):203-215; ISSN: 0045-6535.

Harayama, S.; et. al. **Degradation of crude oil by marine bacteria.** *Journal of Marine Biotechnology.* 1996; 3(4):239-243.
Researchers developed a method to quantify the components of crude oil by thin-layer chromatography and flame-ionization detection, determined the required concentrations of phosphate and nitrate for optimum degradation, and isolated the marine bacteria capable of degrading the different components of crude oil. Three of these strains were used to construct a consortium, which degraded 50% of the saturated fraction and 18% of the aromatic fraction of crude oil in 30 days.

Harkey, Gail A.; Van Hoof, Patricia L.; Landrum, Peter F. **Bioavailability of polycyclic aromatic hydrocarbons from a historically contaminated sediment core.** *Environmental Toxicology and Chemistry.* September 1995; 14(9):1551-1560; ISSN: 0730-7268.
Researchers used the worm *Lumbriculus variegatus* to determine the changes in bioavailability of selected polycyclic aromatic hydrocarbons (PAHs) with sediment aging. For four weeks *L. variegatus* was exposed to sediment cores taken at varying depths from a contaminated lake. Results indicated that the bioaccumulation peak was at the 12- to 16-cm depth (circa 1967), while bioaccumulation was below detection limits in the 0- to 4-cm depth. This raises questions regarding the accuracy of results from toxicity tests solely conducted with surface sediments.

Hart, Stephen. ***In-situ* bioremediation: defining the limits.** *Environmental Science & Technology.* September 1996; 30(9):398A-401A; ISSN: 0013-936X.
The author reports on the still unfulfilled potential of *in situ* bioremediation, and discusses applications, targeting specific microbes, the effectiveness of intrinsic bioremediation, the role of microbes in the wetlands, and the new monitoring tools needed.

Hartley, J. P. **Environmental monitoring of offshore oil and gas drilling discharges - a caution on the use of barium as a tracer.** *Marine Pollution Bulletin.* October 1996; 32(10):727-733; ISSN: 0025-326X.
Researchers illustrate the inefficiency of commonly used methods for extracting barium from sediments when high concentrations of barium sulfate are present in samples.

Heaton, D. M.; Bartle, K. D.; Clifford, A. A.; Myers, P.; King, B. W. **Rapid separation of polycyclic aromatic hydrocarbons by packed column supercritical fluid chromatography.** *Chromatographia.* November 1994; 39(9-10):607-611; ISSN: 0009-5893.
Described is the separation in 6 (six) minutes of the sixteen US Environmental Protection Agency polycyclic aromatic hydrocarbons (PAHs) on a single packed column by supercritical fluid chromatography (SFC). A comparison is made to results obtained using liquid chromatography. The authors reported that SFC has shown to be an efficient and promising method for the rapid monitoring of PAHs.

Hernández, J. E. and others. ***n*-Alkanes and polynuclear aromatic hydrocarbons in fresh-frozen and precooked-frozen mussels.** *Bulletin of Environmental Contamination and Toxicology.* 1995; 55(3):461-468.
Presented are the results acquired in the determination of n-alkanes and polynuclear aromatic hydrocarbons in fresh-frozen and precooked-frozen mussels, *Perna canaliculus*, commercialized in the Canary Islands.

Herold, A. **A review of the uses of planar chromatography in the coal and oil industries.** *Journal of Planar Chromatography.* May-June 1994; 7180-196; ISSN: 0933-4173.
The literature on thin layer chromatography in coal and petroleum analysis over the period January 1987 to December 1992 is reviewed, and the major advantages and limits of thin layer chromatography are discussed.

Hickey, W. J. ***In situ* respirometry: field methods and implications for hydrocarbon biodegradation in subsurface soils.** *Journal of Environmental Quality.* July 1995; 24(4):583-588; ISSN: 0047-2425.
An evaluation and comparison of two rapid non-invasive field procedures, O_2 and CO_2 analysis methods using liquid- and solid-phase systems, is presented. Also considered are the implications of these gas measurements for evaluating in situ hydrocarbon biodegradation.

Holden, P. A.; Firestone, M. K. **Soil microorganisms in soil cleanup: how can we improve our understanding?** *Journal of Environmental Quality.* January-February 1997; 26(1):32-40. ISSN: 0047-2425.
Researchers discuss why a complete understanding of microbial ecology is necessary before utilizing *in situ* biodegradation as a remediation option.

Hong, H.; Xu, L.; Zhang, L.; Chen, J. C.; Wong, Y. S.; Wan, T. S. M. **Environmental fate and chemistry of organic pollutants in the sediment of Xiamen and Victoria Harbours - special guest paper**. *Marine Pollution Bulletin*. April-December 1995; 31(4-12):229-236; ISSN: 0025-326X.
Samples of sediments from Xiamen Harbor, China, and Victoria Harbor, Hong Kong, were examined for non-aromatic hydrocarbons (NAHs), long-chain linear alkylbenzenes (LABs), polycyclic aromatic hydrocarbons (PAHs), organochlorine pesticides (HCHs, DDTs), and polychlorinated biphenyls (PCBs). Results indicated the concentrations in Xiamen Harbor were: 3.1-32.9 μg/g for NAH, 2.9-61 μg/g for PAH, 0.14-1.12 ng/g for HCHs, 4.45-311 ng/g for DDTs, and 0.05-7.24 ng/g for PCBs. In Victoria Harbor the concentrations were: 60-646 μg/g for NAH, 1.2-14.0 μg/g for PAH, 0-2.3 ng/g for HCHs, 1.38-30.3 ng/g for DDTs, and 3.2-16.0 ng/g for PCBs. Researchers concluded that Victoria Harbor is more polluted than Xiamen Harbor.

Huntley, S. L.; Bonnevie, N. L.; Wenning, R. J. **Polycyclic aromatic hydrocarbon and petroleum hydrocarbon contamination in sediment from the Newark Bay Estuary**. *Archives of Environmental Contamination and Toxicology*. 1995; 28(1):93-107; ISSN: 0090-4341.
Researchers determined concentrations and distributions of 19 polycyclic aromatic hydrocarbons (PAHs) and the total extractable petroleum hydrocarbon (TEPH) in 213 sediment samples obtained from 58 sediment cores collected from various rivers and bays near Newark, NJ. Chronological PAH profiles from pre-1930s to present were determined in each core. In addition, the concentrations of total PAHs and individual PAHs were compared to NOAA benchmark sediment effects-range medium (ER-M) values. Results indicate elevated concentrations of both the PAHs and the TEPH in the surface and buried sediments throughout the estuary, and the concentrations increased with depth throughout the estuary. Comparisons to NOAA ER-M values suggest that many of the tested sediments are significantly hazardous to aquatic organisms.

Jackson, Andrew W.; Pardue, John H.; Araujo, Rochelle. **Monitoring crude oil mineralization in salt marshes: use of stable carbon isotope ratios**. *Environmental Science & Technology*. April 1996; 30(4):1139-1144; ISSN: 0013-936X.
Researchers monitored and quantified crude oil mineralization via measuring changes in CO_2 and ^{13}C signatures and the rate of CO_2 production.

Jacob, J. **Method development for the determination of polycyclic aromatic hydrocarbons (PAHs) in environmental matrices**. In: Quevauviller, P.; Maier, E. A., and Griepink, B. *Quality Assurance for Environmental Analysis*. Amsterdam: Elsevier Science B.V. c1995 pp. 563-589. ISBN: 0-444-89955-3.
A general description of the various methods and techniques for determining polycyclic aromatic hydrocarbons in environmental matrices. Included are sections on the availability of reference material (for identification and calibration), the process of extracting PAHs, enrichment and cleanup of PAHs, thin-layer chromatography, high-performance liquid chromatography, and gas-liquid chromatography.

Jacquot, F.; Doumenq, P.; Guiliano, M.; Munoz, D.; Guichard, J. R.; Mille, G. **Biodegradation of the (aliphatic plus aromatic) fraction of Oural crude oil. Biomarker identification using GC/MS SIM and GC/MS/MS**. *Talanta*. March 1996; 43(3):319-330; ISSN: 0039-9140.

Juhasz, A. L.; Britz, M. L.; Stanley, G. A. **Degradation of high molecular weight polycyclic aromatic hydrocarbons by *Pseudomonas cepacia***. *Biotechnology Letters*. May 1996; 18(5):577-582; ISSN: 0141-5492.
Three strains of *Pseudomonas cepacia* were used to degrade polycyclic aromatic hydrocarbons (benzo[a]pyrene, dibenz[a,h]anthracene, and coronene) as a sole carbon/energy source. After 63 days, there was a 20-30 percent decrease in the concentration of benzo[a]pyrene and dibenz[a,h]anthracene and a 65 to 70 percent decrease in coronene concentration. Also, it was reported that all three strains were able to degrade the PAHs simultaneously in a PAH mixture containing 3,4,5,7-benzene ring compounds.

Kanagasabapathy, V. M.; Bell, R. W.; Yang, P.; Allan, L.; Au, L.; Parmar, J.; Lusis, M. A.; Chapman, R. E. **Developments in the supercritical fluid extraction of PAHs from environmental matrix**. *Journal of Chromatographic Science*. August 1995; 33(8):467-474; ISSN: 0021-9665.
A description of supercritical fluid extraction (SFE) optimization and techniques to sample indoor airborne polynuclear aromatic hydrocarbons in such a way as to allow their extraction by SFE.

Kandeler, E.; Pennerstorfer, C.; Bauer, E.; Braun, R. **Microbiological control of the biological decontamination of soils**. *Zeitschrift Fur Pflanzenernahrung Und Bodenkunde*. October 1994; 157(5):345-350; ISSN: 0044-3263.

Kanga, S. A.; Bonner, J. S.; Page, C. A.; Mills, M. A.; Autenrieth, R. L. **Solubilization of naphthalene and methyl-substituted naphthalenes from crude oil using biosurfactants.** *Environmental Science & Technology*. February 1997; 31(2):556-561. ISSN: 0013-936X.
Researchers evaluated the ability of biosurfactants to enhance aqueous-plus-micellar phase solubility of polycyclic aromatic hydrocarbons from weathered crude oil.

Karimi-Lotfabad, Soheila; Pickard, Michael A.; Gray, Murray R. **Reactions to polynuclear aromatic hydrocarbons on soil.** *Environmental Science & Technology*. April 1996; 30(4):1145-1151; ISSN: 0013-936X.
The interactions between polynuclear aromatic hydrocarbons (anthracene, phenanthrene and pyrene) and soils (montmorillonite clay) as a function of the moisture content and time were investigated.

Kästner, M.; Mahro, B. **Microbial degradation of polycyclic aromatic hydrocarbons in soils affected by the organic matrix of compost**. *Applied Microbiology and Biotechnology*. January 1996; 44(5):668-675.
Presented is a description of polycyclic aromatic hydrocarbon (naphthalene, phenanthrene, anthracene, fluoranthene, pyrene) degradation in soil and soil/compost mixtures. Researchers reported that the presence of the solid organic matrix of the compost was necessary for enhanced degradation.

Kazumi, J.; Caldwell, M. E.; Suflita, J. M.; Lovley, D. R.; Young, L. Y. **Anaerobic degradation of benzene in diverse anoxic environments.** *Environmental Science & Technology*. March 1997; 31(3):813-818. ISSN: 0013-936X.
Researchers assess the potential for benzene degradation in an anoxic environment in an effort to extend previous reports of anaerobic benzene utilization to sediments that varied with respect to contamination input, redox condition, and salinity.

Kelland, Malcolm. **Natural gas hydrates: energy for the future.** *Marine Pollution Bulletin*. 1994; 29(6-12):307-311; ISSN: 0025-326X.
The structure, formation, location, storage and utilization of natural gas hydrates are discussed.

Kennes, C.; Lema, J. M. **Degradation of major compounds of creosotes (PAH and phenols) by *Phanerochaete chrysosporium*.** *Biotechnology Letters*. July 1994; 16(7):759-764; ISSN: 0141-5492.
The mixture of the major components of creosotes (naphtalene, phenanthrene, anthracene, p-cresol, pentachlorophenol, and phenol, was degraded by *Phanerochaete chrysosporium*. It was reported that the intermediates such as quinones did accumulate, and a slight variation in biodegradation rates was observed.

Kennicut, M. C. II; Boothe, P. N.; Wade, T. L.; Sweet, S. T.; Rezak, R.; Kelly, F. J.; Brooks, James M.; Presley, B. J.; Wiesenburg, D. A. **Geochemical patterns in sediments near offshore production platforms.** *Canadian Journal of Fisheries and Aquatic Sciences*. November 1996; 53(11):2554-2566. ISSN: 0706-652X.
Geochemical characteristics of sediments adjacent to three production platforms at varying depth (22-150 m) in the Gulf of Mexico were determined. Sediments within 500 meters of each platform have enhanced amounts of course-grain materials containing hydrocarbon and trace metal contaminants derived from platform drilling discharges. However, contaminant levels at most locations were found to be below levels thought to induce biological responses.

Kira, S.; Nogami, Y.; Taketa, K.; Hayatsu, H. **Comparison of techniques for monitoring water-borne polycyclic mutagens: efficiency of blue rayon, Sep-Pak C18, and a biota, *Corbicula*, in concentrating benzo(a)pyrene in a model water system.** *Bulletin of Environmental Contamination and Toxicology*. August 1996; 57(2):278-283; ISSN: 0007-4861.
Using a model water system, researchers concluded that; (a) blue rayon is an effective monitor for BaP in moving waters, (b) the use of Sep-Pak C18 with continuous sampling gives a quantitatively accurate measure for BaP, but may be somewhat inaccurate in turbid waters, and (c) *Corbicula* is useful, yet limited in monitoring.

Kireeva, N. A.; Vodopyanov, V. V. **Mathematical simulation of microbiological processes in oil-polluted soils.** *Eurasian Soil Science*. October 1996; 29(10):1140-1144. ISSN: 1064-2293.

CHEMISTRY/GEOCHEMISTRY/GEOLOGY

Klemme, H. Douglas. **World petroleum systems with Jurassic source rocks**. *Oil and Gas Journal*. November 8, 1993; 9196-99; ISSN: 0030-1388.
The fourteen petroleum systems with Upper Jurassic source rocks that contain a fourth of the world's discovered oil and gas and eleven other systems with Lower and Middle Jurassic source rocks that currently have relatively minor amounts of discovered oil and gas are reviewed geologically.

Komukainakamura, S.; Sugiura, K.; Yamauchiinomata, Y.; Toki, H.; Venkateswaran, K.; Yamamoto, S.; Tanaka, H.; Harayama, S. **Construction of bacterial consortia that degrade Arabian light crude oil.** *Journal of Fermentation and Bioengineering*. 1996; 82(6):570-574. ISSN: 0922-338X.

Kornacki, A. S.; Kendrick, J. W.; Berry, J. L. **Impact of oil and gas vents and slicks on petroleum exploration in the deepwater Gulf of Mexico**. *Geo-Marine Letters*. 1994; 14(2-3):160-169.
Active petroleum vents and slicks have been identified in the deep water region of the Gulf of Mexico using various techniques. The author discusses petroleum vents and slicks in relation to the local geological framework, and that knowledge of these has proven to be an important element of successful exploration.

Kozin, I. S.; Gooijer, C.; Velthorst, N. H. **Direct determination of dibenzo[a,l]pyrene in crude extracts of environmental samples by laser-excited Shpol'skii spectroscopy**. *Analytical Chemistry*. May 1, 1995; 67(9):1623-1626; ISSN: 0003-2700.
Dibenzo[a,l]pyrene, the most carcinogenic aromatic hydrocarbon known to date, has been directly determined in crude oil extracts of several soil and sediment samples by applying Shpol'skii spectroscopy.

Kozin, I.; Gooijer, C.; Velthorst, N. H.; Hellou, J.; Zitko, V. **Isomer-specific detection of PAHs and PAH metabolites in environmental matrices by Shpol'skii luminescence spectroscopy**. *Chemosphere*. October 1996; 33(8):1435-1447; ISSN: 0045-6535.

Kukkonen, J.; Landrum, P. F. **Distribution of organic carbon and organic xenobiotics among different particle-size fractions in sediments**. *Chemosphere*. March 1996; 32(6):1063-1076; ISSN: 0045-6535.

Kukkonen, Jussi; Landrum, Peter F. **Measuring assimilation efficiencies for sediment-bound PAH and PCB congeners by benthic organisms**. *Aquatic Toxicology*. May 1995; 32(1):75-92; ISSN: 0166-445X.
Assimilation efficiencies (AEs) of sediment-sorbed 3H-benzo(a)pyrene (BaP) and 14C-2,2',4,4',5,5'-hexachlorobiphenyl (HCBP) were measured in *Diporeia spp.* and the AE for BaP was determined in *Lumbriculus variegatus*. Three methods of determining AEs were compared for *Diporeia* and two for *L.variegatus*.

Lacotte, D. J.; Mille, G.; Acquaviva, M.; Bertrand, J. C. **In vitro biodegradation of Arabian light 250 by a marine mixed culture using fertilizers as nitrogen and phosphorous sources**. *Chemosphere*. December 1995; 31(11-12):4351-4358; ISSN: 0045-6535.

Lahvis, M. A.; Baehr, A. L. **Estimation of rates of aerobic hydrocarbon biodegradation by simulation of gas transport in the unsaturated zone**. *Water Resources Research*. July 1996; 32(7):2231-2249; ISSN: 0043-1397.
Researchers present a method for estimating rates of aerobic hydrocarbon biodegradation at petroleum spill sites.

Lal, B.; Khanna, S. **Degradation of crude oil by *Acinetobacter calcoaceticus* and *Alcaligenes odorans*.** *Journal of Applied Bacteriology*. October 1996; 81(4):355-362; ISSN: 0021-8847.
Bombay High and Gujarat, two types on Indian crude oil, were tested for biodegradability by *Acinetobacter calcoaceticus* and *Alcaligenes odorans*. Results indicated that *A. calcoaceticus* S30 degraded Bombay High and Gujarat by 50% and 29%, respectively; *A. odorans* P20 degraded these two types of crude by 45% and 37%, respectively. In combination, the two strains degraded 58% of the Bombay High and 40% of the Gujarat. It was also reported that the two strains grew very well on *n*-alkane and pristane, but not on cycloalkanes. In addition, *A. calcoaceticus* S30 could not grow on pure PAHs, except naphthalene, but *A. odorans* P20 grew on anthracene, phenanthrene, dibenzothiophene, fluorene, fluoranthene, pyrene and chrysene.

Law, R. J.; Klungsoyr, J. **The 1994 QUASIMEME Laboratory-performance studies: polycyclic aromatic hydrocarbons (PAH) in standard solutions.** *Marine Pollution Bulletin* . September 1996; 32(8/9):667-673; ISSN: 0025-326X.
As part of the QUASIMEME (EU-Measurement and Testing) Project, a laboratory study was conducted to assess and improve the measurement of concentrations of polycyclic aromatic hydrocarbons (PAHs) in standard solutions. Using gas chromatography and high-performance liquid chromatography, thirty-six labs tested the concentrations of PAH compounds in two acetonitrile solutions. The concentrations of the individual PAH compounds ranged from 21.4 to 96.2 mg/kg in the first solution and from 10.2 to 103.8 mg/kg for the second solution. The authors discuss this wide range of results and the contributing factors.

Law, Robin J.; Biscaya, Jose L. **Polycyclic aromatic hydrocarbons (PAH): problems and progress in sampling, analysis and interpretation.** *Marine Pollution Bulletin.* 1995; 29(4-5):235+; ISSN: 0025-326X.
An overview of the processes and techniques (GC and HPLC) utilized when analyzing sediments and shellfish tissues, including discussion of the comparability problems and a proposed exercise to improve current methodology.

Levy, J. M.; Dolata, L. A.; Rosselli, A. C.; Ravey, R. M. **The use of supercritical fluid extraction as a sample preparation technique for soils.** In: O'Shay, Tracey and Hoddinott, Keith B., Eds. *Analysis of Soils Contaminated with Petroleum Constituents.* Philadelphia, PA: American Society for Testing Materials; 1994; STP 1221120 p.
The applicability of supercritical fluid extraction (SFE) to the preparation of oil-contaminated soil samples is overviewed.

Lexa, J.; Stulik, K. **Determination of polycyclic aromatic hydrocarbons in surface and underground waters by HPLC after extraction into cyclohexane.** *Chemicke Listy.* December 1995; 89(12):787-793; ISSN: 0009-2770.

Li, K.; Fingas, M. F.; Pare, J. R. J.; Boileau, P. **Determination of dissolved organics in the water soluble fraction from crude oils by headspace analysis.** In. *Proceedings: Seventeenth Arctic and Marine Oil Spill Program Technical Seminar.* Ottawa: Environment Canada; 1994; 1 pp. 289-306.
Headspace (HS) gas chromatography/mass spectrometry was used to analyze organics in water soluble fractions (WSF) prepared by stirring crude oils and petroleum products in water. Results indicated that most of the WSF from the crude oil was alkylated aromatic hydrocarbons (benzene, toluene, ethyl benzene and xylenes). Petroleum products generated WSF rich in volatile and moderately volatile compounds, including 2-ring polycyclic aromatic hydrocarbons.

Li, X.; Cullen, W. R.; Reimer, K. J.; Le, X. **Microbial degradation of pyrene and characterization of a metabolite.** *Science of the Total Environment.* January 5, 1996; 17717-29; ISSN: 0048-9697.
The degradation of pyrene (as a sole carbon source) by microorganisms was investigated. Researchers reported that pyrene (10 μg) was degraded to an undetectable level after 120 h of incubation with 0.5 ml of an enriched culture and 10 ml of mineral salt medium. Researchers also isolated and identified cis-dihydrodiol pyrene, the metabolite that accumulates during pyrene degradation.

Li, X.; Le, X. C.; Simpson, C. D.; Cullen, W. R.; Reimer, K. J. **Bacterial transformation of pyrene in a marine environment.** *Environmental Science & Technology.* April 1996; 30(4):1115-1119; ISSN: 0013-936X.
Investigated was the bacterial transformation of pyrene in an estuary environment. A metabolite, separated from sediments and pore water samples from Kitimat Arm (BC), was identified as *cis*-4,5-dihydroxy-4,5-dihydropyrene. Researchers report that the presence of this metabolite of dioxygenase-mediated transformation of pyrene suggests a possible *in situ* transformation of pyrene.

Librando, V.; Darrigo, G.; Spampinato, D. **Reverse phase extraction of arenes and nitroarenes in environmental samples.** *Analusis.* July-August 1994; 22(6):340-342; ISSN: 0365-4877.
Determined were the extraction recoveries of 24 polycyclic hydrocarbons (PAHs) and their nitro-derivatives (N-PAHs) standards by solid phase extraction (SPE) on the octadecyl adsorbent phases. Results indicated the possibility, under controlled conditions, to obtain reproducible, high percentage recovery, especially for PAH.

Lichtfouse, E.; Eglinton, T. I. **^{13}C and ^{14}C evidence of pollution of a soil by fossil fuel and reconstruction of the composition of the pollutant**. *Organic Geochemistry*. October 1995; 23(10):969-973; ISSN: 0146-6380.
Researchers use $^{13}C/^{12}C$ ratios, the ^{14}C age and relative concentrations to assess the origins of n-alkanes in a polluted soil.

Machala, M.; Nezveda, K.; Petrivalsky, M.; Jarosova, A. B.; Piacka, V.; Svobodova, Z. **Monooxygenase activities in carp as biochemical markers of pollution by polycyclic and polyhalogenated aromatic hydrocarbons: Choice of substrates and effects of temperature, gender and capture stress.** *Aquatic Toxicology*. February 1997; 37(2-3):113-123. ISSN: 0166-445X.
Activities of Cytochrome P450-dependent monooxygenase were measured in hepatopancreatic microsomes of carp collected in the Czech Republic. Responses of monooxygenase activities to the exposure to polycyclic and polyhalogenated aromatic compounds (PAC), and the effects of other factors including ambient temperature and stress associated with reduction of water volume at the time of capture were assessed.

Martens, D. A.; Frankenberger, W. T. **Enhanced degradation of polycyclic aromatic hydrocarbons in soil treated with an advanced oxidative process - Fenton's reagent**. *Journal of Soil Contamination*. 1995; 4(2):175-190; ISSN: 1058-8337.
Researchers investigated if pretreatment with an advanced oxidative process (Fenton's reagent) could improve PAH degradation in contaminated soil. Results indicated that, overall, the use of Fenton's reagent promoted the mineralization of the nine spiked PAHs by 87%. Degradation of native PAH was enhanced 44, 39, 5, and 1% for phenanthrene, fluoranthene, pyrene, and chrysene, respectively. However, pretreatment of soil with a surfactant prior to the application of Fenton's reagent increased the PAH degradation rate 84, 83, 55, and 32% for the parent compounds.

Maruya, K. A.; Risebrough, R. W.; Horne, A. J. **Partitioning of polynuclear aromatic hydrocarbons between sediments from San Francisco Bay and their porewaters**. *Environmental Science & Technology*. October 1996; 30(10):2942-2947; ISSN: 0013-936X.
The spatial and temporal variation in the partitioning behavior of polynuclear aromatic hydrocarbons between surface sediments and their porewaters of an intertidal marsh of the San Francisco Bay estuary was examined.

Massoud, M. S.; Al-Abdali, F.; Al-Ghadban, A. N.; Al-Sarawi, M. **Bottom sediments of the Arabian Gulf--II. TPH and TOC contents as indicators of oil pollution and implications for the effect and fate of the Kuwait oil slick.** *Environmental Pollution*. 1996; 93(3):271-284. ISSN: 0269-7491.
This paper investigates the petroleum hydrocarbon pollutants transferred from the 1991 Kuwait oil slick. In 1992, measurements of total petroleum (TPH) in 77 core samples residing in offshore bottom sediments were used to delineate chronic and present-day oil pollution levels, identifying 7 chronic moderately (TPH 50-89 $\mu g\ g^{-1}$) and heavily (TPH 266-1448 $\mu g\ g^{-1}$) polluted areas. Further study showed a definite relationship between grain-size distribution and the TPH content of bottom sediments; while the total organic carbon measurements were not correlated.

Mathey, S. K.; Mishra, M. C.; Sood, S. K. **Microbes: the future enhanced oil recovery tool**. In. Agadi, V. V.; Das, V. K., and Desai, B. N. *Ocean Technology Perspectives*. New Delhi, India: Publications and Information Dir.; 1994; pp. 906-919. ISBN: 81-7236-095-9.
A review of the important developments, concepts and mechanisms related to macrobial oil release, including *in situ* production of surfactants, polymers and other materials that can enhance oil recovery.

Matsuzawa, S.; Garrigues, P.; Budzinski, H.; Bellocq, J.; Shimizu, Y. **Applicability of low temperature high-resolution fluorescence spectroscopy to the analysis of nitro and amino polycyclic aromatic hydrocarbons**. *Analytica Chimica Acta*. August 30, 1995; 312(2):165-177; ISSN: 0003-2670.
Researchers report of the applicability of high-resolution (Shpol'skii effect) fluorescence spectroscopy to the analysis of nitro and amino polycyclic aromatic hydrocarbons (PAHs).

Maxin, C. R.; Kogelknabner, I. **Partitioning of polycyclic aromatic hydrocarbons (PAH) to water-soluble soil organic matter**. *European Journal of Soil Science*. June 1995; 46(2):193-204; ISSN: 1351-0754.
Researchers determined the partition coefficients of selected polycyclic aromatic hydrocarbons (3-ring to 6-ring) to water-soluble soil organic matter.

McGroddy, S. E.; Farrington, J. W.; Gschwend, P. M. **Comparison of the *in situ* and desorption sediment-water partitioning of polycyclic aromatic hydrocarbons and polychlorinated biphenyls.** *Environmental Science & Technology.* January 1996; 30(1):172-177; ISSN: 0013-936X.
Researchers measured the *in situ* sediment porewater partitioning of polycyclic aromatic hydrocarbons in three cores from Boston Harbor, MA.

McGroddy, Susan E.; Farrington, John W. **Sediment porewater partitioning of polycyclic aromatic hydrocarbons in three cores from Boston Harbor, Massachusetts.** *Environmental Science and Technology.* 1995; 29(6):1542-1550.
Polycyclic aromatic hydrocarbons concentrations in sediments and porewaters isolated from three cores from Boston Harbor were measured. The measured concentrations of PAHs from the porewater were significantly lower than predicted by two- and three-phase equilibrium partitioning models.

Mcnally, M. E. P. **Advances in environmental SFE.** *Analytical Chemistry.* May 1, 1995; 67(9):308A-315A; ISSN: 0003-2700.
Presented is an overview of the current theoretical understanding of supercritical fluid extraction and an attempt to forecast the future direction of work in this area.

Miao, Zhuang; Yang, Min J.; Pawliszyn, Janusz. **Extraction of airborne organic contaminants from adsorbents using supercritical fluid.** *Journal of Chromatographic Science.* September 1995; 33(9):493-499; ISSN: 0021-9665.
Researchers developed a sample preparation method based on supercritical fluid extraction (SFE) to obtain the polycyclic aromatic hydrocarbon (PAH) and PCB concentration in ambient air. PAHs and PCBs are collected with a sampling cartridge consisting of a filter and an absorbent bed. After collection, the PAH and PCB content is determined from the extracted filter and absorbent (Florisil).

Middaugh, D. P.; Chapman, P. J.; Shelton, M. E. **Responses of embryonic and larval inland silversides, *Menidia beryllina*, to a water-soluble fraction formed during biodegradation of artificially weathered Alaska north slope crude oil.** *Archives of Environmental Contamination and Toxicology.* October 1996; 31(3):410-419; ISSN: 0090-4341.
Researchers determined the amounts of recoverable water soluble fraction of neutral oil fraction (w/v) present in seawater following the stirring of weathered ANS crude oil for 2 to 14 days in the laboratory under sterile conditions, or stirring for 14 days after the addition of nutrients and oil-degrading microbes. In addition, the relative toxicity of the WSF of neutral fraction hydrocarbons recovered from non-biodegraded and biodegraded weathered ANS crude was measured during embryogenesis in the inland silverside.

Mohammed, N.; Allayla, R. I.; Nakhla, G. F.; Farooq, S.; Husain, T. **State-of-the-art review of bioremediation studies.** *Journal of Environmental Science and Health Part A - Environmental Science and Engineering & Toxic and Hazardous Substance Control.* 1996; 31(7):1547-1574; ISSN: 1077-1204.
The authors summarize the available literature on bioremediation studies.

Mohandass, C.; David, J. J.; Nair, S.; Bharathi, P. A. L.; Chandramohan, D. **Behavior of marine oil-degrading bacterial populations in a continuous culture system.** *Journal of Marine Biotechnology.* 1997; 5(2-3):168-171. ISSN: 0941-2905.

Morel, G. **Method development and quality assurance for the analysis of hydrocarbons in environmental samples.** *International Journal of Environmental Analytical Chemistry.* 1996; 63(4):269-288; ISSN: 0306-7319.
A review of extraction procedures for the analysis of hydrocarbons at the trace level in marine sediment samples. The three extraction techniques reviewed were: ultrasonic bath, mechanical shaker and Soxhlet.

Murphy, T.; Moller, A.; Brouwer, H. ***In situ* treatment of Hamilton Harbor sediment.** *Journal of Aquatic Ecosystem Health.* 1995; 4(3):195-203; ISSN: 0925-1014.
In an effort to increase the biodegradation of PAH contaminants, 18.5 tons of calcium nitrate and 5 tons of nutrients were injected into sediments of the Dofasco Boatslip (Hamilton Harbor). In the laboratory, 78% of the oil and 68% of the polynuclear aromatic hydrocarbons biodegraded in 197 days. This led researchers to suggest that although *in situ* biotreatment takes time, the low cost associated with this method makes it a viable alternative to dredging and confinement.

Naes, Kristoffer; Bakke, Torgeir; Konieczny, Roger. **Mobilization of PAH from polluted seabed and uptake in the blue mussel (*Mytilus edulis L.*).** *Marine and Freshwater Research.* 1995; 46(1):275-285; ISSN: 1323-1650.
Researchers assess the role of 'hot spot' sediments as contaminant sources in Norwegian smelter-affected fjords, addressing the extent of mobilization, the bioavailability of mobilized polycyclic aromatic hydrocarbons (PAHs), and the differences in the PAH profile in sediments, water and mussels.

Nelson, E. C.; Walter, M. V.; Bossert, I. D.; Martin, D. G. **Enhancing biodegradation of petroleum hydrocarbons with guanidinium fatty acids.** *Environmental Science & Technology.* 1996; 30(7):2406-2411; ISSN: 0013-936X.
In laboratory studies, researchers enhanced the process of bioremediation of hydrocarbon-contaminated soils by adding selected guanidinium fatty acids to the soils. Results show rate enhancements in soil slurries and unsaturated soil microcosms when treated with 500-1500 ppm of the surfactant. Researchers added that based on these results, doses of approximately 2 lbs. of CGS/t of soil appear effective at increasing biodegradation rates.

Neustadt, B.; Marr, I. L.; Zwanziger, H. W. **Toxicity testing of oil-contaminated drilling cuttings.** *Fresenius Journal of Analytical Chemistry.* April 1995; 351(7):625-628; ISSN: 0937-0633.
Samples of drill cuttings from the bottom of the North Sea near an oil production platform were examined using the luminescent bacteria *Photobacterium phosphoreum*. From assays of the drilling mud, drill cuttings, and additives, researchers concluded that the toxic component does not originate from the drilling mud oil, but from some additive.

Nirmaier, H. P.; Fischer, E.; Meyer, A.; Henze, G. **Determination of polycyclic aromatic hydrocarbons in water samples using high-performance liquid chromatography with amperometric detection.** *Journal of Chromatography A.* April 12, 1996; 730(1-2):169-175; ISSN: 0021-9673.
Although the majority of the polycyclic aromatic hydrocarbon (PAH) compounds can be detected using high-performance liquid chromatography with UV and fluorescene detection, important compounds such as acenaphthylene do not show fluorescence. To determine acenaphthylene and the six PAHs listed in the TVO (German drinking water standard), researches applied amperometric detection (AD) following HPLC separation. Results indicated the efficiency of AD was found to be superior to UV detection.

O'Malley, V. P.; Abrajano, T. A.; Hellou, J. **Stable carbon isotopic apportionment of individual polycyclic aromatic hydrocarbons in St. John's Harbour, Newfoundland.** *Environmental Science & Technology.* 1996; 30(2):634-639; ISSN: 0013-936X.
Researchers quantitatively assessed the primary source inputs of polycyclic aromatic hydrocarbons to sediments of St. John's Harbor utilizing molecular abundance and carbon isotope measurements of individual 4- and 5-ring PAHs. Results via mass balance calculations using a two-component mixing model showed that approximately 50-80% of the input results from a combustion origin, while 20-50% of the total input can be attributed to direct petroleum.

Ortiz de Montellano, Paul R. **Cytochrome P450: structure, mechanism, and chemistry.** 2nd ed. New York: Plenum; 1995; 652 p.
With an emphasis on the physical and chemical characteristics of cytochrome P450, this monograph includes sections on the structure and use of cytochrome P450, as well as a discussion of the model systems often used to study P450, and the regulatory mechanisms and physiological roles of P450.

Osborne, C. G.; Ravenscroft, P. D.; McCracken, I. R. **Predicted water chemistry trends in North Sea formation brines.** *Marine Petroleum Geology.* 1994; 11(1):20-23; ISSN: 0264-8172.
An aqueous geochemical model has been adapted and developed for use with oil field formation brines under field conditions in the North Sea. The model has been used to identify trends in downhole pH, the potential for carbonate and sulphate scale formation and ionic strength across the North Sea region.

O'Shay, Tracey and Hoddinott, Keith B., Eds. **Analysis of Soils Contaminated with Petroleum Constituents.** Philadelphia, PA: American Society for Testing Materials; 1994; STP 1221120 p.
The latest research on analytical procedures for soil contaminated with petroleum hydrocarbons and the behavior of hydrocarbon-contaminated soils are presented in nine peer-reviewed papers.

Owens, Edward H.; Humphrey, Blair; Sergy, Gary A. **Natural cleaning of oiled coarse sediment shorelines in Arctic and Atlantic Canada.** *Spill Science and Technology Bulletin.* September 1994; 1(1):37-52; ISSN: 1353-2561.
Natural cleaning of oil-contaminated low wave-energy shorelines is examined. Observed was the interaction of mineral fines and oil to produce positively bouyant aggregates.

Parr, J. L.; Claff, R. E.; Kocurek, D. S.; Lowry, J. C. **Interlaboratory study of analytical methods for petroleum hydrocarbons.** O'Shay, Tracey and Hoddinott, Keith B., Eds. *Analysis of Soils Contaminated with Petroleum Constituents.* Philadelphia, PA: American Society for Testing Materials; 1994; STP 1221120 p.
Three methods for measuring petroleum hydrocarbons in soil are given.

Pollard, S. J. T.; Holloway, L. R.; Rawluk, M. **A tiered analytical protocol for the characterization of heavy oil residues at petroleum-contaminated hazardous waste sites.** In: O'Shay, Tracey and Hoddinott, Keith B., Eds. *Analysis of Soils Contaminated with Petroleum Constituents.* Philadelphia, PA: American Society for Testing Materials; 1994; STP 1221120 p.
The methods and applications of a tiered analytical protocol for characterizing heavy oil residues in soil are presented.

Pothuluri, J. V.; Selby, A.; Evans, F. E.; Freeman, J. P.; Cerniglia, C. E. **Transformation of chrysene and other polycyclic aromatic hydrocarbon mixtures by the fungus Cunninghamella elegans.** *Canadian Journal of Botany.* 1995; 73 (Sup. 1):S1025-S1033; ISSN: 0008-4026.
Presented are results of investigations examining the metabolism of chrysene by the fungus *C. elegans* ATCC 36112, as well as an evaluation of fungal transformations of mixtures of polycyclic aromatic hydrocarbons [benzo(a)pyrene, phenanthrene, fluoranthene, pyrene, acenaphthene]. Researchers reported that *C. elegans* metabolized the mixture of PAHs to hydroxylated intermediates within 24 h. Also, in separate experiments *C. elegans* metabolized 45% of the chrysene added to cultures during a 144 h. incubation.

Prince, R. C. **Bioremediation of marine oil spills.** *Trends in Biotechnology.* May 1997; 15(5):158-160. ISSN: 0167-7799.
The author explains how potentially important bioremediation strategies are for dealing with marine oil spills. However, environmental constraints limit their activity, and bioremediation strategies must be tailored to local conditions.

Providenti, M. A.; Lee, H.; Trevors, J. T. **Selected factors limiting the microbial degradation of recalcitrant compounds.** *Journal of Industrial Microbiology.* December 1993; 12(6):379-395; ISSN: 0169-4146.

Puri, V. K.; Das, B. M.; Cook, E. E.; Shin, E. C. **Geotechnical properties of crude oil-contaminated sand.** O'Shay, Tracey and Hoddinott, Keith B., Eds. *Analysis of Soils Contaminated with Petroleum Constituents.* Philadelphia, PA: American Society for Testing Materials; 1994; STP 1221120 p.
The effects of crude oil contamination on compaction, stress deformation, compressibility, shear strength and permeability characteristics of sand are presented.

Raccanelli, S.; Pavoni, B.; Maroli, L.; Sfriso, A. **One step clean-up and separation of chlorinated, aliphatic and polycyclic aromatic hydrocarbons in environmental samples, prior to gas chromatographic quantification.** *Toxicological and Environmental Chemistry.* 1994; 45(1-2):121-137; ISSN: 0277-2248.
The authors describe a single step clean-up and separation of chlorinated, aliphatic and polycyclic aromatic hydrocarbons. Samples of sediment, particulate matter, macroalgae, and zoobenthos from the lagoon of Venice and industrial samples have been analyzed by this procedure.

Radwan, S. S.; Sorkhoh, N. A.; Fardoun, F.; Al-Hasan, R. H. **Soil management enhancing hydrocarbon biodegradation in the polluted Kuwaiti desert.** *Applied Microbiology and Biotechnology.* December 1995; 44(1-2):265-270; ISSN: 0175-7598.
Researchers investigated the self-cleaning mechanisms in oil polluted areas in the Kuwaiti Desert in an effort to ascertain whether self-cleaning is occurring and, if so, what type of soil management may lead to increases in soil biodegradation of oil. Results indicated that self-cleaning is occurring and enhancements may include keeping the contaminated area exposed to the environment, and fertilizing the area with nitrate, very low NaCl levels, and liming.

Rajkumar, W.; Persad, D. **Heavy metals and petroleum hydrocarbons in nearshore areas of Tobago, West Indies.** *Marine Pollution Bulletin.* 1994; 28(11):701-703; ISSN: 0025-326X.
Sediment and seawater samples were collected over the period July 1990 - November 1991 for heavy metals and over the period September 1987 - August 1989 for petroleum hydrocarbons. Sediment and seawater samples were collected at 6 week intervals.

Ramirez, N. E.; Vargas, M. C.; Sanchez, F. N. **Use of the "sediment-chromotest" for monitoring stimulated hydrocarbon biodegradation processes.** *Environmental Toxicology and Water Quality.* August 1996; 11(3):223-230; ISSN: 1053-4725.

Reed, M.; Turner, C; Odulo, A. **The role of wind and emulsification in modeling oil spill and surface drifter trajectories.** *Spill and Science Technology Bulletin.* 1994; 1(2):143-157; ISSN: 1353-2561.
Researchers report that the movement of spilled oil at sea is, in general, a three-dimensional phenomenon in physical space, whereas surface drifter movements are more susceptible to two-dimensional analysis.

Reighard, T. S.; Olesik, S. V. **Bridging the gap between supercritical fluid extraction and liquid extraction techniques: alternative approaches to the extraction of solid and liquid environmental matrices.** *Critical Reviews in Analytical Chemistry.* 1996; 26(2-3):61-99; ISSN: 1040-8347.
Authors present a review of the alternatives that are "bridging the gap" between liquid extraction techniques and supercritical fluid extraction for both solid and liquid matrices.

Rhykerd, Robert L.; Weaver, Richard W.; McInnes, Kevin J. **Influence of salinity on bioremediation of oil in soil.** *Environmental Pollution.* 1995; 90(1):127-130.
The effect of salt (NaCl) on the degradation of petroleum hydrocarbons in a sandy-clay loam and clay soil was assessed. Researchers concluded that the removal of salts from the oil and salt-contaminated soils prior to bioremediation may decrease the bioremediation time.

Richnow, H. H.; Seifert, R.; Kastner, M.; Mahro, B.; Horsfield, B.; Tiedgen, U.; Bohm, S.; Michaelis, W. **Rapid screening of PAH-residues in bioremediated soils.** *Chemosphere.* October 1995; 31(8):3991-3999; ISSN: 0045-6535.
Analytical pyrolysis was used to study the chemical structure of PAH-fragments incorported into humic material during biodegradation. Pyrolysates of humic acids derived from PAH contaminated soils revealed a 2 to 8 fold enrichment of PAHs compared to non-contaminated soils.

Riis, V.; Miethe, D.; Babel, W. **Degradation of refinery products and oils from polluted sites by the autochthonous microorganisms of contaminated and pristine soils.** *Microbiological Research.* September 1995; 150(3):323-330; ISSN: 0944-5013.
Refinery products (diesel fuel, spindle oil, top residue, neutral oil HSP NIV, neutral oil Ro N III) extracted from long-term contaminated soils were investigated with respect to their degradability by the autochthonous microorganisms of contaminated and native soils.

Rivet, L. **La biodegradation des hydrocarbures petroliers (Biodegradation of petrol hydrocarbons).** *Analusis.* October 1995; 23(8):378-380; ISSN: 0365-4877.
The author examines the use of capillary gas chromatography coupled to mass spectrometry (GC/MS) as a tool to analyze residual hydrocarbons and the degree of biodegradation.

Roch, F.; Alexander, M. **Biodegradation of hydrophobic compounds in the presence of surfactants.** *Environmental Toxicology and Chemistry.* July 1995; 14(7):1151-1158; ISSN: 0730-7268.
The availability of hydrophobic compounds within surfactant micelles for microbial uptake was determined.

Roques, D. E.; Overton, E. B.; Henry, C. B. **Using gas chromatography/mass spectroscopy fingerprint analysis to document process and progress of oil degradation.** *Journal of Environmental Quality.* 1994; 23(4):851-855; ISSN: 0047-2425.
Described is a method using high resolution gas chromatography/mass spectrometry (GC/MS), which has been adapted from oil fingerprinting techniques for oil spill response to major spills such as the Exxon Valdez. In addition, the authors demonstrate that high resolution GC/MS and compound specific analyses are a viable method of analyzing the extent of oil bioremediation, and that it likely possible to standardize the method for monitoring the biodegradation of oil.

Rosenberg, E.; Legman, R.; Kushmaro, A.; Adler, E.; Abir, H.; Ron, E. Z. **Oil bioremediation using insoluble nitrogen source.** *Journal of Biotechnology*. November 15, 1996; 51(3):273-278. ISSN: 0168-1656.
Researchers assess the use of a hydrophobic source of nitrogen and phosphorous (F-1) and discuss its applicability for treating oil-polluted soil.

Salanitro, J. P.; Dorn, P. B.; Huesemann, M. H.; Moore, K. O.; Rhodes, I. A.; Jackson, L. M. R.; Vipond, T. E.; Western, M. M.; Wisniewski, H. L. **Crude oil hydrocarbon bioremediation and soil ecotoxicity assessment.** *Environmental Science & Technology*. June 1997; 31(6):1769-1776. ISSN: 0013-936X.
An evaluation of three oils containing low or high organic carbon at 4000-27,000 mg/kg TPH were mixed into silty loamy soils to determine the limits and extent of hydrocarbon biodegradation, earthworm and plant toxicity, and waste leachability of crude oil-containing soils. The results provide the ecological assessment methods of biodegradability, ecotoxicity, and leaching potential of regulated substances as a basis for the framework in which petroleum hydrocarbon-containing soils can be evaluated.

Sarna, L. P.; Webster, G. R. B.; Friesen-Fischer, M. R.; Ranjan, R. **Analysis of the petroleum components benzene, toluene, ethyl benzene and the xylenes in water by commercially available solid-phase microextraction and carbon-layer open tubular capillary column gas chromatography**. *Journal of Chromatography, A*. August 12, 1994; 677(1):201-205; ISSN: 0021-9673.
A description of the extraction of the petroleum components benzene, toluene, ethyl benzene and the xylenes (BTEX) from water using a commercially available poly(dimethylsiloxane) solid phase microextraction fiber assembly with separation and quantification by carbon-layer open tubular capillary column gas chromatography and flame ionization detection is given.

Savchuk, S. A.; Rudenko, B. A.; Brodskii, E. S.; Soifer, V. S. **Application of gas chromatography with open tubular columns and chemiluminescent detection to the determination of sulfur-containing substances in oil pollutions of sea water**. *Journal of Analytical Chemistry*. November 1995; 50(11):1081-1087; ISSN: 1061-9348.
Researchers utilized gas chromatography with open tubular columns and chemiluminescent detection to determine the sulfur-containing compounds in oil pollution in the marine environment (detection limit 0.1 ng/L).

Schade, W.; Bublitz, J. **On-site laser probe for the detection of petroleum products in water and soil.** *Environmental Science & Technology*. May 1996; 30(5):1451-1458; ISSN: 0013-936X.
Researchers discuss the promise of time-resolved laser-induced fluorescence spectroscopy and fiber optics for the detection of environmental pollutants in water and soil.

Schleussinger, A.; Ohlmeier, B.; Reiss, I.; Schulz, S. **Moisture effects on the cleanup of PAH-contaminated soil with dense carbon dioxide.** *Environmental Science & Technology*. November 1996; 30(11):3199-3204; ISSN: 0013-936X.
Examined were the effects of soil moisture on the extraction of polycyclic aromatic hydrocarbons from soil with supercritical carbon dioxide.

Schoenmakers, P.; Blomberg, J.; Kerkvliet, S. **Sophisticated separation methods and the oil industry.** *LC GC - Magazine of Separation Science*. January 1997; 15(1):28. ISSN: 0888-9090.
Hyphenated chromatography techniques and their applications in the oil industry are review and discussed.

Seasonal variation of bacteria in sea ice contaminated by diesel fuel and dispersed crude oil. *Microbial Ecology*. 1997; 33:97-105.
The shipwreck of the *Bahia Paraiso*, which ran aground and sank near the Antarctic Peninsula, prompted the need for research into hydrocarbon contamination of the Southern Ocean ecosystem. Little is known about crude oil degradation processes in cold environments. The study initiated the exploration of crude and diesel oil contamination consequences, on whole and specific bacterial communities in Antarctic sea ice and underlying water, and evaluated the benefit of fertilizer addition for the growth of indigenous communities.

Sharma, Virender K.; Rhudy, Kurtis; Brooks, Rachael; Hollyfield, Shari; Vazquez, Felipe G. **Petroleum hydrocarbons in sediments of Upper Laguna Madre.** *Marine Pollution Bulletin*. April 1997; 34(4):229-234. ISSN: 0025-326X.
Sediments obtained through leaching from petroleum wells and pipelines and industrial surface run-off, were assessed to determine the extent of petroleum contamination in 52 Upper Laguna Madre sites. Conclusions were that aliphatic hydrocarbons with even and odd chain lengths, were equally distributed throughout the study sites. Biogenic and anthropogenic sources probably contribute to aliphatic hydrocarbon contamination.

Shuttleworth, K. L.; Cerniglia, C. E. **Bacterial degradation of low concentrations of phenanthrene and inhibition by naphthalene.** *Microbial Ecology.* May-June 1996; 31(3):305-317; ISSN: 0095-3628.
Researchers isolated three phenanthrene-degrading bacteria from creosote and jet fuel contaminated soils. All three isolates used phenanthrene as a sole carbon and energy source and two of the isolates utilized fluoranthene as the sole carbon and energy source. In addition, all three isolates co-metabolized anthracene and fluorene, but not pyrene; and naphthalene inhibited all of the strains.

Simpson, C. D.; Cullen, W. R.; Quinlan, K. B.; Reimer, K. J. **Methodology for the determination of priority pollutant polycyclic aromatic hydrocarbons in marine sediments.** *Chemosphere.* November 1995; 31(9):4143-4155; ISSN: 0045-6535.
Researchers present the development and application of a method for the isomer specific determination of polycyclic aromatic hydrocarbons (PAHs) in marine sediments, which involves Soxhlet extraction of a sediment sample with methylene chloride--a one-step cleanup on a Florisil column, and analysis via gas chromatography with flame ionization detection (GC-FID).

Siron, R.; Pelletier, E. **Oil biodegradation in cold seawater: a mesocosm study.** Van Coillie, R. and others, (eds.). *Proceedings of the Twentieth Annual Aquatic Toxicity Workshop.* 1994; 1989117-136; ISSN: 0706-6457.
Five mesocosms (3.5 m^3 each) were used to study the behavior of crude oil dispersed in cold and icy seawater (-1.8 to 5.5 degree C). Studied was the biodegradation in various parts of the aquatic environment, including the air-water interface, the water column, and the settling oil residue. Interactions between the bacterial and microalgal communities were also observed.

Siron, R.; Pelletier, E. **Toxicity assessment of oil components and an oil treating agent using the *Photobacterium phosphoreum* bioassay.** van Coillie, R. and others, Editor. *Proceedings of the Twentieth Annual Aquatic Toxicity Workshop.* 1994; 1989164-178; ISSN: 0706-6457.
The Microtox registered test, based on the bioluminescence inhibition of the marine bacterium *Photobacterium phosphoreum*, was used to test the oil toxicity in seawater. Preliminary results show that the Microtox registered test is very sensitive to oil compounds, and when it is used in combination with mesocosms, it provides an efficient experimental tool to access the toxicity of crude oil spilled at sea.

Siron, R.; Pelletier, E.; Brochu, C. **Environmental factors influencing the biodegradation of petroleum hydrocarbons in cold seawater.** *Archives of Environmental Contamination and Toxicology.* May 1995; 28(4):406-416; ISSN: 0090-4341.
Five mesocosms (3.5 m^3 each) located at Pointe-au-Pere, Canada, were used to investigate the biodegradation of crude oil in cold and icy seawater (-1.8 to 5.5°C) under various environmental conditions.

Smith, D. J. T.; Harrison, R. M.; Luhana, L.; Pio, C. A.; Castro, L. M.; Tariq, M. N.; Hayat, S.; Quraishi, T. **Concentrations of particulate airborne polycyclic aromatic hydrocarbons and metals collected in Lahore, Pakistan.** *Atmospheric Environment.* December 1996; 30(23):4031-4040; ISSN: 1352-2310.
Researchers investigated the suspended particulate matter loading of the air at various locations at Lahore, Pakistan, and defined the chemical compositions of the particulates.

Sterzenbach, D.; Wenclawiak, B. W.; Weigelt, V. **Determination of chlorinated hydrocarbons in marine sediments at the part-per-trillion level with supercritical fluid extraction.** *Analytical Chemistry.* March 1, 1997; 69(5):831-836. ISSN: 0003-2700.

Su, J. J.; Kafkewitz, D. **Toluene and xylene degradation by a denitrifying strain of Xanthomonas maltophilia with limited or no oxygen.** *Chemosphere.* May 1996; 32(9):1843-1850; ISSN: 0045-6535.
Researchers examined the degradation of toluene and two isomers of xylene by a culture of bacteria (Pseudomonas) with limited oxygen or under anoxia conditions. Results suggest that limited amounts of oxygen provide no advantage over anoxic denitrification.

Sugai, Susan F.; Lindstrom and Jon E.; Braddock, Joan F. **Environmental influences on the microbial degradation of *Exxon Valdez* Oil on the shorelines of Prince William Sound, Alaska.** *Environmental Science and Technology*. 1997; 31(5):1564-1574. ISSN: 0013-936X.
For three field seasons, researchers examined sediment chemistry data following the *Exxon Valdez* Oil Spill in Prince William Sound, Alaska, to predict the persistence of hydrocarbons. However, sediment chemistry data alone was inconclusive and demonstrated the need for systematic ecosystem level studies of the abiotic and biotic factors influencing biodegradation.

Sugiura, K.; Ishihara, M.; Shimauchi, T.; Harayama, S. **Physiochemical properties and biodegradability of crude oil.** *Environmental Science & Technology*. January 1997; 31(1):45-51; ISSN: 0013-936X.
Utilizing gravimetric measurements, GC/FID, GC/MS, FDMS, and NMR, researchers examine the changes in components of crude oil samples post biodegradation by single bacterium or microbial mix.

Sutherland J. B.; Rafii, F.; Khan, A. A.; Cerniglia, C. E. **Mechanisms of polycyclic aromatic hydrocarbon degradation**. In: Young, L. Y. and Cerniglia, C. E. *Microbial Transformation and Degradation of Toxic Organic Chemicals*: Wiley-Liss, Inc c1995 pp. 269-306. ISBN: 0-471-52109-4.
This review includes sections on the pathways used by microorganisms for the metabolism of polycyclic aromatic hydrocarbons (PAH); the enzymes involved in microbial PAH metabolism; and the genetics of PAH metabolism.

Swannell, R. P. J.; Croft, B. C.; Grant, A. L.; Lee, K. **Evaluation of bioremediation agents in beach microcosms.** *Spill Science and Technology*. 1995; 2(2/3):151-159. ISSN: 1353-2561.
Researchers simulated a crude oil spill (weathered Arabian Light) on an intertidal sand zone in the laboratory to assess the effectiveness of a slow-release inorganic fertilizer (*Max Bac*) and an oleophilic organic fertilizer (*Inipol EAP22*) as bioremediation agents.

Swartz, Richard C. and others. **PAH: a model to predict the toxicity of polynuclear aromatic hydrocarbon mixtures in field-collected sediments.** *Environmental Toxicology and Chemistry*. November 1995; 14(11):1977-1987; ISSN: 0730-7268.
Authors present and provide verification of the PAH model. The PAH model predicts the probability of acute sediment toxicity to marine and estuarine amphipods caused by the stresses of 13 PAHs.

Szpilowski, S.; Owczarczyk, A.; Wierzchnicki, R.; Strzelecki, M. **Application of tracer method for investigation of dilution and decay of petrochemical effluent discharged into big river.** *Water Air and Soil Pollution*. 1994; 78(3-4):199-213; ISSN: 0049-6979.
Researchers investigated the dilution and decay of petrochemical effluent discharged into a river.

Tedesco, Steven A. **Surface Geochemistry in Petroleum Exploration**: Chapman and Hall; 1995; 206 p. ISBN: 0412993015.
A broad array of surface geochemistry techniques is surveyed and integrated with surface geochemistry data interpretation with data from conventional methods of oil exploration.

Ten Hulscher, Th. E. M.; Cornelissen, G. **Effect of temperature on sorption equilibrium and sorption kinetics of organic micropollutants - a review.** *Chemosphere*. February 1996; 32(4):609-626; ISSN: 0045-6535.
The authors discuss and review the influence of temperature on sorption kinetics and equilibrium for organic pollutants. In addition, the literature on the effect of temperature on the diffusion of organic compounds in polymeric structures is summarized.

Thibault, Stephanie L.; Anderson, Michael; Frankenberger, W. T. **Influence of surfactants on pyrene desorption and degradation in soils.** *Applied and Environmental Microbiology*. January 1996; 62(1):283-287; ISSN: 0099-2240.
Tested were four surfactants at various concentrations to assess their ability to solubilize soil-adsorbed pyrene. Results indicated that inoculation with pyrene degraders in the presence of the surfactant Witconol SN70 proved to be the most effective means for pyrene mineralization (46%-80%) under unsaturated conditions. However, Witconol SN70 inhibited the effectiveness of the degraders in soil slurries.

Thierrin, J.; Davis, G. B.; Barber, C. **A ground water tracer test with deuterated compounds for monitoring in situ biodegradation and retardation of aromatic hydrocarbons.** *Ground Water.* May-June 1995; 33(3):469-475; ISSN: 0017-467X.
Inside a BTEX contaminated plume of anoxic groundwater in the Swan coastal plain, Western Australia, fully deuterated benzene, toluene, p-xylene, and naphthalene were used with bromide (inert reference) as groundwater pollutant tracers. In addition to the determination of local aquifer parameters and retardation coefficients for organic pollutants, this tracer test showed that the deuterated organic compounds can be utilized for in situ determination of natural biodegradation rates of organic pollutants.

Tiehm, A.; Fritzsche, C. **Utilization of solubilized and crystalline mixtures of polycyclic aromatic hydrocarbons by a Mycobacterium sp.** *Applied Microbiology and Biotechnology.* March 1995; 42(6):964-968; ISSN: 0175-7598.
Researchers studied a strain of Mycobacterium by examining its growth and degradation potential using a variety of mixtures of fluorene, phenanthrene, fluoranthene, and pyrene in an effort to investigate whether the presence these PAH mixtures influence the degradation of single compounds.

Timberlake, D. L.; Garbaciak, S. Jr. **Bench-scale testing of selected remediation alternatives for contaminated sediments.** *Journal of Air and Waste-Management Association.* 1995; 45(1):52-56; ISSN: 1047-3289.
Researchers conducted bench-scale tests of solvent extraction, thermal desorption, and wet air oxidation technologies using contaminated sediments from four United States rivers. The main contaminants of concern were polychlorinated biphenyls and polynuclear aromatic hydrocarbons. Raw sediment contaminant concentrations ranged from .32 - 21.9 mg/kg dry mass for PCBs and 2.7 - 266 mg/kg for PAHs.

Tsomides, H. J.; Hughes, J. B.; Thomas, J. M.; Ward, C. H. **Effect of surfactant addition on phenanthrene biodegradation in sediments.** *Environmental Toxicology and Chemistry.* June 1995; 14(6):953-959; ISSN: 0730-7268.
Whether commercial surfactants enhance the bioremediation of polycyclic aromatic hydrocarbon-contaminated sediments was determined. A laboratory study was conducted using phenanthrene and an inoculum of PAH-degrading microorganisms, enriched from aquatic sediment. The results indicated that many surfactants are toxic to the PAH-degrading microorganisms and the use of surfactants may not be desirable to achieve complete contaminant removal.

Tumeo, Mark; Braddock, Joan; Venator, Tamara; Rog, Steve; Owens, Dennis. **Effectiveness of a biosurfactant in removing weathered crude oil from subsurface beach material.** *Spill Science and Technology Bulletin.* September 1994; 1(1):53-59; ISSN: 1353-2561.
The results of removal of weathered crude oil from beach material using biosurfactant PES-51 (R) are offered.

Uzaki, M.; Yamada, K.; Ishiwatari, R. **Carbon isotope evidence for oil-pollution in long chain normal alkanes in Tokyo Bay sediments.** *Geochemical Journal.* 1993; 27(6):385-389; ISSN: 0016-7002.
The ^{13}C values of individual n-alkanes in polluted sediments are examined using a gas chromatography-isotope ratio mass spectrometry (GC-IRMS) method. The usefulness of the method in pollution studies is presented.

Van Kemenade, Inga; Anderson, William A.; Scharer, Jeno M.;Moo-Young, Murray. **Bioremediation enhancement of phenanthrene contaminated soils by chemical pre-oxidation.** *Hazardous Waste & Hazardous Materials.* Fall 1995; 12(4):345-355; ISSN: 0882-5696.
Researchers investigated a two-step oxidation process for the treatment of phenanthrene contaminated soil fines in an effort to: (a) determine the enhancement of the removal of phenanthrene from soil fines, (b) decrease the time required to reduce the contaminants in the soil, and (c) describe a relationship between the level of chemical pre-oxidation and its effect on the biological oxidation step.

Venkateswaran, K.; Harayama, S. **Sequential enrichment of microbial populations exhibiting enhanced biodegradation of crude oil.** *Canadian Journal of Microbiology*. September 1995; 41(9):767-775; ISSN: 0008-4166.
Researchers discuss the use of a sequential enrichment technique, a modification of the simple enrichment technique in which a hydrocarbon mixture is used as a substrate and organisms are isolated from this first enrichment. The residual hydrocarbons from the first enrichment are recovered and are used for a second enrichment from which other microorganisms are isolated.

Venosa, Albert D. and others. **Bioremediation of an experimental oil spill on the shoreline of Delaware Bay**. *Environmental Science & Technology*. May 1996; 30(5):1764-1775; ISSN: 0013-936X.
Researchers determined if bioremediation with inorganic mineral nutrients and/or microbial inoculation enhanced the removal of crude oil contaminating a sandy beach. Biodegradation was tracked using GC/MS analysis of selected compounds. Three treatments were examined: (a) no-nutrient control, (b) addition of water soluble nutrients, (c) water soluble nutrients with natural microbial inoculum from the site. Results indicated that significant differences in bioremediation were observed between the treated and untreated plots, although not between plots treated with nutrients and the inoculum.

Vera-Avila, L. E.; Covarrubias, R. **On-line trace enrichment and HPLC determination of polycyclic aromatic hydrocarbons in water.** *International Journal of Environmental Analytical Chemistry*. 1994; 56(1):33-47; ISSN: 0306-7319.
Described is a quick and simple method for determining trace levels of polycyclic aromatic hydrocarbons in water. Recoveries > 70%, RSD < 10%, and limits of detection ranging from 1.2 mu g/l (naphthalene) to 4 ng/l (anthracene, fluoranthene and benzo(k)fluoranthene) were obtained with spiked water samples.

Verbeek, A. G.; Mackay, W. C.; MacKinnon, M. D. **Acute toxicity of oil sands wastewater: a toxic balance**. Van Coillie, R. and others, Editor. *Proceedings of the Twentieth Annual Aquatic Toxicity Workshop*. 1994; 1989196-207; ISSN: 0706-6457.
The objective of this study was to identify and determine the significance of the toxic fractions of wastewater from oil sands extraction using a bioassay directed Toxicity Identification Evaluation and to use this data to construct a toxic balance.

Visser, T.; Vredenbregt, M. J.; Jong, A. P. J. M. de. **Confirmational analysis of polycyclic aromatic hydrocarbons in soil extracts by cryotrapping gas chromatography-Fourier transform infrared spectrometry**. *Journal of Chromatography A*. 1994; 687303-313; ISSN: 0021-9673.
Fourier transform infrared spectrometry-gas chromatography has been proven to be suitable for the identification of molecules. Using extracts of sediment, soil and river clay, this study investigated the usefulness of cryotrapping GC-FT-IR for the identification of polycyclic aromatic hydrocarbons in complex environmental samples and in particular to confirm the results using a standard high performance liquid chromatography-fluorescence method.

Volkering, Frank; Breure, Anton M.; Van Andel, Johan G.; Rulkens, Wim H. **Influence of nonionic surfactants on bioavailability and biodegradation of polycyclic aromatic hydrocarbons.** *Applied and Environmental Microbiology*. May 1995; 61(5):1699-1705; ISSN: 0099-2240.
The presence of the Triton X-100, Tergitol NPX, Brij 35, and Igepal CA-720 (nonionic surfactants) resulted in increased apparent solubilities and elevated maximal rates of dissolution of crystalline naphthalene and phenanthrene.

Wade, Terry L.; Velinsky, David J.; Reinharz, Eli; Schlekat, Christian E. **Tidal river sediments in the Washington, DC area .II. Distribution and sources of organic contaminants**. *Estuaries*. June 1994; 17(2):321-333; ISSN: 0160-8347.
The concentrations of aliphatic, aromatic and chlorinated hydrocarbons were assessed from 33 surface-sediment samples taken from waters in the Washington, DC area. Sources are conjectured.

Walter, M. V.; Nelson, E. C.; Firmstone, G.; Martin, D. G.; Clayton, M. J.; Simpson, S.; Spaulding, S. **Surfactant enhances biodegradation of hydrocarbons: microcosm and field study.** *Journal of Soil Contamination*. 1997; 6(1):61-77. ISSN: 1058-8337.
Researchers investigated new ways to enhance biodegradation of hydrocarbons in the soil by applying various combinations of an anionic surfactant guanidinium cocoate, nitrogen:urea, a consortium of degrading microorganisms, and vermiculite.

Wang, R. F.; Luneau, A.; Cao, W.; Cerniglia, C. E. **PCR detection of polycyclic aromatic hydrocarbon-degrading mycobacteria**. *Environmental Science & Technology*. January 1996; 30(1):307-311; ISSN: 0013-936X.
Researchers developed polymerase chain reaction (PCR) methods specific for two species of Mycobacterium, which are reported to be very effective in the use of monitoring the PAH-degradation in the bioremediation of PAH-contaminated soil.

Wang, Xiaojiang; Brusseau, Mark L. **Cyclopentanol-enhanced solubilization of polycyclic aromatic hydrocarbons by cyclodexdrins**. *Environmental Science and Technology*. September 1995; 29(9):2346-2351.
Reported is the effect of cyclopentanol on the solubilization of six polycyclic aromatic hydrocarbons (PAHs) by β-cyclodextrin and γ-cyclodexrin. The addition of .1% v/v cyclopentanol increases the solubilization power of β-CD for pyrene, acenaphthene, phenanthrene, and fluoranthene. However, the solubilization of acenaphthene and phenanthrene by β-CD in the presence of cyclopentanol decreases at higher β-CD concentrations. In contrast, cylcopentanol has no effect on naphthalene and a significant decrease in the solubilization ability of β-CD for anthracene. Results also show that the solubilization of all six PAHs by γ-CD is significantly increased by 1% v/v cyclopentanol.

Wang, Z and Fingas, M. **Study of the effects of weathering on the chemical composition of a light crude oil.** In. *Proceedings: Seventeenth Arctic and Marine Oil Spill Program Technical Seminar.* Ottawa: Environment Canada; 1994; 1 pp. 133-171.
Discussed are weathering processes that act on crude oil or petroleum distillate products spilled into the sea, including processes such as spreading, evaporation, dispersion, evaporation, dissolution, oxidation, water-oil emulsification, degradation, adsorption, sinking and sedimentation.

Wang, Z. and Fingas, M. **Quantitative oil analysis method**. In. *Proceedings: Seventeenth Arctic and Marine Oil Spill Program Technical Seminar.* Ottawa: Environment Canada; 1994; 1 pp. 307-335.
The authors discuss the necessity of appropriate and reliable chemical analytical methods for oil samples when assessing the petroleum damage to the environment caused by accidental release of crude oil. Analytical methods and techniques have made major advances in recent years. Yet, the analytical methods and designs have not taken into account the differences between oil spills and spills of other hazardous materials.

Wang, Z.; Fingas, M. **Separation and characterization of petroleum hydrocarbons and surfactant in Orimulsion dispersion samples**. *Environmental Science & Technology*. November 1996; 30(11):3351-3361; ISSN: 0013-936X.
Researchers report detailed separation and characterization results of petroleum hydrocarbons and surfactant in Orimulsion dispersions.

Wang, Z.; Fingas, M.; Sergy, G. **Chemical characterization of crude oil residues from an Arctic beach by GC/MS and GC/FID**. *Environmental Science and Technology*. 1995; 29(11):2622-2631.
The authors describe a 'total oil analysis method' to monitor chemical composition changes and study the fate of oil residues. In the Arctic environment, researchers found that biodegradation played a significant role in the removal of oil residues, and compositional changes due to weathering proceed at a much slower rate as a result of the Arctic conditions.

Wang, Zhendi; Fingas, Merv. **Use of methyldibenzothiophenes as markers for differentiation and source identification of crude and weathered oils**. *Environmental Science and Technology*. 1995; 29(11):2842-2849; ISSN: 0013-936X.
Authors describe an effective gas chromatographic/mass spectrometric method for differentiation and source identification of crude and weathered oils by using isomeric methyldibenzothiophene compounds, which can be distinctively used to indicate the occurrence of microbial degradation of oils.

CHEMISTRY/GEOCHEMISTRY/GEOLOGY

Weber, F. J.; Hage, K. C.; Debont, J. A. M. **Growth of the fungus *Cladosporium sphaerospermum* with toluene as the sole carbon and energy source.** *Applied and Environmental Microbiology.* October 1995; 61(10):3562-3566; ISSN: 0099-2240.
Researchers are the first to report the growth of a eukaryotic organism (*C. sphaerosperum*) with toluene as the sole source of carbon and energy.

Wenclawiak, B. W.; Heemken, O. P.; Sterzenbach, D.; Schipke, J.; Theobald, N.; Weigelt, V. **Device for efficient solvent collection of environmentally relevant compounds in off-line SFE.** *Analytical Chemistry.* December 15, 1995; 67(24):4577-4580; ISSN: 0003-2700.
Using a Dewar condenser to reduce analyte losses, researchers investigated and quantified five groups of analytes of environmental concerns by GC-FID/GC-ECD. Results indicated that the collection losses were reduced to 2%, with the condenser temperature kept at –25° C.

Whittaker, M.; Pollard, S. J. T. **Characterization of refractory wastes at hydrocarbon-contaminated sites: 1. Rapid column fractionation and thin layer chromatography of reference oils.** *Journal of Planar Chromatography.* September-October 1994; 7354-361; ISSN: 0933-4173.
Presented are details of a rapid, reliable protocol for the component class analysis of seven weathered reference oils.

Whittaker, M.; Pollard, S. J. T.; Fallick, A. E.; Preston, T. **Characterization of refractory wastes at hydrocarbon-contaminated sites. 2. Screening of reference oils by stable carbon isotope fingerprinting.** *Environmental Pollution.* 1996; 94(2):195-203. ISSN: 0269-7491.

Whittaker, M.; Pollard, S. J. T.; Fallick, T. E. **Characterization of refractory wastes at heavy oil-contaminated sites: a review of conventional and novel analytical methods.** *Environmental Technology.* November 1995; 16(11):1009-1033; ISSN: 0959-3330.
The authors present a review of current analytical methodologies for the characterization of oil-contamination extracted from a waste-soil matrix, including a discussion of the applications and limitations of rapid screening and extended analysis of refractory petroleum wastes streams.

Whyte, L. G.; Greer, C. W.; Inniss, W. E. **Assessment of the biodegradation potential of psychrotrophic microorganisms.** *Canadian Journal of Microbiology.* February 1996; 42(2):99-106; ISSN: 0008-4166.
In an effort to isolate and characterize psychrotrophic (catalytic activity at temperatures below 25ø C) and psychrophillic polycyclic aromatic hydrocarbon degrading microorganisms, researchers analyzed 135 psychrotrophic microorganisms from the Northwest Territories for their ability to mineralize a variety of organic pollutants.

Widrig, D. L.; Manning, John F. **Biodegradation of no.2 diesel fuel in the vadose zone: a soil column study.** *Environmental Toxicology and Chemistry.* November 1995; 14(11):1813-1822; ISSN: 0730-7268.
Researchers set out to: (a) determine the extent of diesel fuel degradation in soil columns under four operating conditions [biologically inhibited control; continuous saturation with nitrogen and phosphorous; periodic operation (flooding with nitrogen and phosphorous, and calcium and magnesium, followed by draining and aeration)], (b) evaluate carbon dioxide production and oxygen production, (c) monitor hydraulic conductivity, (d) examine the system requirements for nitrogen and phosphorus.

Wildhaber, M. L.; Schmitt, C. J. **Estimating aquatic toxicity as determined through laboratory tests of great lakes sediments containing complex mixtures of environmental contaminants.** *Environmental Monitoring and Assessment.* July 1996; 41(3):255-289; ISSN: 0167-6369.

Wolfe, D. A. and others. **Comparative toxicities of polar and non-polar organic fractions from sediments affected by the *Exxon Valdez* oil spill in Prince William Sound, Alaska.** *Chemical Ecology.* 1995; 10(1-2):137-156; ISSN: 0275-7540.

Wrenn, B. A.; Haines, J. R.; Venosa, A. D.; Kadkhodayan, M.; Suidan, M. T. **Effects of nitrogen source on crude oil biodegradation.** *Journal of Industrial Microbiology.* September 1994; 13(5):279-286; ISSN: 0169-4146.
Studied were the effects of NH_4Cl and KNO_3 on biodegradation of light Arabian crude oil by oil-degrading enrichment culture in respirometers.

Wrenn, B. A.; Suidan, M. T.; Strohmeier, K. L.; Eberhart, B. L.; Wilson, G. J.; Venosa, A. D. **Nutrient transport during bioremediation of contaminated beaches: Evaluation with lithium as a conservative tracer.** *Water Research.* March 1997; 31(3):515-524. ISSN: 0043-1354.
A lithium nitrate tracer was used to study the pattern and rate of nutrient transport in a low energy sandy beach (Delaware Bay). Researchers report that the rate of tracer washout was more rapid during spring tide (tidal amplitude is largest) than neap tide; yet the path of the tracer remained unchanged, moving vertically beneath the beach surface and horizontally through the sand towards the sea.

Ye, Dingyi and others. **Degradation of polynuclear aromatic hydrocarbons by *Sphingomonas paucimobilis*.** *Environmental Science & Technology.* January 1996; 30(1):136-142; ISSN: 0013-936X.
Researchers investigated the ability of *Sphingomonas paucimobilis* (EPA 505) to metabolize a variety of high molecular weight polynuclear aromatic hydrocarbons. It was concluded that *S. paucimobilis* does have this ability to degrade several four- and five-ring PAHs of various molecular weights, shapes, and structures.

Yeung, P. Y. P.; Johnson, R. L.; Acharya, S. N. **An improved procedure for determining oil content in wet soil samples.** O'Shay, Tracey and Hoddinott, Keith B., Eds. *Analysis of Soils Contaminated with Petroleum Constituents.* Philadelphia, PA: American Society for Testing Materials; 1994; STP 1221120 p.
The differences and difficulties in recovering oil from a soil sample are examined.

Young, L. Y. and Cerniglia, C. E. **Microbial Transformation and Degradation of Toxic Organic Chemicals:** Wiley-Liss, Inc c1995654 p. ISBN: 0-471-52109-4.
This monograph provides current perspectives from laboratory and field studies on the biodegradation of toxic organic chemicals. Sections include the issues, the microbiology, applications in cleanup and bioremediation, and future trends.

Young, R. N.; Mohammed, L. F.; Mohammed, A. M. O. **Retention and transport of oil residue in a sandy loam soil.** In: O'Shay, Tracey and Hoddinott, Keith B., Eds. *Analysis of Soils Contaminated with Petroleum Constituents.* Philadelphia, PA: American Society for Testing Materials; 1994; STP 1221120 p.
Experimental and modeling approaches that assist in understanding the behavior of oil in soils are outlined.

Yuan, M.; Todd, A. C.; Sorbie, K. S. **Sulphate scale precipitation arising from seawater injection: a prediction study.** *Marine Petroleum Geology.* 1994; 11(1):24-30; ISSN: 0264-8172.
A thermodynamic prediction model of sulphate scaling has been applied to a wide range of offshore field brines to investigate sulphate scale precipitation due to the mixing of seawater and the factors influencing the precipitation. The implication of the findings is discussed in relation to oilfield scaling problems.

Zhang, Heqing; Jiang, Yuejin; Li, Fujiao. **Distribution and major sources of the oil in the northern waters of the South China Sea.** *China Environmental Science.* 1994; 5(1):54-58; ISSN: 1003-1189.
The distribution characteristics and the main sources of oil in the northern waters of the South China Sea are analyzed and described.

Zhou, J. L.; et. al. **Seasonal distribution of dissolved pesticides and polynuclear aromatic hydrocarbons in the Humber Estuary and Humber coastal zone.** *Marine Pollution Bulletin.* September 1996; 32(8/9):599-608; ISSN: 0025-326X.
Researchers determined the distribution of atrazine, Irgarol 1051, lindane, malathion, fluoranthene, and pyrene dissolved in the water column of the Humber Estuary and adjacent coastal zone.

ENGINEERING/PHYSICS

Affouf, M. **Numerical study of a singular system of conservation laws arising in enhanced oil reservoirs.** *Applied Numerical Mathematics.* 1994; 151-11; ISSN: 0618-9274.
Presented is a numerical study of the structure of elementary nonlinear waves and their qualitative behavior for the degenerate hyperbolic system of equations describing the process of polymer flooding of an oil reservoir.

Al-Muzaini, S. **The use of air flotation for the treatment of industrial wastes discharged into coastal waters.** *Journal of Environmental Science and Health, Part A: Environmental Science and Engineering.* 1994; A29(7):1367-1382; ISSN: 0360-1226.
The authors discuss the use of a dissolved air flotation unit as a first step in removing oil in the marine environment.

Andreasen, Christian. **National Hydrographic Offices' contributions to increased safety and improved environment at sea.** *Marine Pollution Bulletin.* 1994; 29(6-12):401-405; ISSN: 0025-326X.
Electronic chart display and information systems (ECDIS) developed by the International Hydrographic Organization are discussed in relation to improving navigation, thus reducing the risk of environmental pollution resulting from marine accidents.

Baker, J. H. A. **The oil spill recovery unit (OSRU) concept.** *Underwater Technology.* 1995; 21(1):5-11.
Presented is a description of the Oil Spill Recovery Unit -- a tanker that captures and directs oil-contaminated water (via booms) into a large, centrifugally-enhanced separation tank where the contaminated water is then collected and pumped to the tanker's other tanks for secondary settlement (via gravitation). The cleansed water is then pumped back into the sea.

Bartha, J. M. **Major improvement of marine oil spill emergency system.** In. *MTS 94: Challenges and Opportunities in the Marine Environment, Conference Proceedings.* Washington DC: Marine Technology Society; 1994; pp. 735-739. ISBN: 0933957130.
Described are methods and technologies to dramatically improve the efficiency of rapid (140,000 gallons per day), economical and environmentally safe recovery of marine oil spills.

Bjerrum, Anders; Ishoy, Anders. **AUV for surveys in coastal waters.** *Sea Technology.* February 1995; 36(2):19-25.
A description of Martin, an unmanned free-swimming underwater vehicle scheduled for launch in 1995, and a discussion of Martin's planned applications, including pipeline inspections and environmental monitoring in shallow waters, are included.

Borzelli, G. **A new perspective on oil slick detection from space by NOAA satellites.** *International Journal of Remote Sensing.* 1996; 17(7):1279-1292.
Authors present an extension of the split window technique algorithm to account for small surface emission variations.

Brown, Anne; Hanley, Michelle, and Stanton, Nathaniel. **Surface oil skimmer.** Durham, NH: Sea Grant College Program, University of New Hampshire; [1993]; UNHMP-AR-SG-93-7. 51 p.
The surface oil skimmer can be deployed quickly from a variety of vessels to assist in the cleaning of an oil spill.

Cairns, Zoe. **Ship specific tagging of oil contaminated discharges.** *Marine Pollution Bulletin.* February 1997; 34(2):70. ISSN: 0025-326X.
As a result of illegal operational discharges of oil from tankers and other ships, the Marine Safety Agency has funded a study to examine the possibility of adding an identifiable tag in the oil, which would enable identification of ships responsible for illegal discharge.

CBT: a viable alternative to the double hull tanker? *Marine Log.* February 1997; 102(2):20. ISSN: 0897-0491.
A discussion on the "Central Ballast Tanker" (CBT) as an alternative to the double hull tanker. The CBT's promoters are now in the process of getting the tanker recognized as equivalent to the double hull tanker under OPA 90 and MARPOL requirements.

Cedar-Southworth, Donna. **Deep water...America's new frontier and a challenge for MMS.** *MMS Today.* February 1995; 5(1):12-13.
A discussion on the promises and pitfalls of deep water drilling.

ENGINEERING/PHYSICS

Cekirge, H. M.; Giamonna, C. P.; Berlin, J.; Long, C.; Koch, M.; Jamail, R. **Oil spill modeling using parallel computations.** *Spill Science and Technology Bulletin.* September 1994; 1(1):61-68; ISSN: 1353-2561.
In the context of the history of oil spill modeling, an ideal oil spill model (IOSM) based on parallel computing is proposed.

Chatre, S.; Purohit, H.; Shanker, R.; Khanna, P. **Bacterial consortia for crude oil spill remediation.** *Water Science and Technology.* 1996; 34(10):187-193. ISSN: 0273-1223.
A bacterial consortium was designed for degradation of Gulf and Bombay High crude oil due to ineffective physio-chemical methods, public concern, and the need for cost effective, environmentally acceptable mitigation technologies after a spill. Selected members of bacterial consortium led to the degradation of aromatic and aliphatic fractions in 72 hours. A consortium of four could degrade 70% of the crude oil; while another member effectively emulsified the crude oil for degradation by the other consortium members.

Choi, H. M. **Needlepunched cotton nonwovens and other natural fibers as oil cleanup sorbents.** *Journal of Environmental Science and Health Part A.* 1996; 31(6):1441-1457.
The use of biodegradable/natural fibers (cotton, milkweed, kapok, wool, and kenaf fibers) as oil cleanup sorbents was investigated. It was found that the oil sorption capabilities of the natural fibers (with the exception of kenaf) were much greater than that of polypropylene.

Cook Inlet receives 'near shore' oil spill control vessel. *Marine Log.* October 1994; 99(10):16; ISSN: 0897-0491.
A brief description of the first US Coast Guard documented Oil Spill Response Vessel Towboat, which was delivered by Workboats Northwest, Inc., to Cook Inlet Spill Prevention and Response, Inc.

Corapcioglu, M. Y.; Tuncay, K.; Lingam, R.; Kambham, K. K. R. **Analytical expressions to estimate the free product recovery in oil-contaminated aquifers.** *Water Resources Research.* December 1994; 30(12):3301-3311; ISSN: 0043-1397.
Analytical solutions to estimate the recovery of oil from an established oil lens are presented.

Dalmazzone, C.; Bocard, C.; Ballerini, D. **IFP methodology for developing water-in-crude oil emulsion inhibitors.** *Spill Science and Technology.* 1995; 2(2/3):143-150. ISSN: 1353-2561.
Presented is an experimental methodology developed by the Institut Francais du Petrole (IFP) to identify new efficient emulsion inhibitors.

DePaoli, D. W.; Wilson, J. H.; Thomas, C. O. **Conceptual design of soil venting systems.** *Journal of Environmental Engineering.* May 1996; 122(5):399-406; ISSN: 0733-9372.
Authors describe a simple, economically-based approach for the conceptual design of a soil venting system.

Dixon, Iain and others. **Photoacoustic monitoring of oil pollutants.** *Marine Pollution Bulletin.* June 1996; 32(6):454-455; ISSN: 0025-326X.
A new photoacoustic system designed by scientists at Heriot-Watt University (Edinburgh) may revolutionize the monitoring of production water discharge. It is reported that this system, which uses pulsed laser photoacoustic spectroscopy, will be capable of providing a continuous readout of hydrocarbon concentrations and is unaffected by flow rates. In addition, both dissolved and dispersed oil can be monitored simultaneously.

Early warning of pollution for Malaysia. *Marine Pollution Bulletin.* November 1996; 32(22):767; ISSN: 0025-326X.
Wave Scan, an early warning system to minimize damage from sludge dumping and oil spills, has been introduced by the Malaysian Department of the Environment to upgrade pollution control capability. Wave Scan gives an alert if oil or grease concentrations exceed set levels.

Elf first to use 'green' gas flare burner. *Oil & Gas Journal.* December 9, 1996; 94(50):30; ISSN: 0030-1388.
Expro North Sea Ltd. has developed a silent enclosed burner. The 4 m tall burner is reported to reduce noise, heat, and smoke emissions when gas and condensate are being burned off during well testing. Elf Petroland BV is likely to be the first user with a well in Europe's largest bird sanctuary.

Establishing a better fix on global positioning offshore. *Sea Technology.* September 1994; 35(9):80; ISSN: 0093-3651.
London-based Marine Technology Directorate Ltd. will be engaging in work to establish benchmark standards for differential global positioning systems (DGPS), improve confidence in DGPS, and seek to eliminate the need to utilize traditional radar systems.

ENGINEERING/PHYSICS

Fingas, Merv. **Water-in-oil emulsion formation: a review of physics and mathematical modeling.** *Spill Science and Technology Bulletin.* March 1995; 2(1):55-59; ISSN: 1353-2561.
The author presents a literature review of the physics and modeling of water-in-oil emulsification.

Flynn, Jan. **Oman-India pipeline sets survey challenges.** *Sea Technology.* February 1995; 36(2):16-18.
The Oman-India 1170-kilometer pipeline across the Arabian Sea will be at a depth four times greater than any previous pipeline. The author describes the results of a preliminary study of this undertaking.

Fuentes, H. R.; Jaffe, R.; Tsihrintzis, V. A.;Boye, D. J. **Experimental effects of weathering on the dispersion of a crude oil in saline water.** *Journal of Marine Environmental Engineering.* 1996; 3(1):15-30; ISSN: 1061-026X.
Researchers describe the effects of weathering on Arabian crude oil by simulating its dispersion in saline water under controlled conditions with simulated ocean turbulence. Results show an increase in viscosity and density with a decrease in interfacial surface tension between oil and water. Total and aromatic hydrocarbon concentrations under mixing conditions are a function of weathering time, depth, and duration time of mixing.

Galindez-Ruiz, N. G.; Craig, B. D. **Effect of crude oil on corrosion of alloys in severe sour environments.** *Materials Performance.* 1995; 34(4):50-53.

Gardner, Mark P. **Program helps quickly calculated deviated well path.** *Oil and Gas Journal.* November 22, 1993; 9179-80; ISSN: 0030-1388.
A Basic computer program that can rapidly calculate the angle and measured depth of a simple directional well is described.

Gerlach, Clare L. **New instrument brings PAH analysis to the field.** *Environmental Science & Technology.* 1996; 30(6):252A-254A; ISSN: 0013-936X.
The development of a new generation of compact gas chromatographs, field-portable X-ray fluorescence units and portable mass spectrometers is discussed.

Giammona, Charles P; Binkley, Kandace S.; Engelhardt, F. Rainer; Nichols, James D.; Buechel, Sally. **Aerial image processing technology for emergency response.** *Spill Science and Technology Bulletin.* March 1995; 2(1):47-54; ISSN: 1353-2561.
Using examples from experimental oil spills in the North Sea during August of 1993, the authors demonstrate how remote sensing imagery can affect and improve the decision-making process involved in oil-spill response.

Goodman, Ron. **Overview and future trends in oil spill remote sensing.** *Spill Science and Technology Bulletin.* September 1994; 1(1):11-21; ISSN: 1353-2561.
Airborne remote sensors and their method of operation are described in relation to potential improvement of oil spill response.

Green, D. A.; Naimimohasses, R.; Smith, P. R.; Thomason, H. ***In-situ* measurement and classification of oil pollution.** *Environment International.* 1995; 21(2):245-250; ISSN: 0160-4120.
The researchers use an *in situ* optical sensing technique to measure and classify suspensions of oil-in-water in the concentration range 0-100 μL/L. Correct classification is shown for concentrations of 10μL/L and above. The sensor system is based on a pipeline mounted nephelometer and artificial neural network processor.

Hayes, Miles O. **An exposure index for oiled shorelines.** *Spill Science & Technology Bulletin.* 1996; 3(3):139-147. ISSN: 1353-2561.
During the *Exxon Valdez* oil spill in Prince William Sound, Alaska, the absence of recorded wave data prompted the need for a method to measure the exposure index to cleansing of the oiled shoreline by wave action. A simplified technique using wind gauge data correlated with three effective fetch distances measured perpendicular to and at 45^0 to the shoreline agreed with both the biological and geomorphological criteria for exposure to wave action.

Heras, H.; Zhou, S.; Ackman, R. G. **Plastic bags for stable storage of the water-soluble fraction of crude petroleum used in aquatic environment toxicity tainting studies.** *Bulletin of Environmental Contamination and Toxicology.* 1995; 55(4):October 1995; ISSN: 0007-4861.
Compared were two different storage systems for the stability of contained WSF (water-soluble fraction of petroleum hydrocarbons).

Hsueh, W. J.; Lee, Y. J. **A hydraulic absorber for wideband vibration reduction in ship hulls.** *Journal of Offshore Mechanics and Arctic Engineering.* 1994; 116(1):43-46; ISSN: 0892-7219.
A vibration reduction of ship hulls by an active absorber system is proposed.

International Conference on Composite Materials in the Petroleum Industry, Rueil, Malmaison, France, 3-4 November, 1994: Special Issue. *Revue De Institut Francias Du Petrole.* 1995; 5(1): ISSN: 0020-2274.
An entire issue of this journal devoted to new composite materials used to improve efficiency and safety of oil structures and oil transport.

Jacobs, Merrill A.; Waldron, Darryle M. **Approaches to sheltered-water oil spills. Relatively low-cost, near-shore & onshore spill response using current new technology, older equipment & its practical applications to reduce environmental damage & spill costs.** *Sea Technology.* October 1996; 37(10):33, 35-38. ISSN: 0093-3651.
'Clean Seas' utilized simple, effective, relatively inexpensive systems in moving oil to a recovery device or a recovery device moved to encounter oil in an advancing mode, to meet the challenges of shallow-water recovery, quickly and efficiently.

Jacobson, J. R. **Offshore oil and gas trends in ROVs and tooling.** *Sea Technology.* April 1994; 35(4):27-32; ISSN: 0093-3651.
Overviewed are the recent improvements made to remotely operated vehicles (ROVs).

Kam, J. C. P.; Birkinshaw, M. **Reliability-based fatigue and fracture mechanics assessment methodology for offshore components.** *International Journal of Fatigue.* 1994; 16(3):183-192; ISSN: 0142-1123.
Summarized is the recent development of reliability-based fatigue initiation and fracture mechanics (crack growth) analyses for the in-service assessment of the integrity of offshore structural components. Related practical issues are also discussed.

Kaminski, L. **Pollution control boats cruise waterways.** *Water Environment and Technology.* 1994; 6(11):16-18; ISSN: 1044-9493.
Multi-purpose surface water clean-up vessels cleaning the ports of SE France have been reported to help rejuvenate fish populations. These vessels use oil separation, floating hydrocarbon recovery, and chemical dispersion processes. Using hydraulic suction, pollutants can be recovered through the boat's submerged opening bow.

Karyakin, A. V.; Galkin, A. V. **Fluorescence of water-soluble components of oils and petroleum products forming the oil pollution of waters.** *Journal of Analytical Chemistry.* November 1995; 50(11):1078-1080; ISSN: 1061-9348.
Researchers examined the changes in the optical properties of water-soluble components of petroleum products under photooxidation conditions.

Krapivin, V. F.; Lan, H. B. **Mathematical model for the dynamics of radionuclides, heavy metals, and petroleum hydrocarbons in the Arctic basin.** *Physical Oceanography.* 1995; 6(6):435-451.
The researchers discuss a mathematical model for the dynamics of pollution in the Arctic basin. The model features blocks simulating contaminant fluxes through the trophic chains. Provided are results of numerical experiments showing the model's capability to predict and assess the dynamics of heavy metals, hydrocarbons, and radionuclides in the Arctic basin.

Krishnan, R.; Parker, H. W.; Tock, R. W. **Electrode assisted soil washing.** *Journal of Hazardous Materials.* 1996; 48(1-3):111-119; ISSN: 0304-3894.
A newly patented Electrode Assisted Soil Washing (EASW) process is reported to be effective in removing petroleum contaminants (including gas, diesel, crude oil, etc.), chlorinated hydrocarbons, and heavy metals from contaminated soils consisting of high percentages of clay and silt.

Lacrampecouloume, G.; Walgenwitz, F.; Poirier, Y. **Evolution of the isotopic composition of strontium within residual salts: A tool for the knowledge of connections in oil tanks.** *Analusis.* April 1997; 25(3):72-75. ISSN: 0365-4877.

Leach, W. G. **Maximum hydrocarbon window determination in south Louisiana.** *Oil and Gas Journal.* March 29, 1993; 9181-84; ISSN: 0030-1388.
A detailed look at the distribution of hydrocarbons in the Tertiary sands of south Louisiana is offered and the maximum hydrocarbon window (MHW) technique is described.

Li, Xijun. **The usefulness of satellite remote sensing on monitoring oil spill at Laotieshan Channel.** *Zhongguo Hanghai.* 1994; 128-32; ISSN: 1000-4653.
The author discusses the use of satellite remote sensing technology, including Landsat.

ENGINEERING/PHYSICS

Liou, Jim C. **Leak detection by mass balance effective for Norman Wells line.** *Oil and Gas Journal.* April 22, 1996; 94(17):69-74; ISSN: 0030-1388.
The author compares the use of mass-balance calculations and a leading software system (NovaCorp's Leakstop) for leak detection on a major Canadian crude-oil pipeline. Results from the comparison indicated that the mass-balance calculations were equally as effective as the software system.

Logan, K. P. **Neural network-based autopilot for tanker conning.** *Sea Technology.* 1995; 36(4):51-53; ISSN: 0093-3651.
The control and maneuvering difficulties in the large oil tankers of today, especially in restricted waterways where ships must pass in close proximity, is quite well known. By utilizing neural network learning techniques and their application to automated tanker control, the author envisions an intelligent autopilot that will learn ship maneuvering dynamics through experience.

Mardell, Garry; Flynn, Jan. **Deep water challenges: oil industry moves off continental shelf; meets new oceanographic data-gathering challenges.** *Sea Technology.* August 1995; 36(8):15-19; ISSN: 0093-3651.
The authors examine the oil-industry's expansion to beyond the continental shelf to deeper water by reviewing some of the work carried out over the past year with data-gathering deep water moorings.

Martinez, Antonio; Moreno, Victoriano. **An oil spill monitoring system based on SAR images.** *Spill Science & Technology Bulletin.* 1996; 3(1/2):65-71. ISSN: 1353-2561.
The issue of oil pollution in the Mediterranean Sea caused by natural or human causes is of great importance to both the environment and economy, and it is a subject of increasing public concern. In this paper a project for the development and implementation of a low cost demonstrator system for the detection of marine oil spills is presented. At present, the SAR satellite images are the only reliable remote sensing data applicable for the purpose of monitoring the Mediterranean basin.

Maure, A.; Cerrolaza, M.; Berrios, R. **Modeling the behavior of crude oil spills in shallow bodies of water.** *Environmental Software.* 1995; 10(4):241-249.
Authors discuss the use and importance of an accurate numerical model of water contamination using the finite element method and the finite difference method in an effort to predict the ecological impacts of oil contamination and evaluate the remediation actions.

McQueen, J. T.; Draxler, R. R. **Evaluation of model back trajectories of the Kuwait oil fires smoke plume using digital satellite data.** *Atmospheric Environment.* July 1994; 28(13):2159-2174; ISSN: 1352-2310.
A study evaluating the accuracy of the National Weather Service Medium Range Forecast (MRF) global model outputs in simulating the Kuwait oil fire smoke plume's transport and dispersion is reported. Researchers concluded the use of the standard course grid MRF wind fields to drive the transport model leads to large errors near the source due to poor horizontal and vertical resolution.

Michel, D. **Shell Oil's Auger TLP/ROV: challenging, innovative.** *Sea Technology.* April 1994; 35(4):17-20; ISSN: 0093-3651.
Shell Oil, with the aid of nearly 800 other companies, has constructed in the Gulf of Mexico the Auger TLP which is an oil and gas production platform which is held in place by vertical tendons that eliminate significant vertical movement while allowing limited horizontal movement.

Murthy, T. K. S. and Brebbia, C. A., Eds. **Marine Engineering: Design and Operation of Ships and Offshore Structures**: Wessex Institute of Technology; [1994]; 260 p.
Computer aided design (CAD), safety at sea, Arctic transportation, advanced marine vehicles and environmental problems are discussed in the context of marine engineering.

Myers, Don. **Invert muds help reduce sloughing shale problems.** *Oil and Gas Journal.* June 28, 1993; 9153-54+; ISSN: 0030-1388.
It is reported that Canadian Hunter Exploration has found that invert muds can help prevent sloughing shale problems and decrease the time it takes to reach total well depth.

Myers, P. E.; Mulvaney, G. M.; Ntela, N. **Analysis of tank failure reveals oversight in inspection procedures.** *Oil & Gas Journal.* February 17, 1997; 95(7):47-51. ISSN: 0030-1388.
As a result of microbial-induced corrosion, 10,000-bbl of oil spilled from a crude oil storage tank in Africa. The fact that this spill occurred despite an internal inspection performed 8 months prior to the incident reveals a weakness in the tank-inspection program.

ENGINEERING/PHYSICS

Natesan, U. **Satellite assistance in oil pollution studies.** *Pollution Research.* 1994; 13(1):91-93; ISSN: 0257-8050.
A brief discussion describing the necessity of improved instrumentation and methods for obtaining timely information for the purposes of monitoring oil pollution and its impact.

National Research Council. **Drilling and Excavation Technologies for the Future**: National Academy Press; 1994;161 p. ISBN: 0309050766.
Examined is the feasibility of advances in drilling and related technologies with attention paid to application.

National Research Council. **Improving the Safety of Marine Pipelines**: National Academy Press; 1994;141 p. ISBN: 0309050472.
The causes of pipeline failures are reviewed and analyzed and the operation of pipeline safety systems and devices is assessed.

New tank design cuts pollution risk. *Marine Pollution Bulletin.* February 1996; 32(2):183; ISSN: 0025-326X.
According to a recent report in Lloyds List, a new low-cost technique to protect fuel spaces in the event of an accidental impact has been developed by BP Shipping. The technique involves simply dividing the existing tanks into two by installing a longitudinal oil-tight bulkhead in each tank.

New uses for old rigs. *Marine Log.* July 1995; 100(7):14-16; ISSN: 0897-0491.
Presented is a description of the conversion of rigs: one semi-submersible converted to a floating production facility, and two jack-ups converted to a power generating platform for a West African community. Also described is a new floating dry dock in the Amfels yard in Brownsville, Texas, which will soon be converting semi-submersibles, jack-ups, floating production facilities, and tension leg platforms.

Nicol, J. P.; Wise, W. R.; Molz, F. J.; Benefield, L. D. **Modeling biodegradation of residual petroleum in a saturated porous column.** *Water Resources Research.* December 1994; 30(12):3313-3325; ISSN: 0043-1397.
Developed is a framework for numerically modeling the biodegradation of petroleum hydrocarbons within a flooded column of porous media in which a residual saturation of petroleum is present.

Nielsen, P. H.; Christensen, T. H.; Albrechtsen, H. J.; Gillham, R. W. **Performance of the *in situ* microcosm technique for measuring the degradation of organic chemicals in aquifers.** *Ground Water Monitoring and Remediation.* Winter 1996; 16(1):130-140; ISSN: 0277-1926.
Researchers discuss the installation and use of an *in situ* microcosm (ISM) and discuss their experiences concerning data interpretation and the monitoring of redox conditions. An ISM is a stainless steel cylinder, equipped with valves for loading and sampling, designed to isolate approximately 2 L of the aquifer.

Nordvik, A.; Simmons, J, and Hudon, T. **MSRC oil spill response vessel oil water separator system tests.** In. *Proceedings: Seventeenth Arctic and Marine Oil Spill Program Technical Seminar.* Ottawa: Environment Canada; 1994; 1 pp. 593-605.
The authors provide a discussion of the Marine Spill Response Corporation's sixteen oil-spill response vessels (OSRVs), which have the ability to recover and store 4000 bbl of recovered oil-water-debris mixture, and an outline and summaries of the tests performed aboard the OSRV Virginia Responder.

Nordvik, Atle B.; Simmons, James L.; Bitting, Kenneth R.; Lewis, Alun; Strom-Kristiansen Tove. **Oil and water separation in marine oil spill clean-up operations.** *Spill Science & Technology Bulletin.* 1996; 3(3):107-122. ISSN: 1353-2561.
Over time the properties of spilled oil undergo changes which effect differential density separation. As oil weathers, the oil density increases as lighter components evaporate and as the oil incorporates water to form an emulsion. These changes reduce the effectiveness of oil-water separators. Emulsion breakers are presented as a method of accelerating and improving differential density in an oil spill recovery system. The effectiveness of their use is dependant of the efficiency of the product, the oil properties, and timely application after a spill.

On-line hydrocarbon monitor. *Marine Pollution Bulletin.* October 1995; 30(10):677; ISSN: 0025-326X.
A brief report on the TD-4100, a new on-line hydrocarbon monitor from Turner Designs (Sunnyvale, California). The TD-4100 is designed to detect aromatic hydrocarbons of 1 ppb for gas or diesel in clean water and features a non-fouling falling-stream flow cell.

ENGINEERING/PHYSICS

OTC 95: multiple focus for industry on the move. *Sea Technology*. April 1995; 36(4):54-55.
A preview of the 27th Offshore Technology Conference held May 1-4 1995, at the Houston Astrodome. Organizers expect over 30,000 participants from 80 countries, and services from 1300+ exhibiting companies.

Pagano, Susanne S. **Optimism is watchword in deep water U.S. Gulf.** *Sea Technology*. April 1995; 36(4):10-11.
Discussed are the developments and technology relating to the encouraging news that deep water areas of the Gulf of Mexico may have the potential to rival the largest oil field in United States, Alaska's Prudhoe Bay field.

Pappworth, S. S. R. **Certain facility, equipment designs lessen environmental costs.** *Oil and Gas Journal*. 26 February 1996; 94(9):47-53; ISSN: 0030-1388.
The author reports that oil and gas companies may reduce environmental compliance costs by understanding the detailed knowledge of environmental rules and regulations and applying these rules by changing their facility and equipment designs.

Patterson, John C.; Bucaram, S. M.; Curfew, J. V. **Experience reveals ways to minimize failures in rod-pumped wells.** *Oil and Gas Journal*. July 5, 1993; 9129-32; ISSN: 0030-1388.
It is reported that ARCO Oil and Gas has developed recommendations for reducing equipment failure in sucker-rod pumping installations. The recommendations cover selection and design, operating procedures and chemical treatment.

Pavlakis, Petros; Sieber, Alois; Alexandry, Stamatina. **On the optimization of spaceborne SAR capacity in oil spill detection and the related hydrodynamic phenomena.** *Spill Science & Technology Bulletin*. 1996; 3(1/2):33-40. ISSN: 1353-2561.
The result of this paper is a theoretical investigation on hydrodynamic mechanism which influences the performance of spaceborne SAR imagery for detecting oil spills. The ideal oil spill detection performance may be achieved by selecting microwave bands and incidence angles that sense Bragg waves falling within such spectral regions. Non-linear phenomena related to energy transfer among the gravity-capillary waves create sensitive narrow spectral regions that react more severely to the presence of a spill.

Pelyushenko, S. A. **Microwave radiometer system for the detection of oil slicks.** *Spill Science and Technology*. 1995; 2(4):249-254. ISSN: 1353-2561.
Radiometric sensors often incur difficulty detecting oil from other objects; however, microwave radiometry may offer the ability to detect an oil spill and determine the thickness and volume of the oil. To this end, presented is a procedure to convert antenna temperatures to brightness temperatures and then to oil thickness.

Polymer disks demonstrated as a means to clean up oil spills. *Oil and Gas Journal*. November 6, 1995; 93(45):22; ISSN: 0030-1388.
Ab-Tech Industries (Tucson) has announced and demonstrated OARS (Oil Aquatic Recovery System), which can economically absorb and contain oil spills on water. OARS consists of polymer disks contained in polypropylene nets. The polymer disks utilize molecular physics and chemical reactions to ensnare and absorb oil and other petroleum products.

Quinn, M. F.; Alotaibi, A. S.; Sethi, P. S.; Albahrani, F.; Alameddine, O. **Measurement and analysis procedures for remote identification of oil spills using a laser fluorosensor.** *International Journal of Remote Sensing*. September 10, 1994; 15(13):2637-2658; ISSN: 0143-1161.
Discussion of a laser fluorescing procedure that has been developed for remotely detecting and identifying crude oils and oil based products from an airborne platform.

Reed, Mark; Aamo, Ole Morten. **Real time oil spill forecasting during an experimental oil spill in the Arctic ice.** *Spill Science and Technology Bulletin*. September 1994; 1(1):69-77; ISSN: 1353-2561.
An oil spill trajectory and weathering model, OILMAP, was used to forecast spill trajectories for an experimental oil spill in the Barents Sea marginal ice zone.

Rhoads, D. C. **Measuring hydrocarbon contaminants on the seafloor: *in-situ* hyperspectral UV-imaging spectrometer for rapid mapping of hydrocarbon 'hot spots' in bottom sediments.** *Sea Technology*. August 1995; 36(8):37-42; ISSN: 0093-3651.
A discussion of the REMOTS (remote ecological monitoring of the seafloor) sensor system, which is based on Science Applications International Corp.'s existing REMOTS sediment profile camera.

Rhoads, D. C.; Muramoto, J. A.; Coyle, C.; Ward, R. H.; Anderson, R.; Mooradian, G.; Sunshine, J. **Hyperspectral UV imaging spectrometer for *in-situ* measurement of organic contamination in bottom sediments.** In. *MTS 94: Challenges and Opportunities in the Marine Environment, Conference Proceedings.* Washington DC: Marine Technology Society; 1994; pp. 378-384. ISBN: 0933957130.
A discussion of a hyperspectral UV imaging field sensor for rapid sediment quality screening of contaminant 'hot spots' of polyaromatic hydrocarbons (PAHs), fuels, and oils being developed by SAIC.

Rowe, D. M. **Possible offshore application of thermoelectric conversion.** *Marine Technology Society Journal.* Fall 1993; 2743-48; ISSN: 0025-3324.
Oil platforms in the North Sea provide access to geothermal reservoirs which might be tapped for electricity generation with the proper technology.

Safety of navigation at sea. *Marine Pollution Bulletin.* November 1996; 32(22):765; ISSN: 0025-326X.
The use of the Global Positioning System (GPS) as a primary source of navigational information is causing concern. Any inaccuracies in the GPS would leave ships very vulnerable; therefore, a cross-checking system has been recommended by three lighthouse authorities.

Salancy, A. M. and others. **Offshore single point mooring systems for import of hazardous liquid cargoes.** LaJolla, CA: California Sea Grant; 1994; CUIMR-T-94-002. 179 p.
Two single point mooring systems (SPMS) configurations were examined: catenary anchor leg mooring and single anchor leg mooring. Results indicated that SPMS for offshore southern California are feasible.

Sayed, M.; Kotlyar, L. S.; Sparks, B. D. **Spreading of crude petroleum in brash ice: effects of oil's physical properties and water current.** *International Journal of Offshore Polar Engineering.* 1995; 5(2):127-133; ISSN: 1053-5381.
Researchers utilized a refrigerated, circulation current flume to investigate crude oil (Amauligak, Hibernia, Norman Wells) spreading in brash ice. Also investigated were the physical properties of the oils including surface and interfacial tensions and viscosities.

Schmidt, Victor A. **2-D seismic vessels for 3-D missions: old 2-D vessels can be used in new, more productive ways, serving vessel owners, oil companies.** *Sea Technology.* September 1994; 35(9):15-22; ISSN: 0093-3651.
Schmidt reports on the status of the geophysical exploration industry and examines the 2-D versus 3-D vessel problem.

Schnorr, DeWayne R. **Logs determine water flow behind pipe in Alaska.** *Oil and Gas Journal.* November 8, 1993; 9177-81; ISSN: 0030-1388.
The technique for determining water flow in both injection and producing wells is described, yielding data that provide insight into ways to modify injection profiles so that oil recovery can be improved across a field.

Sebastiao, P.; Guedes Soares, C. **Modeling the fate of oil spills at sea.** *Spill Science and Technology.* 1995; 2(2/3):121-131. ISSN: 1353-2561.
Presented is a numerical model for the simulation of the physicochemical weathering processes of an oil spill at sea. Included in the model are processes such as spreading, evaporation, dispersion into the water column, emulsification and the change in viscosity and density.

Shimamoto, Y. and Sugimura, H. **The development of marine waste oil treatment unit.** Chung, J. S.; Natvig, B. J., and Das, B. M., Eds. *The Proceedings of the Fourth, 1994, International Offshore and Polar Engineering Conference (ISOPE 1994)*; 1994 Apr 10-1994 Apr 15; Osaka, Japan. Golden, CO: International Society of Offshore and Polar Engineering; 1994: 233-239. ISBN: 1880653109.
A new water and sludge separating unit which is designed to operate on board ocean-going ships to prevent oil pollution at sea is described.

Sobey, R. J.; Barker, C. H. **Wave-driven transport of surface oil.** *Journal of Coastal Research.* Spring 1997; 13(2):490-496. ISSN: 0749-0208.
The transportation of surface oil spill by surface gravity waves is investigated in coastal waters. Illustrations of spill response scenarios in near shore wave environments are demonstrated with the use of coupled Eulerian transport and spectral wave models.

Sorenson, Mark. **ARC/INFO marine spill GIS.** *Spill Science and Technology Bulletin.* March 1995; 2(1):81-85; ISSN: 1353-2561.
The author discusses the use of GIS technology in the field of marine contingency planning.

ENGINEERING/PHYSICS

Soundings: Coast Guard issues tanker escort rules. *Sea Technology.* September 1994; 35(9):9; ISSN: 0093-3651.
It is reported that a rule has been issued requiring that all laden, single-hulled oil tankers must be accompanied by two escort vessels in Prince William Sound, Alaska and Puget Sound, Washington.

Spaulding, M. L.; Kolluru, V. S.; Anderson, E.; Howlett, E. **Application of three-dimensional oil spill model (WOSM/OILMAP) to hindcast the *Braer spill.*** *Spill Science and Technology Bulletin.* September 1994; 1(1):23-35; ISSN: 1353-2561.
WOSM/OILMAP, a three-dimensional oil spill model, was applied to hindcast the transport and fate of the January 1993 *Braer* oil spill which occurred off the southern coast of Shetland Island. The model included advection, spreading, evaporation, emulsification, entainment, oil-shoreline interaction and subsurface transport.

Spaulding, Malcolm L.; Opishinski, Thomas; Haynes, Sean. **COASTMAP: An integrated monitoring and modeling system to support oil spill response.** *Spill Science & Technology Bulletin.* 1996; 3(3):149-169. ISSN: 1353-2561.
Providing real-time data during an oil spill response modeling is one of the most difficult tasks during the spill event. COASTMAP, a software application, designed for monitoring accurate estimates of currents, winds and oil spill trajectory and for predicting fate of estuarine and coastal seas during an oil spill event is presented in this paper.

Spears, Mike. **Seafloor-oiled-site cleanup system.** *Sea Technology.* August 1995; 36(8):66-67; ISSN: 0093-3651.
A description of the Sweep Assembly System, developed by American Oilfield Divers Inc., which has been designed to decrease offshore operators' overall cost of their well-site clearance programs.

Stahl, M. J. **Computer analysis improves deepwater drillstring design.** *Oil and Gas Journal.* 1994; 92(14):43-48; ISSN: 0030-1388.
A critical drillstring load calculation method developed as part of the Texas A & M Ocean Drilling Program (ODP) is explained.

Strom-Kristiansen, T.; Lewis, A.; Daling, P. S.; Nordvik, A. B. **Heat and chemical treatment of mechanically recovered w/o emulsions.** *Spill Science and Technology.* 1995; 2(2/3):133-141. ISSN: 1353-2561.
After a crude oil or heavy oil spill, the breaking of water-in-oil emulsions (w/o) and discarding of the separated water allow for more oil to be recovered by Oil Spill Recovery Vessels. Researchers determined whether a combination of heat treatment and chemical treatment (emulsion breaker) is more effective than either treatment alone. Results indicate that the stability of w/o emulsion and the effects of heat are highly dependent on the varying characteristics of the oil from which it is formed. Stable w/o emulsions can be broken by heat alone, but were broken more rapidly with the addition of an emulsion breaker to the heat. W/o emulsions created by paraffinic oil showed increased breaking rates than those formed from crude oils with high asphalene content. All w/o emulsions formed from crude oil could be broken by moderate amounts of heat.

Sutton, D. and Richter K. **Computer model simulations of fuel spills near Ballast Point, San Diego Bay.** In. *Oceans '95: Challenges of Our Changing Global Environment.* Washington D.C.: Marine Technology Society; 1995; v.3 pp. 1714-1721. ISBN: 0-933957-14-9.
Presented is a fuel spill computer model predicting and simulating transport of a surface slick and a dissolved fraction occupying the upper 2 meters of the water column in an estuarine environment (San Diego Bay).

Sved, D. W.; Roberts, M. H. **A novel use for the continuous-flow serial diluter: aquatic toxicity testing of contaminated sediments in suspension.** *Water Research.* 1995; 29(4):1169-1177; ISSN: 0043-1354.
Researchers exposed fish (*Leiostomus xanthurus*) to suspended sediments in a flow-through system. A continuous-flow serial diluter was used to produce five concentrations of creosote. Sediment without creosote was used to maintain constant sediment concentration throughout the process and as a control. Results using this method compare favorably to tests using other fish and methods; however, other methods have not demonstrated the ease or consistency in the application of a range of concentrations as the system described.

ENGINEERING/PHYSICS

Tansel, B.; Regula, J.; Shalewitz, R. **Treatment of fuel oil and crude oil contaminated waters by ultrafiltration membranes.** *Desalination.* 1995; 102(1):301-311; ISSN: 0011-9164.
An evaluation of the effectiveness of ultrafiltration technology for the treatment of fuel/crude oil contaminated waters.

Texas facility treats, recycles refinery, petrochemical wastes. *Oil & Gas Journal.* September 16, 1996; 94(38):49-50; ISSN: 0030-1388.
A brief description of Duratherm Inc.'s recycling center, which treats refinery and petrochemical plant wastes to universal treatment standards.

Theophilopoulos, Nick A.; Efstathiadis, Stelios G.; Petropoulos, Yannis. **ENVISYS Environmental Monitoring Warning and Emergency Management System.** *Spill Science & Technology Bulletin.* 1996; 3(1/2):19-24. ISSN: 1353-2561.
The ENVISYS, an international cooperation project for the Mediterranean Sea, is a framework of the telematics for the environment program. Primary goals are to design a complete system for early oil spill detection, provide decision support to responsible authorities during cleanup operations; and utilize a 24 h SAR satellite coverage to inform public agencies.

Thompson, Keith F.; Holt, John; Kennedy, Greg. **Eh mapping locates petroleum seepage. Electrical potential of superficial seafloor sediments reveals location, extent of natural seepages of oil, gas.** *Sea Technology.* July 1997; 38(7):47-53. ISSN: 0093-3651.
Reports of petroleum seepage initiated the collection of over 10,000 sediment samples and the examination of Gulf of Mexico seafloor core data that led to the development of *in situ* measurements of electrical potential in sediments processes. Several autonomous instrument packages were designed and tested against laboratory standards, obtaining Eh measurements in superficial sediments in water depths up to 600 meters; with attainable depths of 3,000 meters, rapidly rendering accurate emplacement locations and stable responses.

Thorpe, S. A. **Vertical dispersion of oil droplets in strong winds; the *Braer* oil spill.** *Marine Pollution Bulletin.* November 1995; 30(11):756-758; ISSN: 0025-326X.
The author reports that oil droplets are most likely carried down from the sea surface much more rapidly than predicted in earlier models.

True, Warren. **Composite wrap approved for U.S. gas-pipeline repairs.** *Oil and Gas Journal.* October 9, 1995; 93(41):67-71; ISSN: 0030-1388.
The use of a new pipeline wrap to repair damaged pipe, consisting of polyester resin reinforced by glass filament, has been tentatively approved by the Research & Special Programs Administration of the Department of Transportation.

UK identification transponders initiative. *Marine Pollution Bulletin.* January 1997; 34(1):4. ISSN: 0025-326X.
A brief report on the UK government's encouragement to all ships carrying dangerous/destructive cargo around the coast of northern Scotland to fit automatic ship transponders. Transponder devices allow immediate and automatic ship identification from the shore, thus eliminating anonymity of ships.

US Coast Guard ease demands on single-hull oil tankers. *Marine Pollution Bulletin.* May 1997; 34(5):286-287. ISSN: 0025-326X.
The US Coast Guard imposed no further constraints other than the OPA's requirements since neither economical nor technical structural modifications could be identified. All new oil tankers and ships undergoing conversion must be fitted with double hulls. There is a 25-year phase-out of single-hull vessels, and interim, operational measures for existing, single-hull vessels.

US Department of the Interior, Mineral Management Service Gulf of Mexico OCS Region. **Shallow gas flows while cementing surface casing.** *Safety Alert.* April 3, 1995; (165).
A documented account of an accident occurring while personnel waited for annular cement to develop sufficient compressive strength and the steps to avoid such an incident are included.

Vandycke, S. **New developments in environmental dredging: from scoop to sweep dredge.** *Terra Et Aqua.* 1996; 65:19-25.
A discussion is rendered on the development of the scoop dredge, results of dredging operations, various test and monitoring programs, and the development and evaluation of the sweep dredge for dredging and removal of contaminated fine-grained sediments in an economic and ecologically acceptable way.

ENGINEERING/PHYSICS

Veil, John A.; Burke, Christopher J.; Moses, David O. **Synthetic-based muds can improve drilling efficiency without polluting.** *Oil and Gas Journal.* 4 March 1996; 94 (10):49-54; ISSN: 0030-1388.
The authors review and discuss attributes associated with the use of synthetic-based muds such as less waste, diminished pollution hazard, reduced area of environmental impact, shortening of drilling time, and improved drilling performance.

Verrett, A. J. **Texaco's DeepStar: deepwater staged recovery.** *Sea Technology.* April 1994; 35(4):10-14; ISSN: 0093-3651.
Deepwater reserves, those of a water depth between 3,000 and 6,000 feet, in the Gulf of Mexico are currently largely inaccessible. DeepStar, a component of Texaco, is developing a production strategy ('staged development') and equipment to access the reserves.

Wagner, Mary Jo. **Pumping out pipelines with space technology.** *Sea Technology.* April 1995; 36(4):13-17.
A description how remote bathymetry from European Space Agency's ERS-1 offers shorter, cheaper planning surveys for offshore pipelines.

Walton, W. D.; McElroy, J.; Twilley, W. H.; Hiltabrand, R. R. **Smoke measurements using a helicopter transported sampling package.** In. *Proceedings: Seventeenth Arctic and Marine Oil Spill Program Technical Seminar.* Ottawa: Environment Canada; 1994; 1 pp. 735-764.
Discussed is a first generation smoke sampling package designed to be deployed on a helicopter winch cable. The package contains three radio-controlled sampling pumps and instruments for measuring and recording temperature, relative humidity, barometric pressure, wind speed, and package orientation.

Whitcombe, D. N.; Murray, E. H.; Staubin, L. A.; Carroll, R. J. **The application of 3-D depth migration to the development of an Alaskan offshore oil field.** *Geophysics.* October 1994; 59(10):1551-1560; ISSN: 0016-8033.
3-D velocity models were developed to correct the positions of mapped features, thus enabling several wells to be successfully placed close to major faults. The seismic data were 3-D poststack depth migrated with the final velocity model, producing a repositioned image that was consistent with ray-trace predictions.

Whittaker, M.; Pollard, S. J. T. **A performance assessment of source correlation and weathering indices for petroleum hydrocarbons in the environment.** *Environmental Toxicology and Chemistry.* June 1997; 16(6):1149-1158. ISSN: 0730-7268.
The source of petroleum contaminants and the extent of contaminant weathering after deposition, were determined by an empirical evaluation of oil n-alkanes, isoprenoids, hopane and sterane biomarkers. Calculations for source correlation and weathering indices were made. The relationship between heavy composition and index value was investigated. Hopanes decreased as polar and asphaltene compounds increased. These results help in assessing degradation status of petroleum wastes.

Wong, Kau-Fui Vincent; Guerrero, Diego. **Quantitative analysis of shore-line protection by boom arrangements.** *Spill Science and Technology Bulletin.* March 1995; 2(1):61-66; ISSN: 1353-2561.
The authors quantitatively analyzed boom arrangement to increase effectiveness in shoreline protection. It was reported that the angle between the shoreline and the parallel booms was effective in the 45° and 75° range for all velocities. The arrangement most effective was a set of three parallel booms placed at an angle of 60° to the shoreline with cylinders placed along the center-line.

ENVIRONMENT/ECOSYSTEM MANAGEMENT/SPILLS

Abdullah, A. R.; Woon, W. C.; Bakar, R. A. **Distribution of oil and grease and petroleum hydrocarbons in the Straits of Johor, Peninsular Malaysia.** *Bulletin of Environmental Contamination and Toxicology*. July 1996; 57(1):155-162; ISSN: 0007-4861.
Determined was the amount of petroleum hydrocarbon pollution, as well as oil and grease in the water and sediments of the Straits of Johor and

Adams, Steve. **Commercial fisherman enlisted in oil spill research.** *Seafare*. Spring 1995; [5].
A brief discussion concerning the utilization of commercial fishermen and their equipment during an oil spill cleanup.

Al-Awadhi, N.; Al-Daher, R.; El Nawawy, A.; Balba, M. T. **Bioremediation of oil-contaminated soil in Kuwait. Landfarming to remediate oil-**

ENVIRONMENT/ECOSYSTEM MANAGEMENT/SPILLS

Alvarez, Pedro J. J. **Caution against the inappropriate use of analytical fate and transport models to estimate the age and risk of petroleum product releases.** *Ground Water Monitoring and Remediation.* Spring 1996; 16(2):72-76; ISSN: 1069-3629.
With the intent to caution against the inappropriate use of analytical fate and transport models, the author utilizes a case study to illustrate the common faults and misjudgments associated with modeling petroleum product releases (benzene) to ground water.

Ambrose, Phillippa; Jones, Peter. **Offshore rig disposal back in the news.** *Marine Pollution Bulletin.* April 1996; 32(4):322; ISSN: 0025-326X.
A brief news item concerning the controversy surrounding the new plans to dump large platform jackets from offshore oil structures into the North Sea. Both Esso (Norway) and Unocal (UK) have submitted plans to dump jackets into areas of over 100 m in depth. Both plans are currently being reviewed by local authorities and opposed by Greenpeace.

Aquashuttle monitors *Exxon Valdez* oil spill pollution consequences. *Sea Technology.* October 1994; 35(10):63; ISSN: 0093-3651.
Investigators from the Prince William Sound Science Center (PWSSC), Alaska, are conducting research on the effects of oil spills on salmon and Pacific herring populations as part of the Sound Ecosystem Assessment (SEA) program.

Aurand, D. **The application of ecological risk assessment principles to dispersent use planning.** *Spill Science and Technology.* 1995; 2(4):241-247. ISSN: 1353-2561.
The author presents a method for applying ecological risk assessment protocols to the planning of oil spill responses.

Baruah, D.; Sarma, S. K. **Botanical composition and application of Raunkiaer's law of frequency in the oil spilled areas of Rudrasagar and Lakwa oil fields of Sibsagar district of Assam.** *Journal of Environmental Biology.* October 1996; 17(4):299-304; ISSN: 0254-8704.

Battle to protect Egyptian Marine Park. *Marine Pollution Bulletin.* September 1996; 32(8/9):584-585; ISSN: 0025-326X.
A brief news story concerning the grounding of the bulk carrier *Million Hope* in the Red Sea on June 20, 1996.

Bence, A. E.; Kvenvolden, K. A.; Kennicutt, M. C. **Organic geochemistry applied to environmental assessments of Prince William Sound, Alaska, after the *Exxon Valdez* oil spill** - a review. *Organic Geochemistry.* January 1996; 24(1):7-42; ISSN: 0146-6380.
The authors provide a review of the applications of organic geochemistry to resolve three issues: (a) how it was used to identify a pre-spill background of seep, pyrogenic, and biogenic hydrocarbons in benthic sediments; (b) how tars and oils from sources unrelated to the spill were identified; and (c) how the *Exxon Valdez* residues were identified from refined products, as well as from non-hydrocarbons, in analyses of biological samples. In addition, two applications are provided: the quantification of the rates of degradation and removal of spill oil residues from the shorelines, and the quantification of the contributions of multiple hydrocarbon components to the benthic sediments, including an assessment of the input of the spilled oil.

Benka-Coker, M. O.; Ekundayo, J. A. **Effects of an oil spill on soil physico-chemical properties of a spill site in the Niger Delta area of Nigeria.** *Environmental Monitoring and Assessment.* June 1995; 36(2):93-104; ISSN: 0167-6369.
Researchers analyzed soil samples at an oil spill site in the Niger Delta area of Nigeria. Researchers reported top soil from the heavy impact zone contained a hydrocarbon range from 0.8 to 12.4 ppm and the oil penetration depth at 7.2 m, and the medium-impact zone concentrations ranged from 0.02 to 0.40 ppm, while hydrocarbons were not detected in 75% of the soil from the non-impacted reference zone. In addition, measurements of heavy metals at the study site revealed significant concentrations ($p < 0.05$) of lead, iron, zinc in the heavy impact zone.

Bernard, D.; Jeremie, J. J.; Pascaline, H. **First assessment of hydrocarbon pollution in a mangrove estuary.** *Marine Pollution Bulletin.* February 1995; 30(2):146-150; ISSN: 0025-326X.
Investigators examined non-aromatic hydrocarbon partitioned between the dissolved and particulate phases from the 'Grande Rivere a Goyaves' (river) and 'Grand Cul-de-Sac Marin' (lagoon) to assess petroleum contamination in a mangrove ecosystem.

ENVIRONMENT/ECOSYSTEM MANAGEMENT/SPILLS

Bernard, D.; Pascaline, H.; Jeremie, J. J. **Distribution and origin of hydrocarbons in sediments from lagoons with fringing mangrove communities.** *Marine Pollution Bulletin.* October 1996; 32(10):734-739; ISSN: 0025-326X.
Researchers investigated the distribution of non-aromatic and polycyclic aromatic hydrocarbons in surface sediments from the lagoons that are surrounded by a mangrove ecosystem. Utilizing chromatography adsorption and gas chromatography techniques, researchers concluded that naturally occurring hydrocarbons dominate the coastlines; however, the harbor sediment is polluted by petroleum hydrocarbons.

Bicego, M. C.; Weber, R. R.; Ito, R. G. **Aromatic hydrocarbons on surface waters of Admiralty Bay, King George Island, Antarctica.** *Marine Pollution Bulletin.* July 1996; 32(7):549-553; ISSN: 0025-326X.
During the summers of 1989, '90, '92, and '93, researchers measured total aromatic hydrocarbons for surface seawater at 24 points in Admiralty Bay, Antarctica using spectrofluorimetric methods. Results indicated that the levels varied between 0.05 and 8.86 μg/l, but the majority of the samples were measured below 1.00 μg/l. Therefore, it was concluded there were no significant hydrocarbon inputs in the Bay.

Bioremediation video. *Centerpoint: A Publication of the Hazardous Substance Research Centers Program.* 1993; 1(1):1.
A description and availability of a bioremediation video are given.

Birkett, S. H.; Rapport, D. J. **Comparing the health of two large marine ecosystems: the Gulf of Mexico and the Baltic Sea.** *Ecosystem Health.* 1996; 2(2):127-144.
A stress response framework is utilized to assess the overall condition of the Gulf of Mexico and the Baltic Sea. Results indicate that despite significant structural differences, the Gulf of Mexico and the Baltic Sea reveal a very similar history of distress.

Boeer, B. **Increased soil temperatures in salt marshes and mangroves after the 1991 *Gulf War* Oil spill.** *Fresenius Environmental Bulletin.* 1996; 5(7-8):442-447. ISSN: 1018-4619.
To determine the impact of the remaining bitumen from the 1991 Gulf War Oil Spill along the Saudi Gulf coast north of Jubail, three permanent transects were established in Dawhat ad-Dafi Bay. Soil temperatures of the dominant plant associations were measured throughout the year, in oiled and non-oiled substrates. Tar contaminated soil temperatures increased within seaward salt marshes and mangroves, while the landward salt marshes were less affected.

Boer, B. **Impact of a major oil spill off Fujairah.** *Fresenius Environmental Bulletin.* January-February 1996; 5(1-2):7-12; ISSN: 1018-4619.

Boer, B. **Increased soil temperatures in salt marshes and mangroves after the 1991 *Gulf War* oil spill.** *Fresenius Environmental Bulletin.* July-August 1996; 5(7-8):442-447; ISSN: 1018-4619.

Bourbonniere, R. A.; Meyers, P. A. **Anthropogenic influences on hydrocarbon contents of sediments deposited in eastern Lake Ontario since 1800.** *Environmental Geology.* July 1996; 28(1):22-28; ISSN: 0943-0105.
Researchers sampled and analyzed sediment cores from the Rochester Basin of eastern Lake Ontario in an effort to provide a record of any changes in the hydrocarbon concentration since 1800. Results indicated that sediments deposited prior to the mid-1800s contain very low concentrations. Concentrations begin to rise by the late 1800s and continue today. Petroleum residues begin to appear in sediments deposited in the late 1800s but remain minor constituents of the hydrocarbon contents of modern sediments.

Braddock, J. F.; McCarthy, K. A. **Hydrologic and microbiological factors affecting persistence and migration of petroleum hydrocarbons spilled in a continuous-permafrost region.** *Environmental Science & Technology.* August 1996; 30(8):2626-2633; ISSN: 0013-936X.
Researchers investigated the amount and direction of groundwater flux and the microbial activity at a site near Barrow, AK, contaminated by fuel spills (~1300m^3). Results indicated that the flux is small , a result of the shallow permafrost. In addition, researchers report that despite evidence of an active microbial population, microbial processes are somewhat limited by a brief annual thaw season.

Brenk, V. **The environmental effects and economic consequences of accidents at sea involving potentially dangerous substances.** *Actual Problems of the Marine Environment: Lectures of the 3rd International Scientific Symposium.* 1994; 1(1):97-114; ISSN: 0946-2015.
Despite Germany's implementation of impressive programs, equipment and vessels, at most only a few thousand tons of oil can be combatted under favorable conditions. The author discusses this and the consequences of major oil spills in the North Sea.

***Brent Spar* disposal options unveiled.** *Oil & Gas Journal.* August 19, 1996; 94(34):36-38; ISSN: 0030-1388.
A brief look at each of the 30 selected proposals for disposing the *Brent Spar* oil storage and loading buoy. Of these options, 19 are for onshore scrapping and 11 for non-scrapping. In late 1996, Shell U. K. will narrow the proposals to six.

Burger, J. **Before and After an Oil Spill: the *Arthur Kill*.** New Brunswick, NJ : Rutgers University Press; 1994;305 p. ISBN: 0813520959.
On January 1st, 1990, more than 550,000 gallons of no.2 fuel oil leaked from a cracked underwater pipeline into the *Arthur Kill* (waterway dividing Staten Island and New Jersey). This monograph is divided into two sections: the spill response/cleanup and the biological effects of the spill. Included in the former section are discussions concerning governmental agency and environmental organization cooperation, legal considerations, bioremediation and rehabilitation; the latter section includes chapters on the effects of the spill on vegetation, mollusks, crabs, fish, shrimp, waterfowl, birds, marine mammals, turtles, and humans.

Burt, James S.; Ebell, Geoff F. **Organic pollutants in mussels and sediments of the coastal waters off Perth, Western Australia.** *Marine Pollution Bulletin.* November 1995; 30(11):723-732; ISSN: 0025-326X.
Presented is a summary of the results of a 1991 survey of organic contaminants in marine sediments and mussel (*Mytilus edulis*) collected from the waters off Perth. Contaminants examined include polychlorinated biphenyls, pesticides, aliphatic and polycyclic aromatic hydrocarbons, and organotin compounds. Researchers reported that contamination was generally confined to areas adjacent to shipping facilities and marinas, with the exception of PAHs, which were widespread throughout the study area.

Carls, E. G.; Fenn, D. B.; Chaffey, S. A. **Soil contamination by oil and gas drilling and production operations in Padre Island National Seashore, Texas, USA.** *Journal of Environmental Management.* November 1995; 45(3):273-286; ISSN: 0301-4797.
In an effort to identify the extent of soil-contaminating substances in the Padre Island National Seashore, researchers analyzed soil samples from 18 oil and gas drilling and production sites. Results indicated that although widespread, the contaminating substances tend to be localized in the vicinity of drilling/production activity. Researchers also reported that sixteen sites were associated with elevated levels of heavy metals (barium, chromium, lead, zinc), sodium, salinity, pH, and/or petroleum hydrocarbons, although a discernible pattern of pollution between the sites was not found.

Casteel, Pamela. **Pipeline pandemonium.** *Texas Shores.* Winter 1995; 27(1):10-11; ISSN: 0747-0959.
A brief description of the October 1994 southeast Texas flood which caused the rupture of four underground fuel lines in the San Jacinto River, releasing more than a million gallons of oil, gasoline and diesel fuel into the marine environment.

Christensen, Rebecca R. **Fugitive emissions from Norwegian oil and gas production.** *Marine Pollution Bulletin.* 1994; 29(6-12):300-303; ISSN: 0025-326X.
The author reports a positive downtrend in fugitive emissions from oil and gas production, and that fugitive emissions (mainly methane) are approximately equivalent to 0.02% of the total gas produced in 1992 on the Norwegian continental shelf.

Clarkson, T. S.; Martin, R. J.; Rudolph, J.; Graham, B. W. L. **Benzene and toluene in New Zealand air.** *Atmospheric Environment.* February 1996; 30(4):569-577; ISSN: 1352-2310.
Presented are the results of measurements of benzene and alkyl benzenes at a coastal site in New Zealand. Researchers found that the typical concentration values in urban, rural, and marine locations are in the ranges 300-600, 0-900, 0-100 parts per trillion, respectively.

Cleanup underway at oil storage site in Netherlands. *Oil and Gas Journal.* 11 March 1996; 94 (11):44-45; ISSN: 0030-1388.
At the Nijmegen (Netherlands) oil storage depot, remediation work is being carried out by a process of soil venting and sparging, which involves the creation of an air flow into groundwater saturated soils by injecting compressed air.

ENVIRONMENT/ECOSYSTEM MANAGEMENT/SPILLS

Conides, A.; Diapoulis, A.; Koussouris, T. **Ecological study of an oil polluted coastal lake ecosystem in Greece** . *Fresenius Environmental Bulletin.* June-July 1996; 5(5-6):324-332; ISSN: 1018-4619.
Coming clean about oil tankers. *New Scientist.* March 2, 1996; 149(2019):3; ISSN: 0262-4079.
A brief editorial concerning the consequences and politics of the *Sea Empress* oil spill.

Cripps, G. C. **Hydrocarbons in the antarctic marine environment: monitoring and background.** *International Journal of Environmental Analytical Chemistry.* 1994; 55(1-4):3-13; ISSN: 0306-7319.
A review of the work on hydrocarbons in the Southern Ocean by the British Antarctic Survey in the Bransfield Strait and Scotia Sea regions. Discussion includes analytical methods and a monitoring program.

Cripps, G. C.; Shears, J. **The fate in the marine environment of a minor diesel fuel spill from an Antarctic research station.** *Environmental Monitoring and Assessment.* July 1997; 46(3):221-232. ISSN: 0167-6369.

Daniels, R. E.; Harrison, A. F.; Parkinson, J. A.; Hall, G. **Disposal of oil in sandy coastal soils.** *Spill Science and Technology.* 1995; 2(2/3):161-169. ISSN: 1353-2561.
An investigation to determine the ecological risks associated with the disposal of oiled beach material in coastal sand dunes and dune pastures. It is reported that field scale experiments showed that the breakdown of deposited hydrocarbons began quickly and lead to nearly complete degradation.

Daskalakis, K. D.; O'Conner, T. P. **Distribution of chemical concentrations in US coastal and estuarine sediment.** *Marine Environmental Research.* 1995; 40(4):381-398.
Authors provide a description of the Coastal Sediment Database (COSED), which contains data for nearly 13,500 coastal sediment samples and more than 80 analytes (including metals, pesticides, PAHs, PCBs, and physical parameters).

Debusschere, K. and others. **Recovery of a Deltaic Barrier Island to Hurricane and Oil Spill Impacts in Coastal Louisiana.** New Orleans: Minerals Management Service; 1994; OCS Study, MMS 94-0055. 85 p.

Dedomenico, L.; Crisafi, E.; Magazzu, G.; Puglisi, A.; Larosa, A. **Monitoring of petroleum hydrocarbon pollution in surface waters by a direct comparison of fluorescence spectroscopy and remote sensing techniques.** *Marine Pollution Bulletin.* October 1994; 28(10):587-591; ISSN: 0025-326X.
Remote sensing by helicopter and flourescence spectroscopy were used to estimate oil pollution levels. Results, obtained in an oil polluted bay with each methodology, were in agreement and indicated that remotely sensed data together with data from flourescence spectroscopy are applicable for monitoring hydrocarbon pollution.

Dehrmann, Alison. **South African oil spill: clean-up continues, thousands of penguins released after treatment.** *Penguin Conservation.* 1994; 7(3):10-11.

Desideri, P. G.; Lepri, L.; Checchini, L.; Santianni, D.; Masi, F.; Bao, M. **Organic compounds in antarctic sea-water and pack-ice.** *International Journal of Environmental Analytical Chemistry.* 1995; 61(4):319-330; ISSN: 0306-7319.
Using HRGC and GC-MS, researchers analyzed pack-ice and sea water collected from varying depths at Terra Nova Bay and Ross Sea. Identified were several classes of anthropogenic organic compounds, and results showed changes in organic composition at varying depths.

Diener, Douglas. **Disturbance of deep-water reef communities by exploratory oil and gas operations in the Santa Maria Basin and Santa Barbara Channel, final report.** Camarillo, CA: US Department of the Interior, Mineral Management Service; 1995; 382 p. (OCS Study; MMS 95-0030).

DOE dealing with problems in SPR sites. *Oil and Gas Journal.* November 27, 1995; 93(48):32; ISSN: 0030-1388.
The US Department of Energy has implemented a plan to remove 72 million bbl of oil out of its Weeks Island (LA) Strategic Petroleum Reserve (SPR) site because of a naturally occurring fracture, which eventually may cause large amounts of crude to leak into the surrounding area. In addition, DOE has found high levels of methane accumulating in crude stored at other SPR sites. This methane buildup has rendered some the crude oil temporarily unusable.

ENVIRONMENT/ECOSYSTEM MANAGEMENT/SPILLS

Duke, Norman C.; Pinzon, Zuleika S.; Prada, Martha C. **Large-scale damage to mangrove forests following two large oil spills in Panama.** *Biotropica.* March 1997; 29(1):2-14. ISSN: 0006-3606.
The mangrove forests of Bahia Las Minas on the Caribbean coast of Panama was evaluated to determine the lethal and sublethal damage caused by the tanker *Witwater* in 1968, and the ruptured land tank in 1986. Deforestation was site-and spill-specific, confirming decreased canopy leaf biomass in "open" canopy sites. Mangrove forests suffered 34% of the damage, 18% of trees oiled eventually died, and the total area of damaged mangroves was 5-6 times greater than the deforested areas alone after the large 1986 oil spill.

EIS to be prepared for Texas deepwater port. *Oil and Gas Journal.* August 16, 1993; 9123; ISSN: 0030-1388.
Elements of the Safeharbor project proposed by the Port of Corpus Christi Authority (PCCA) and environmental issues raised by the proposal are discussed.

Eckhoff, Rolf K. **New safety issues when moving from liquid fuels to natural gas.** *Marine Pollution Bulletin.* 1994; 29(6-12):304-306; ISSN: 0025-326X.
Discussed are the safety issues such as global greenhouse effects, local fire and explosion, and local asphyxiation hazards, caused by the loss of confinement of either compressed natural gas or liquified natural gas.

Edgell, Nicholas. **The *Braer* tanker incident: some lessons from the Shetland Islands.** *Marine Pollution Bulletin.* 1994; 29(6-12):361-367; ISSN: 0025-326X.
The circumstances which lead to the accident are briefly reviewed. Suggested are lessons such as the need for improved internationally agreed rules requiring early reporting, the need to halt the decline in the number of professional salvage companies, the value of well-planned and well-practiced reponse plans, and the need for better anchoring systems.

El-Raey, M.; Abdel-Kader, A. F.; Nasr, S. M.; El-Gamily, H. I. **Remote sensing and GIS for an oil spill contingency plan, Ras-Mohammed, Egypt.** *International Journal of Remote Sensing.* July 20, 1996; 17(11):2013-2026; ISSN: 0143-1161.
The authors prepare an oil spill contingency plan for Ras-Mohammed area at the southern tip of Sinai using SPOT-XS data.

Ellison, A. M.; Farnsworth, E. J. **Anthropogenic disturbance of Caribbean mangrove ecosystems: past impacts, present trends, and future predictions.** *Biotropica.* December 1996; 28(4 Part A):549-565. ISSN: 0006-3606.

Engelhardt, F. R.; Nordvik, A. B.; Giammona, C. P.; Aurand, D. V. **Oil spill response R and D.** *Sea Technology.* January 1994; 35(1):56-59; ISSN: 0093-3651.
Funded primarily by the Marine Preservation Association, an R & D program has been developed by the Marine Spill Response Corp. (MSRC) to enhance oil spill response decision-making.

European pipelines have costly spills. *Oil and Gas Journal.* 4 March 1996; 94 (10):69; ISSN: 0030-1388.
Brief discussion involving the 11 oil spill incidents on European soil in 1994, which totaled more than 15,000 bbl. (less than 2,500 bbl. were recovered from cleanup) and resulted in costs reaching in excess of $9.7 million.

Ferm, R. **Assessing and managing man-made impacts on the marine environment - the North Sea example.** *Science of the Total Environment.* July 16, 1996; 186(1-2):3-11; ISSN: 0048-9697.

Fingas, M. **Oil spills and their cleanup.** *Chemistry & Industry.* December 18, 1995; (24):1005-1008; ISSN: 0009-3068.
Presented is a basic overview of oil spill cleanup, including discussions on the various techniques utilized for oil spill containment, mechanical removal, shoreline cleanup, chemical treatment, *in situ* burning, and bioremediation.

Floodgate, G. D. **Some environmental aspects of marine hydrocarbon bacteriology.** *Aquatic Microbial Ecology.* 1995; 9(1):3-11; ISSN: 0948-3055.
The author summarizes what is currently known about polluting oil into the sea and the significant environmental factors which govern the oil breakdown rate, the bacteriology associated with the area of oil spill during the Gulf War, as well as critically reviews the theory and practice of bioremediation as applied to contaminated beaches.

Fondekar, S. P. **Goa Coast Oil Spill.** *Marine Pollution Bulletin.* 1995; 28(11):646; ISSN: 0025-326X.
A description of the June 5, 1994, MV Sea Transporter oil spill, which spilled an estimated 2 t of oil near the Sinquerin beach.

Fritz, D. E.; Taylor, E.; Steen, A. E., and Williams, J. R. **An annotated bibliography of environmental and human health effects from inland freshwater oil spills.** In. Proceedings: Seventeenth Arctic and Marine Oil Spill Program Technical Seminar. Ottawa: Environment Canada; 1994; 1 pp. 501-504.
Authors report on an annotated bibliography being created by compiling references concerning the environment and human health impacts of oil spilled in inland surface waters.

Fuentes, H. R.; Jaffe, R.; Tsihrintzis, V. A., and Boye, D. J. **The fate of a crude oil spill in simulated sub-tropical ocean waters.** In: Wrobel, L. C. and Latinopoulos, P. ***International Conference on Water Pollution: Modelling, Measuring and Prediction*** . Billerica, MA: Computational Mechanics, Inc.; 1995; pp. 245-251.
Authors discuss efforts to develop experimental facilities and procedures to understand the processes that affect the fate and transport of oil spills. In addition, the results of lab spill simulation experiments of weathered Arabian crude oil are described.

Futsaeter, Gunnar. **Environmental policy and regulation for oil exploration and shipping activities in the Barents Sea.** *Marine Pollution Bulletin.* 1994; 29(6-12):348-353; ISSN: 0025-326X.
A discussion of the vulnerability of the Arctic environment, including the environmental risks associated with petroleum activities in the region, and the management and regulation of this area by the Norwegian Pollution Control Authority.

Gellert, G. A.; Daugherty, S. J.; Rabiee, L.; Mazur, M.; Merryman, R. E. **California's American Trader oil spill: effective interagency and public-private collaboration in environmental disaster response.** *Journal of Environmental Health.* November 1994; 57(4):7-12; ISSN: 0022-0892.
An examination of the interagency collaboration of both public and private organizations during the American Trader tanker spill off the coast of Huntington Beach, CA in 1990. Included are data that were derived from surveys/interviews of key players from various organizations and a discussion of features that contributed to effective management of the emergency response.

Gilfillan, Edward S. and others. **Use of remote sensing to document changes in the marsh vegetation following the *Amoco Cadiz* oil spill (Brittany, France, 1978).** *Marine Pollution Bulletin.* December 1995; 30(12):780-787; ISSN: 0025-326X.
The residual effects and the following cleanup of the *Amoco Cadiz* oil spill were analyzed using image analysis of historical aerial photographs. Researchers compared two similar heavily-oiled marsh areas with one receiving no cleanup and the other cleaned by sediment removal. Results indicated the uncleaned marsh area recovered to its prior condition, whereas the cleaned marsh area was extensively altered as a result of changes in intertidal height of the sediment surface.

Goodlad, J. **Effects of the *Braer* oil spill on the Shetland seafood industry.** *Science of the Total Environment.* July 16, 1996; 186(1-2):127-133; ISSN: 0048-9697.

Goodstein, E. **Saturday effects in tanker oil spills: reply.** *Journal of Environmental Economics Management.* 1994; 26(3):297-299; ISSN: 0095-0696.
This reply concerns a response by Solow, who commented on the statistical methodolgy to Goodstein's 'saturday effect'. The reply indicated that the primary Goodstein result withstands close statistical scrutiny.

Gray, Chris. **It's Slick Work.** *The Times - Picayune.* New Orleans, Louisiana; May 23, 1997; A: 1A & 10A.
This article reports on the Texaco pipeline rupture on May 16, 1997 spilling 210,000 gallons of oil into Lake Barre', Louisiana. The oil spill will ultimatley affect shallow waters. Impact of fisheries, wildlife habitat and vegetation are still in assessment stages.

Green, G.; Nichols, P. D. **Hydrocarbons and sterols in marine sediments and soils at Davis Station, Antarctica: a survey for human-derived contaminants.** *Antarctic Science.* June 1995; 7(2):137-144; ISSN: 0954-1020.
A survey of hydrocarbon and sterols in marine and shoreline sediments was conducted near Davis Station in Princess Elizabeth Land, Prydz Bay. Soil samples were analyzed and found anthropogenic-originated hydrocarbons present at up to 5.5 μg/g (dry weight of sediment). On the shoreline, degraded hydrocarbons were found at fairly high levels, up to 220 μg/g, in soils at the fuel storage depot. It was suggested that the source of these hydrocarbons appeared to be spillage from fuel storage tanks and fuel pipeline leakage.

ENVIRONMENT/ECOSYSTEM MANAGEMENT/SPILLS

Grounded tanker may cause U. K.'s largest oil spill. *Oil and Gas Journal.* 26 February 1996; 94(9):34; ISSN: 0030-1388.
A brief article describing the February 1996 Sea Empress oil spill, which has leaked an estimated 70,000 metric tons of crude oil on the South Wales coast.

Gulf of Mexico and Caribbean oil spills in coastal ecosystems: assessing effects, natural recovery, and progress in remediation research symposium; 1995 Jul 14-1995 Jul 15; New Orleans, LA.
A notification of an oil spill conference to be held in New Orleans. For more information contact: Edward Proffit, Louisiana Environmental Research Center, McNeese State University, P. O. Box 90655, Lake Charles, LA 70609.

Gunther, K.; Schlosser, D.; Schmauder, H. P.; Rausch, U. **Bioremediation of contaminated groundwater.** *Applied Biochemistry and Biotechnology.* July 1994; 48(1):11-14; ISSN: 0273-2289.
Contaminated groundwater from the former East Germany was biologically treated using lab-scale solid-state reactors. Tested was the ability of bacterial strains of the autochroneous microflora to utilize representative pollutants.

Guzman, H. M.; Jarvis, K. E. **Vanadium century record from Caribbean reef corals: a tracer of oil pollution in Panama.** *Ambio.* December 1996; 25(8):523-526. ISSN: 0044-7447.
Researchers utilized the element vanadium, which is abundant in crude oils, as a proxy tracer of oil pollution along the Panama's Caribbean coast. A century chronology was developed and showed a significant increase in vanadium after 1962, when a refinery operation was introduced in the area.

Hanna, R. G. M. **An approach to evaluate the application of the vulnerability index for oil spills in tropical Red Sea environments.** *Spill Science and Technology.* 1995; 2(2/3):171-186. ISSN: 1353-2561.
Researchers apply the "Vulnerability Index" to evaluate the effects of the *Nabila* oil spill on the Egyptian Red Sea coastal area.

Henderson, Shirley. **Shell accused of Turkish water pollution.** *Marine Pollution Bulletin.* May 1996; 32(5):389; ISSN: 0025-326X.
Shell, the multinational oil company, has been accused of contaminating an aquifer that provides drinking water to Diyarbakir, a Turkish city of 2 million inhabitants. According to Lloyds List, leaked internal memos mention that Shell was, in fact, aware of this practice of disposing huge volumes of oil-polluted water into the shallow aquifer, a practice that breaches Turkish and European environmental regulations. Shell International stated that it did not believe a contamination was evident but accepts responsibility.

Henriquez, L. R. **Risk asssesment of offshore oil and gas activities in the Netherlands.** *Marine Pollution Bulletin.* 1994; 29(6-12):317-322; ISSN: 0025-326X.
Considered is the need for the application of risk assessment with respect to safety, health, and the environmental aspects.

Holloway, Marguerite. **Sounding out science.** *Scientific American.* October 1996; 275(4):106-112; ISSN: 0036-8733.
The author describes the problems and paradoxes associated with the scientific legacy of the most studied oil spill in history, the *Exxon Valdez* oil spill of 1989.

Hopkins, Liz. **Oil and gas developments in the South Atlantic.** *Marine Pollution Bulletin.* May 1997; 34(5):286. ISSN: 0025-326X.
In October 1995, Faulkland Island issued its first offshore oil and gas license, enabling operators to gather seismic and exploration drilling data to assess commercial viability of any hydrocarbon reserves. Pre-operations identified local issues and/or affects of the oil industry activities, leading to potential interface with local authorities, services, infrastructure, population, and the environment for future projects.

Huesemann, M. H. **Guidelines for land-treating petroleum hydrocarbon-contaminated soils.** *Journal of Soil Contamination.* 1994; 3(3):299-318; ISSN: 1058-8337.
Provided are specific guidelines for optimization of the land treatment process at a field site. The necessary steps in the land treatment are outlined in the time sequence expected under field conditions. Steps include sampling, site assessment, determination of contaminant levels and characteristics, estimation of biodegradation potential, estimation of bacterial numbers in the soil, design of the land treatment unit, adjustment of the soil pH/moisture content, addition of nutrient fertilizers and bulking agents, periodic monitoring of specific parameters and the final closure of a site.

Huesemann, M. H. **Predictive model for estimating the extent of petroleum hydrocarbon biodegradation in contaminated soils.** *Environmental Science & Technology.* January 1995; 29(1):7-18; ISSN: 0013-936X.
An investigation of the factors which affect the maximum extent of total petroleum hydrocarbon (TPH) was performed using a series of solid- and slurry-phase soil bioremediation experiments involving different crude oils and refined petroleum products. Investigators found that the degree of TPH biodegradation was mainly affected by the type of hydrocarbons in the contaminant matrix, while the influence of soil type, fertilizer, microbial counts and treatment type appeared to be insignificant. Based on these findings, a predictive algorithm was developed and the model predictions were in close agreement with analytical results from other labs.

Human Relations Area File, Inc. **Social Indicators Study of Alaskan Coastal Villages. VI, Analysis of the *Exxon Valdez* Oil Spill Area**. Anchorage, Alaska: Minerals Management Service; 1994; OCS Study, MMS 94-0064.

Husain, T.; Khan, S. M. **Impact assessment and forecasting of soot from Kuwaiti oil fires using a modeling approach.** *Atmospheric Environment.* July 1994; 28(13):2175-2196; ISSN: 1352-2310.
A regional transport model, the Air Resources Laboratories- Atmospheric Transport and Dispersion, was used to assess the impact on air quality due to the burning oil wells and to address an early warning system by forecasting movement and dispersion of plumes. Researchers reported the forecast was reliable 80% of the time and the performance of the model proved satisfactory.

Husain, Tahir. **Kuwaiti oil fires - modeling revisited.** *Atmospheric Environment.* 1994; 28(13):2211-2226; ISSN: 1352-2310.
The author presents and overview of the various models used to evaluate the local, regional and global impacts of the Kuwaiti oil fires.

Husain, Tahir. **Kuwaiti Oil Fires: Regional Perspectives**. Oxford, UK: Pergamon; 1995. ISBN: 008042418X.
The author collects, summarizes, and interprets the mass of information and data relating to Kuwaiti oil fires resulting from the Gulf War.

Hysing, T.; Torset, O. P. **Reduction of oil outflows at collisions and groundings through improved vessel design arrangements.** *Marine Pollution Bulletin.* 1994; 29(6-12):368-374; ISSN: 0025-326X.
A description of various methods to reduce the oil outflow collision and grounding accidents. Measures discussed include main hull design and tank arrangement, structural resistance of hull, and piping systems for automatic redistribution of oil in case of pressure drops. In addition, a probabilistic outflow model is used for a parameter study of the oil spills from a double hull tanker. The use of this model and other simplified models reveal that a considerable reduction of the pollution risk may be achieved by careful modification of main particulars and tank sizes.

Jacobsson, Mans. **Compensation for oil pollution damage caused by oil spills from ship and the International Oil Pollution Compensation Fund.** *Marine Pollution Bulletin.* 1994; 29(6-12):378-384; ISSN: 0025-326X.
Discussion of two international conventions governing pollution damage caused by oil spills from laden tankers, the 1969 Civil Liability Convention and the 1971 Fund Convention, and the intergovernmental organization International Oil pollution Compensation Fund, which pays compensation to victims of oil pollution in member states when the compensation from the shipowner is insufficient.

ENVIRONMENT/ECOSYSTEM MANAGEMENT/SPILLS

Jaff, Rudolf and others. **Pollution effects of the Tuy River on the Central Venezuelan coast: anthropogenic organic compounds and heavy metals in Tivela mactroidea**. *Marine Pollution Bulletin*. December 1995; 30(12):820-825; ISSN: 0025-326X.
Presented is a study focusing on determining the effects of the Tuy River outfall on the central Venezuelan coast. Using bivalve samples as marine pollution indicators, researchers detected petroleum hydrocarbons derived from fossil fuels, halogenated organics (PCBs) and heavy metals.

Jaworski, Carole. **Perspectives on an oil spill.** *Nor'Easter*. Spring 1996; 8(1):9-11.
The worst oil spill in Rhode Island history is described by scientists and reporters who were on the scene.

Johnson, D. S., (compiler). **Oil spill bibliography**. Honolulu, HI: University of Hawaii Sea Grant College Program; 1993; HAWAU-L-93-001. 5 p.
This bibliography contains a listing of publications that are related to the research and references of the report Oil spills at sea: potential impacts on Hawaii, prepared for the State of Hawaii Department of Health by the Hawaii Sea Grant Program.

Johnson, Paul R. **Offshore concerns off base?** *Science News*. October 22, 1994; 146(17):259; ISSN: 0036-8423.
An editorial letter from a subscriber rebuffing some of the information presented in 'When offshore wells shut down,' Janet Raloff, Science News, July 16, 1994, p. 47. Janet Raloff offers a reply.

Kennicutt, M. C. and others. **Human contamination of the marine environment - Arthur Harbor and McMurdo Sound, Antarctica**. *Environmental Science & Technology*. May 1995; 29(5):1279-1287; ISSN: 0013-936X.
Reported are concentrations of polycyclic aromatic hydrocarbons, polychlorinated biphenyls, pesticides, and trace metal concentrations in McMurdo Sound and Arthur Harbor sediments. In addition, biomarkers, biliary metabolites and EROD activities were also measured. Researchers found trace metals and PAH sediment concentrations to rarely exceed toxic levels, whereas PCBs in Winter Quarters Bay were often above toxic levels.

Kireeva, N. A.; Novoselova, E. I.; Khaziev, F. K. **Use of active sludge for reclamation of oil-polluted soils.** *Eurasian Soil Science*. November 1996; 29(11):1305-1308. ISSN: 1064-2293.

Klungsoyr, J.; Saetre, R.; Foyn, L.; Loeng, H. **Man's impact on the Barents Sea**. *Arctic*. September 1995; 48(3):279-296; ISSN: 0004-0843.
A review of the current knowledge of the human impact on the Barents Sea ecosystem, including the effects of offshore oil and gas exploration.

Knott, David. **Ethnic cleansing by the *Sea Empress***. *Oil and Gas Journal*. 4 March 1996; 94 (10):41; ISSN: 0030-1388.
The author discusses the monitoring study currently being carried out by Robin Crump, head of the field studies unit at Dyfed Wildlife Trust, Haverfordwest, Wales. The study is designed to monitor the effects of the *Sea Empress* spill -- a spill that released more than 65,000 metric tons of crude oil adjacent to Milford Haven harbor on February 15, 1996.

Knott, David. ***Sea Empress* strikes thrice**. *Oil and Gas Journal*. 26 February 1996; 94(9):34; ISSN: 0030-1388.
A brief description of the human error involved in the recent Sea Empress oil spill.

LaBelle, R. P.; Galt, J. A.; Tennyson, E. J., and McGrattan, K. B. 1993 **Spill off Tampa Bay, a candidate for burning**? In. Proceedings: **Seventeenth Arctic and Marine Oil Spill Program Technical Seminar**. Ottawa: Environment Canada; 1994; 1 pp. 635-649.
Authors describe the general behavior and movements of the spilled oil and the sea and weather conditions during and following the August 10, 1993 collision of the Tank Barge Ocean 255 and the Tank Barge Bouchard B-155 with the freighter Balsa 37 in Tampa Bay, Florida. In addition, discussed is the possibility of removing the oil by *in-situ* burning, and the results of smoke plume model runs.

LaBelle, Robert P.; Galt, Jerry A.; Tennyson, Edward J.; McGrattan, Kevin B. **The 1993 oil spill off Tampa Bay, a scenario for burning?** *Spill Science and Technology Bulletin*. September 1994; 1(1):5-9; ISSN: 1353-2561.
The potential of offshore burning of oil in the recent Tampa Bay spill as a generic oil spill response option is considered.

Lara, R. J.; Asteasuain, A.; Rusansky, C.; Asteasuain, R. **Distribution of petroleum hydrocarbons in waters of the Bahia Blanca Bay, Argentina.** *Marine Pollution Bulletin.* 1995; 30(4):281-283; ISSN: 0025-326X.
Authors discuss the results of two years of sampling the Bahia Blanca Bay to determine the petroleum hydrocarbon distribution along its the main navigation channel.

Lavrentyev, P. J. **Anthropogenic stress in ciliate communities: a short-term study on Arctic tundra lakes.** *Archiv Für Hydrobiologie: Ergebnisse Der Limnologie [Advances in Limnology].* 1994; 40149-153; ISSN: 0071-1128.
Researchers examined the response of planktonic, benthic, and colonizing ciliates to oil spills at the arctic tundra lakes. A significant drop in species diversity, simplification of structure, and mass blooms of a few opportunistic species characterized communities with heavy contamination.

Lazes, R. **A study on the effects of oil fires on fire boom employed during the *in-situ* burning of oil.** In. *Proceedings: Seventeenth Arctic and Marine Oil Spill Program* Technical Seminar. Ottawa: Environment Canada; 1994; 1 pp. 717-724.
A description of the use and environmental concerns associated with *in-situ* burning of oil, including the Newfoundland Offshore Burn Experiment, conducted by Environmental Canada. The results of this experiment included: the overall emissions were less than expected; all measurements were well below health concerns at 150 meters from the burning fire; and polycyclic aromatic hydrocarbons were found to be lower in soot from the fire than in the oil prior to the fire. The authors state that these results now open the door on the use of *in-situ* burning of oil as a major tool to be utilized to lessen the environmental consequences of oil spills.

Lazes, Richard. **A study on the effects of oil fires on fire booms employed during the in situ burning of oil.** *Spill Science and Technology Bulletin.* September 1994; 1(1):85-87; ISSN: 1353-2561.
The Newfoundland Offshore Burn Experiment (NOBE) is overviewed.

Lear, E. M., editor. **MMS Worldwide Tanker Spill Database: an Overview.** Herndon, VA: Minerals Management Service; 1994; OCS Report, MMS 94-0002. 120 p.

Lenihan, Hunter S.; Oliver, John S. **Anthropogenic and natural disturbances to marine benthic communities in Antarctic.** *Ecological Applications.* 1995; 5(2):311-326; ISSN: 1051-0761.
The authors describe the changes in marine bottom communities along a defined gradient of contamination in Antarctica.

Lethbridge, G.; Vits, H. J. J.; Watkinson, R. J. ***Exxon Valdez* and bioremediation.** *Nature.* September 8, 1994; 371(6493):97; ISSN: 0028-0836.
The claim that genetically engineered microorganisms are required for bioremediation of crude oils is countered.

Liptak, J. F.; Lombardo, G. **The development of chemical-specific, risk-based soil cleanup guidelines results in timely and cost-effective remediation.** *Journal of Soil Contamination.* 1996; 5(1):83-94; ISSN: 1058-8337.

Long, E. R.; Robertson, A.; Wolfe, D. A.; Hameedi, I.; Sloane, G. M. **Estimates of the spatial extent of sediment toxicity in major U.S. estuaries.** *Environmental Science & Technology.* December 1996; 30(12):3583-3592; ISSN: 0013-936X.
Authors provide a synopsis of estimates of the spatial extent of sediment toxicity in major estuaries based upon data compiled from NOAA surveys.

Loughlin, Thomas R., Ed. **Marine Mammals and the *'Exxon Valdez'*.** San Diego, CA: Academic Press; 1994;395 p. ISBN: 0124561608.
A monograph including 39 contributors on subjects such as toxicology, pathology, impacts on population dynamics, and behavioral changes induced by the *Exxon Valdez* oil spill.

Lunel, T.; Swannell, R.; Rusin, J.; Wood, P.; Bailey, N.; Haliwell, C.; Davies, L.; Sommerville, M.; Dobie, A.; Mitchell, D.; McDonagh, M.; Lee, K. **Monitoring the effectiveness of response operations during the *Sea Empress* incident: a key componant of the successful counter-pollution response.** *Spill Science and Technology.* 1995; 2(2/3):99-112. ISSN: 1353-2561.
A detailed chronological description of the successful counter-pollution response to the 19 million gallons of Forties Blend and 370 t of Heavy Fuel oil spilled as a result of the grounding of the *Sea Empress* in Milford Haven (U. K.) is presented. It is estimated that this counter-pollution response may have prevented 57,000 t-110,000 t of emulsion impacting the shoreline.

Macdonald, R. W.; Bewers, J. M. **Contaminants in the Arctic marine environment: priorities for protection.** *ICES Journal of Marine Science.* June 1996; 53(3):537-563; ISSN: 1054-3139.
The authors report on the potential adverse effects on the Arctic marine environment resulting from global and regional releases of chemical and radioactive contaminants from humans. Reviewed are the sources, transport mechanisms, and biological effects of organic compounds, lead, cadmium, mercury, artificial radionuclides, and oil.

Machate, T.; Noll, H.; Behrens, H.; Kettrup, A. **Degradation of phenanthrene and hydraulic characteristics in a constructed wetland.** *Water Research.* March 1997; 31(3):554-560. ISSN: 0043-1354.
The use of a macrophyte-based treatment system (with *Typha* spp. and *Scirpus lacustris*) for purifying wastewater containing phenanthrene and Tween 80 was investigated.

Macias-Zamora, J. V. **Distribution of hydrocarbons in recent marine sediments off the coast of Baja California.** *Environnmental Pollution.* 1996; 92(1):45-53.
In recent marine sediments from 24 stations off the coast of the USA-Mexico border, concentrations of linear or n-hydrocarbons, polycyclic aromatic hydrocarbons (PAH), and unresolved complex mixture (UCM) were measured. Results indicated the average, maximum, and minimum of each were as follows: n-hydrocarbons - 15 μg/g, 70.6 μg/g, 0.8 μ/g/g; PAHs - 0.4 μg/g, 1.93 μg/g, below detection levels; UCM - 37 μg/g, 220 μg/g, below detection levels.

Madany, I. M.; Al-Haddad, A.; Jaffar, A.; Al-Shirbini, E. S. **Spacial and temporal distributions of aromatic petroleum hydrocarbons in the coastal waters of Bahrain** . *Archives of Environmental Contamination and Toxicology.* 1994; 26(2):185-190; ISSN: 0090-4341.
A comprehensive field study of the levels of aromatic petroleum hydrocarbons in water was conducted using fifty monitoring stations throughout the coastal areas of Bahrain. The authors report that the study revealed marked temporal and spatial variations in petroleum hydrocarbon concentrations. The higher mean values (up to 88.5 mu g/L) were found to be near industrial areas and the lowest (16.1 mu g/L) at the remote stations. Overall, the levels in the Bahrain region of the Gulf were high compared to other areas of the Gulf, indicating a chronic oil pollution problem.

MMS: Gulf emissions not harmful. *Oil and Gas Journal.* October 1995; 93(43):38; ISSN: 0030-1388.
Systems Applications International conducted a clean air study, under a $5.8 million contract with the Minerals Management Service, concluding that air emissions from oil and gas production in the Gulf of Mexico are not harming US onshore air quality.

Magnusson, K., et al. **Contamination and correlation with toxicity of sediment samples from the Skagerrak and Kattegat.** *Journal of Sea Research.* 1996; 35(1-3):223-234; ISSN: 1385-1101.
Researchers examined the pollution (polycyclic aromatic hydrocarbon, organochlorines, heavy metals, and ammonia) concentrations and toxicity from 11 sample stations from the Skagerrak and Kattegat. Researchers determined PAH and organochlorines by bioassays of *Nitocra spinipes* and *Daphnia magna* in whole sediment. Determinations of heavy metals and ammonia were done in pore water with *Mytilus edulis* larvae and in solvent extracts from sediment with tests measuring EROD activity in *Oncorhyncus mykiss* and rate of denitrification. It was concluded that sites close to G"teberg and in an area from the Oslo fjord to the Norwegian Trench had the highest concentration of pollution.

Mathiesen, Tor-Christian. **The human element in environmental protection.** *Marine Pollution Bulletin.* 1994; 29(6-12):375-377; ISSN: 0025-326X.
A discussion concerning the importance of human elements in the chain of events leading to a shipping accident.

McCabe, T. R. **Assessing values of Arctic wildlife and habitat subject to potential petroleum development.** *Landscape and Urban Planning.* 1994; 28(1):33-45; ISSN: 0169-2046.
The habitat and constituent wildlife species of the Arctic National Wildlife Refuge (ANWR), including porcupine caribou (*Rangifer tarandus*), brown bear (*Ursus arctos*) and the vegetation of the coastal plain, were assessed to determine the potential impact from petroleum development. Implications for ecosystem management are outlined.

McCarthy, Elizabeth. ***Sea Empress* oil pollutes Ireland's sandy shores.** *New Scientist.* April 20, 1996; 150(2026):8; ISSN: 0262-4079.
A brief news story regarding the *Sea Empress*, which ran aground off the west coast of Wales in February spilling 70,000 tons of light crude oil along more than 100 kilometers of the Irish coast.

McCarthy, Mac W.; McGrath, John. **Air cushioned vehicles: efficient alternative transportation for spill response.** *Spill Science and Technology Bulletin.* September 1994; 1(1):79-84; ISSN: 1353-2561.
Theory, case histories and personal experiences are offered to develop support for planning air cushioned vehicles (ACVs) as an amphibious alternative in marine spill response transportation.

McConnaughey, Janet. **Energy department to lose $100 million on oil reserve.** *The New Orleans Times-Picayune.* Monday, August 7, 1995; 117(188):3A.
A fracture was discovered in the Weeks Island salt dome in which the DOE has stored 3 billion gallons of crude oil as a part of its Strategic Petroleum Reserves program. The DOE, fearing that growth of the fracture could cause oil to spill from the dome into the surrounding wetlands, has begun drilling 55 200 foot wells around the dome. Refrigerant will be circulated through these wells to freeze any groundwater which could seep into the dome and cause salt to leach out, causing the stored oil to leak out. The freezewall contract will cost $5.8 million, but the entire shutdown could cost $100 million. The DOE will sell some of its oil to help cover the cost.

Mearns, Alan J. **Elements to be considered in assessing the effectiveness and effects of shoreline countermeasures.** *Spill Science and Technology Bulletin.* March 1995; 2(1):5-10; ISSN: 1353-2561.
The author provides guidance on how the field testing and evaluation of shoreline treatment methods during an oil spill response should be conducted, reported and reviewed.

Metwally, M. E. S.; Almuzaini, S.; Jacob, P. G.; Bahloul, M.; Urushigawa, Y.; Sato, S.; Matsmura, A. **Petroleum hydrocarbons and related heavy metals in the near-shore marine sediments of Kuwait.** *Environment International.* 1997; 23(1):115-121. ISSN: 0160-4120.
Researchers determined the concentrations of petroleum aromatic hydrocarbons, total organic carbon, and petroleum-related heavy metals collected from stations along coastal Kuwait. Results indicated that the highest petroleum hydrocarbon concentration was found near the industrial area of Shuaiba and in the Shuwaikh port. Additionally, it was reported that petroleum-related heavy metals (Pb, Ni, V) were detected at all stations, thus suggesting that petroleum-related activities are major sources of pollution in the area.

Miller, Gregory. **Coastal habitat restoration planning in Louisiana: lessons from *the Greenhill-Timbalier Bay* oil spill case.** *Coastal Management.* 1994; 22413-420; ISSN: 0892-0753.
A case history detailing a 1992 well blowout and oil spill in *Timbalier Bay*, and the assessment and restoration activities that have been implemented as a result of the incident.

Minas, W.; Gunkel, W. **Oil pollution in the North Sea: a microbiological point of view.** *Helgolander Meeresuntersuchungen.* 1995; 49(1-4):143-158; ISSN: 0174-3597.
Oil degradation rates and potentials in the North Sea were assessed and determined. Researchers found that oil biodegradation was four times greater in the summer; however, abiotic factors (erosion and dispersion) were responsible for enhanced oil removal rather than oil biodegradation.

Mohammed, S. Z. **Observations on the benthic macrofauna of the soft sediment on western side of the Arabian Gulf (ROPME sea area) with respect to 1991 Gulf War oil spill.** *Indian Journal of Marine Sciences.* September 1995; 24(3):147-152; ISSN: 0379-5136.
From April - May 1992 following the Gulf War, researchers aboard the *R. V. Mt. Mitchell* observed and surveyed the benthic fauna of the western side of the Arabian Gulf (Kuwait to Qatar). Researchers found the main component to be *molluscs*, followed by *crustacea, polychaeta* and *echinodermata.* With more than 80 species of benthic fauna found, it was concluded that the species diversity and the rank-abundance relationships reflected no deleterious effect on the soft sediment communities.

Moore, J. **Environmental studies on the** *Sea Empress* oil spill. *Marine Pollution Bulletin.* May 1996; 32(5):386-387; ISSN: 0025-326X.
The author presents a brief assessment of the environmental damage caused by the *Sea Empress*, which spilled 60,000 tons of oil at the entrance to Milford Haven in Wales.

Morel, G.; Koffi, P. K. **Implementation of an environmental monitoring network and a pollution combating unit in Cote e'ivoire.** *Water Science and Technology.* 1995; 32(9-10):141-150; ISSN: 0273-1223.

ENVIRONMENT/ECOSYSTEM MANAGEMENT/SPILLS

Morrison, R. J.; Delaney, J. R. **Marine pollution in the Arafura and Timor Seas.** *Marine Pollution Bulletin.* April 1996; 32(4):327-334; ISSN: 0025-326X.
A review of the available information on marine pollution in the Arafura and Timor Seas, including assessments based on physical, social, and economic features of the area. In addition, presented are a number of proposals to maintain and improve the environment, including a monitoring program and an expanded oceanographic information base, which would work to provide early indication of changing pollution conditions.

Muschenheim, D. K.; Milligan, T. G. **Flocculation and accumulation of fine drilling waste particulates on the Scotion Shelf (Canada).** *Marine Pollution Bulletin.* October 1996; 32(10):740-745; ISSN: 0025-326X.
A discussion of recent data showing that the cumulative effects of drilling waste discharges may extend further from the platforms than was previously accepted.

Nair, T. V.; Chacko, J.; Chandramohanakumar, N. **Distribution of petroleum hydrocarbons in sediments of the Cochin Estuary, south west coast of India.** *Indian Journal of Marine Sciences.* December 1995; 24(4):240-242; ISSN: 0379-5136.
Researchers reported that petroleum hydrocarbon concentrations varied between 249 µg/g and 570 µg/g dry weight, which supports the conclusion that this estuarine zone was significantly polluted.

Newey, S; Seed, R. **The effects of the *Braer* oil spill on rocky intertidal communities in South Shetland, Scotland.** *Marine Pollution Bulletin.* 1995; 30(4):274-280; ISSN: 0025-326X.
The apparent effects of the *Braer* oil spill on the composition and diversity of rocky intertidal communities around the south mainland coast are reported.

New products: new oil gelling agent. *Marine Pollution Bulletin.* September 1994; 28(9):573; ISSN: 0025-326X.
Australian scientists have discovered a mixture which gels oils and solvents very rapidly. The reaction employs rapidly reacting monomers and silicone reagents.

News: liability accepted for South African oil spill. *Marine Pollution Bulletin.* September 1994; 28(9):519; ISSN: 0025-326X.
The *Apollo Sea bulk* carrier has been determined circumstantially to be the source of oil that has been polluting South Africa's Cape coast tourist beaches.

Nihoul, Claire; Ducrotoy, Jean-Paul. **Impact of oil on the marine environment: policy of the Paris Commission on Operational Discharges from the Offshore Industry.** *Marine Pollution Bulletin.* 1994; 29(6-12):323-329; ISSN: 0025-326X.
Statistics collected over the last 10 years indicate the input of oil in the North Sea due to the offshore industry has been estimated at 29%, with 75% of that caused by cuttings. The authors discuss the physical and environmental impacts of this oil on the marine environment and review the decisions and recommendations adopted by the Paris Commission.

Nordvik, Atle B. **The technology windows-of-opportunity for marine oil spill response as related to oil weathering and operations.** *Spill Science and Technology.* March 1995; 2(1):17-46; ISSN: 1353-2561.
By using oil weathering and technology performance data, the author examines and estimates time-periods (windows) during which response procedures, technologies, equipment, etc., are most effective in spill clean up for oils of differing chemical and physical properties. The 'generic' time periods or windows include: dispersants, in situ burning, booms, skimmers, sorbents, and oil-water separators.

Nordvik, Atle; Simmons, James L.; Champ, Michael A. **Oil spill cleanup: window of opportunity.** *Sea Technology.* October 1995; 36(10):10-16; ISSN: 0093-3651.
The authors discuss the importance of contingency planning and response, as well as describe the timeline of an oil spill and the appropriate technologies utilized with each step.

O'Conner, T. P. **Trends in chemical concentrations in mussels and oysters collected along the US coast from 1986 to 1993** *Marine Environmental Research.* 1996; 41(2):183-200; ISSN: 0141-1136.
Results from annual collections and analyses of mussels and oysters throughout the coast of the United States are presented. The author reports a decreasing trend (nationally) for banned chemicals and chemicals whose use has greatly diminished; however, other chemicals remain at relatively stable levels.

Okita, Toshiichi; Yanagihara, Mamoru; Yoshida, Katsuumi; Iwata, Motoichi; Tanabe, Kiyoshi; Hara, Hiroshi. **Measurements of air pollution associated with oil fires in Kuwait by a Japanese research team.** *Atmospheric Enviornment.* 1994; 28(13):2255-2259; ISSN: 1352-2310.
A research team reports on the monitoring of air pollution in Kuwait caused by oil-well fires at nine sights using lightweight samplers. Researchers detected high levels of total airborne particulate matter, soot, organic carbon, S04, and Cl, but levels of SO2, NO2, CO and benzo(a)pyrene were low.

Oil fingerprinting to track Australia's pollution. *Marine Pollution Bulletin.* May 1995; 30(5):293-294.
A new agreement between the Australian Maritime Safety Authority (AMSA) and the Australian Government Analytical Laboratories (AGAL) aims to improve the enforcement of Australia's pollution laws. Oil fingerprints produced from newly developed testing techniques by AGAL will improve detection of alleged polluters.

Olds, Alberta - Testing compost to clean petroleum contaminated soils. *Biocycle.* January 1997; 38(1):20. ISSN: 0276-5055.

Onianwa, P. C. **Petroleum hydrocarbon pollution of urban topsoil in Ibadan City, Nigeria.** *Environment International.* 1995; 21(3):341-343; ISSN: 0160-4120.
The relative amounts of petroleum hydrocarbons in topsoil from various areas within Ibadan City, Nigeria were investigated. The areas selected consisted of railway tracks, gas stations, refuse dumps, residential areas, high traffic density areas, mechanical workshops, and control zones. Gas stations and mechanical workshops were the only areas found to have significant hydrocarbon levels.

Owen, Bruce M. and others. **The economics of a disaster: the *Exxon Valdez* oil spill**: Quorum Books; 1995. ISBN: 0-89930-987-9.
A comprehensive and detailed account of the economics of liability and damages associated with the *Exxon Valdez* oil spill.

Pain, S.; Kleiner, K. **Frustrated west watches as Arctic oil spill grows.** *New Scientist.* November 5, 1994; 144(1950):8-9; ISSN: 0262-4079.
A brief account of Russia's largest oil spill, a recent massive leak from the 19-year-old Komineft pipeline.

Pennisi, Elizabeth. **Blackened mangrove, smothered reef: years later, oil still sickens tropical coastal ecosystems.** *Science News.* April 9, 1994; 145232-233.
The effects of the *Bahi las Minas* oil spill off the Atlantic coast of Panama in 1986 are revisited, particularly noting the effect on mangroves and coral reefs.

Persad, D.; Rajkumar, W. **A synoptic view of the levels of dispersed dissolved petroleum hydrocarbons (DDPH) and heavy metals in the south-eastern Caribbean Sea.** *Marine Pollution Bulletin.* July 1995; 30(7):487-489; ISSN: 0025-326X.
Researchers report on data collected on two separate cruises -- the first, conducted in November 1991, sampled dissolved and dispersed petroleum hydrocarbons in the southeastern Caribbean (between Barbados, Trinidad, Tobago, and Martinique); the second, conducted November 1993, sampled dissolved heavy metals in the southeast Caribbean (northeast of Tobago).

Pettersen, B. **Major environmental challenges for Norwegian offshore and shipping activities.** *Marine Pollution Bulletin.* 1994; 29(6-12):345-347; ISSN: 0025-326X.
Presented is the Norwegian governmental view of the challenges for the petroleum industry and shipping companies, including the relationship between governmental and regional initiatives and the industry's responsibilities.

Pettersen, Harald; Naf, Carina; Broman, Dag. **Impact of PAH outlets from an oil refinery on the receiving water area - sediment trap fluxes and multivariate statistical analysis.** *Marine Pollution Bulletin.* February 1997; 34(2):85-95. ISSN: 0025-326X.
Researchers determined PAH concentrations in the wastewater from a petroleum refinery on the Swedish Baltic coast and in settling particulate matter (SPM) collected in the waters adjacent to the refinery. Using pattern recognition techniques, researchers concluded that the PAH composition in SPM samples from the waters adjacent to the refinery were comparable to that found in background reference sites and not to the wastewater samples from the refinery, which indicates the refinery is not a significant source of the PAHs in the surrounding area.

Pineiro, Alvarez; Yusty, Lage; Gonzalez-Barros, Carril; Lozano, Simal. **Aliphatic hydrocarbon levels in turbot and salmon farmed close to the site of the *Aegean Sea* oil spill.** *Bulletin of Environmental Contamination and Toxicology* . 1996; 57(5):811-815. ISSN: 0007-4861.
This report covers the variations over time, of aliphatic hydrocarbon levels in turbot and Atlantic salmon caused by the *Aegean Sea* supertanker that spilled approximately 60,000 tons of *Brent* oil off the coast of Galicia (N. W. Spain) on December 3, 1992.

Prado-Jatar, M. A.; Brown, M. T. **Interface ecosystems with an oil spill in a Venezuelan tropical savannah.** *Ecological Engineering*. March 1997; 8(1):49-78. ISSN: 0925-8574.
'Emergy' analysis was used to evaluate ecologic and economic impacts in four different oiled zones from the blowout of a Venezuelan Oil Company well in Monagas State in eastern Venezuela. Developments and the role of restoration efforts are described in this paper.

Putorti, A. D. Jr.; Evans, D. D., and Tennyson, E. J. **Ignition of weathered and emulsified oils.** In. Proceedings: *Seventeenth Arctic and Marine Oil Spill Program Technical Seminar*. Ottawa: Environment Canada; 1994; 1 pp. 657-667.
Presented are results from laboratory experiments that measure the ignition time for oils and emulsions when heated by thermal radiation. Also, measurements of thermal radiation for diesel fuel pool fires of sizes likely to be utilized for oil spill ignition are combined with laboratory measurements of ignition times to provide a guide for igniting weathered and emulsified oils.

Radwan, Samir; Sorkhoh, Naser; El-Nemr, Israa. **Oil biodegradation around roots.** *Nature*. July 27, 1995; 376(6538):302; ISSN: 0028-0836.
Included are observations of effects of oil pollution in Kuwaiti desert four years after Gulf War. Researchers found the moderately to weakly oil-contaminated areas (with <10% by weight of oil sediment) support wild annuals, primarily of the family Compositae, and conclude that the rich oil-utilizing microflora around the roots of both wild and crop plants clean oil-polluted sand adjacent to the roots, which suggests that densely cultivating suitable plants in oil-polluted areas of the Kuwaiti desert may be good means of bioremediation.

Ranatunga, N. G. and Fernando, W. A. S. **Organo-carbon pollution monitoring survey in the western and southern coast of Sri Lanka.** *In. Annual Scientific Sessions: Proceedings of the First Annual Scientific Sessions, 2nd November, 1993, Colombo, Sri Lanka*. Colombo, Sri Lanka: National Aquatic Resources Agency; 1993; pp. 48-50.
Authors report on surveys being conducted along the western coast of Sri Lanka to ascertain the extent of organo/carbon contamination on the beaches. Results indicate that the pollution increases moving from the south to the north. Also, the highest values were observed in June, July, August, and October, and the main cause is presumed to be from petroleum tank washing in the sea.

Readman, J. W., et. al. **Recovery of the coastal marine environment in the Gulf following 1991 war-related oil spills.** *Marine Pollution Bulletin*. June 1996; 32(6):493-498; ISSN: 0025-326X.
Researchers investigated the recovery of coastal marine environments affected by the oil spills of the Gulf War by comparing and analyzing 1991 and 1992/1993 subsequent surveys that were conducted at the same sites. Results indicated that by 1992 degradation had resulted in a composition dominated by an unresolved complete mixture. A 50% reduction in contamination levels was found between 1991 and 1992, and a much lesser reduction was found for the period 1992 to 1993.

Reed, Mark; Aamo, Ole Morten; Daling, Per S. **Quantitative analysis of alternate oil spill response strategies using OSCAR.** *Spill Science and Technology Bulletin* . March 1995; 2(1):67-74; ISSN: 1353-2561.
Researchers describe and assess the use of Oil Spill Contingency and Response (OSCAR), a three dimensional numerical model of the physical and chemical behavior and fate of spilled oil coupled to a model of oil spill response actions.

Renner, Rebecca. **Proposed sediment contamination guidelines to look at chemical mixtures.** *Environmental Science & Technology*. February 1997; 31(2):80A-81A. ISSN: 0013-936X.
Presented is a brief discussion on a proposal for national guidelines to assess sediment contamination from chemical mixtures in fresh and estuarine water and the marine environment, which will be reviewed in February 1997 by the EPA's Science Advisory Board.

Rhinelander, Wisconsin - Biopiles remediate soil impacted by leaky oil tanks. *Biocycle*. January 1997; 38(1):22. ISSN: 0276-5055.

Rice, S.; Spies, R.; Wolfe, D., and Wright, B. **Proceedings of the *Exxon Valdez* Oil Spill Symposium**. Bethesda, MD: American Fisheries Society; 1996; 926 p.(AFS Symposium; v. 18). ISBN: 0-913235-95-4.
This volume includes 61 papers from the 1993 *Exxon Valdez* Oil Spill Symposium. Subjects included: fate and toxicity, subtidal, subsistence, treatment effects, intertidal, herring, salmon, fish, birds, mammals, archaeology, and human impacts.

Ristola, T.; Pellinen, J.; Van Hoof, P. L.; Leppänen, M.; Kukkonen, J. **Characterization of Lake Ladoga sediments. II. Toxic chemicals**. *Chemosphere*. March 1996; 32(6):1179-1192; ISSN: 0045-6535.
Research analyzed 12 sediment samples collected at various locations of Lake Lagoda for polycyclic aromatic hydrocarbons, chlorobenzenes, organochloropesticides and heavy metals in an effort to explain the negative effects of these sediments (observed in previous bioassays) with a midge (*Chironomus riparius*). However, results indicated that the concentrations of the analyzed chemicals were typical of unpolluted lakes, with only the PAHs slightly elevated.

Ritchie, W. **Maritime oil spills: environmental lessons and experiences with special reference to low-risk coastlines**. *Journal of Coastal Conservation*. 1995; 1(1):63-76.
The author discusses oil spill contingency plans using the *Braer* oil spill of 1993 as a case study of the application of sound coastal geomorphological and ecological data to impact assessment.

Ritter, W. F.; Scarborough, R. W. **A review of bioremediation of contaminated soils and groundwater**. *Journal of Environmental Science and Health Part A - Environmental Science and Engineering*. 1995; 30(2):333-357; ISSN: 0360-1226.
A general discussion on the subject of bioremediation of contaminated groundwater and soils, as well as an examination of research needs for bioremediation.

Riviere, Luc; Garland, Emmanuel. **Experience of produced water treatment in the North Sea**. *Marine Pollution Bulletin*. 1994; 29(6-12):312-316; ISSN: 0025-326X.
A description of the experiences of the ELF company regarding produced water treatment and disposal in the North Sea. Included in the discussion are evaluations of various techniques, the reasons for problems encountered, the contributions of recent technologies, and inherent problems associated with the design of an installation. Also reported are the limits of the industry's efforts to reduce hydrocarbon release into the sea.

Rodrigues, R. **Microhabitat variables influencing nest-site selection by tundra birds**. *Ecological Applications*. 1994; 4(1):110-116; ISSN: 1051-0761.
Studies were performed to determine what types of microhabitat characteristics attract the most common bird species to nest at particular sites on tundra habitats in the Prudhoe Bay oil field. The differences in microhabitats have implications for management of abandoned gravel sites as oil production declines in Prudhoe Bay.

Rog, S.; Owens, D.; Pearson, L.; Tumeo, M.; Braddock, J., and Venator, T. **PES-51 registered shoreline restoration of weathered subsurface oil in Prince William Sound, Alaska**. *In. Proceedings: Seventeenth Arctic and Marine Oil Spill Program Technical Seminar*. Ottawa: Environment Canada; 1994; 1 pp. 607-620.
A description of a July 1993 shoreline restoration project conducted by Tesoro Alaska Petroleum Company and Tesoro Environmental Products Company using PES-51, a biosurfactant, and a modified air knife injection system on La Touche Island in Prince William Sound.

Ross, Gary Noel. **Butterflies descend on offshore rigs: scientist reports firsthand on monarchs' migration route**. *Louisiana Environmentalist*. September/October 1994; 2(5):12-15.
Offshore oil production structures provide a haven for wildlife, including migrating butterflies.

Ross, J. L.; Ferek, R. J.; Hobbs, P. V. **Particle and gas emissions from an *in situ* burn of crude oil on the ocean**. *Journal of the Air and Waste Management Association*. 1996; 46251-259; ISSN: 1047-3289.
Described are airborne measurements for particles and gases from two test burns of crude oil during NOBE (Newfoundland Offshore Burn Experiment.

Rudenko, B. A.; Savchuk, S. A.; Belushkin, V. V.; Zolotova, M. Y.; Kudin, A. M.; Lazeikina, M. A. **A study of petroleum pollution in some water areas in the Sea of Azov**. *Journal of Analytical Chemistry*. January 1996; 51(2):202-208; ISSN: 1061-9348.
Researchers used extraction-gravimetric, IR spectroscopic, and gas chromatographic methods to determine the concentration of petroleum products of the water in Taganrog Bay of the Sea of Azov. Researchers reported the concentrations in the examined area having a range from 5-15 mg/L, which is 100-300 times above the maximum permissible concentration for fishery areas.

ST mini-profile: Ocean Pollution Research Center. *Sea Technology*. October 1994; 35(10):45; ISSN: 0093-3651.
A profile of the Ocean Pollution Research Center (OPRC) of the University of Miami Rosenstiel School of Marine and Atmospheric Science (RSMAS) is presented.

Saeed, T.; Al-Bloushi, A.; Al-Matrouk, K. **Assessment of levels of polycyclic aromatic hydrocarbons in the oil from Kuwait oil lakes**. *Archives of Environmental Contamination and Toxicology*. 1995; 29(1):45-51; ISSN: 0090-4341.
Researchers determined the levels of polycyclic aromatic hydrocarbons (PAHs) in Kuwaiti lakes to assess the impact of the Gulf War. Samples were collected from two oil lakes. These samples were fractionated and analyzed quantitatively by GC/MS. The effects of weathering were also monitored over a 21 month period. Results indicated that initially total PAH levels ranged from 52.4 to 425.7 mg/kg, with phenanthrene and chrysene as the major compounds. Benzo(a)pyrene was found to be in all samples at varying levels (0.46 to 5.3 mg/kg). After 21 months, the total PAH content was found to be higher (ranging from 59.55 to 616.9 mg/kg), as were the levels of benzo(a)pyrene (0.16 to 22.2 mg/kg).

Schneider, David. **Like a sieve**. *Scientific American*. September 1995; 273(3):42; ISSN: 0036-8733.
Last year's rupture of an oil pipeline in Russia's Komi Republic resulted in an oil spill of very large proportions. According to oil pollution expert Richard Golob, a corroding oil infrastructure is causing as much as 10 million metric tons of oil to be spilled from pipelines in the former Soviet Union each year. In the cited case as well as in others, it has not been economically feasible to shut off the flow when leaks occur, as oil producers were paid not for the amount of oil delivered, but for the amount produced.

***Sea Empress* oil spill response questioned**. *Oil & Gas Journal*. January 27, 1997; 95(4):34. ISSN: 0030-1388.
A brief report alleging that poor knowledge of the sea conditions (tides, water depths) in the spill area (Milford Haven harbor) may have worsened the effects of the spill.

Sen Gupta, R.; Fondekar, S. P.; Shailaja, M. S.; Sankaranarayanan, V. N. ***Maersk Navigator* oil spill in the Great Channel (Andaman Sea) in January 1993 and its environmental impact.** *Spill Science and Technology*. 1995; 2(2/3):113-119. ISSN: 1353-2561.
Observations of the oil slicks, tar residues, and dissolved petroleum hydrocarbons soon after the *Maersk Navigator* oil spill of January 1993 showed little impact on the Indian EEZ of the Great Channel. Researchers reported that it appears as if the prevailing NE winds and surface currents pushed the oil patches out towards to the open Indian Ocean.

Shipley, Frank. **Fallout from airborne hydrocarbons affects bay quality**. *BayLine*. Spring 1995; 4-5.
A discussion of hydrocarbon pollutants which are airborne and deposited across the Galveston Bay watershed.

Shipley, Frank S. **Pipeline breaks impact water quality: oil and water still don't mix**. *BayLine*. 1995; Winter1+.
The impact and sources of oil in the waters of Galveston Bay, and the Galveston Bay Plan, an initiative to keep Glaveston Bay clean, are discussed.

Simpson, R. D.; Smith, S. D. A.; Pople, A. R. **The effects of a spillage of diesel fuel on a rocky shore in the sub-Antarctic region (Macquarie Island)**. *Marine Pollution Bulletin*. April-December 1995; 31(4-12):367-371; ISSN: 0025-326X.
Researchers assessed the extent of the effects of the *Nella* Dam spill of diesel fuel at Macquarie Island via examination of algal and invertebrate populations of the littoral and sublittoral rocky shore and the invertebrate communities living in the holdfasts of the giant kelp *Durvillaea antarctica*. Results indicated that on the rocky shore, the spill affected only some biota of the lower littoral and sublittoral zones (primarily echinoderms and *Nacella macquariensis*). In the holdfasts, the oil-affected locations were dominated by polychaetes, whereas the communities at the control locations were dominated by peracarid crustaceans.

Singsaas, I.; Brandvik, P. J.; Daling, P. S.; Reed, M., and Lewis, **A. Fate and behavior of oils spilled in the presence of ice - a comparison of the results from recent laboratory, meso-scale flume and field tests.** In. *Proceedings: Seventeenth Arctic and Marine Oil Spill Program Technical Seminar.* Ottawa: Environment Canada; 1994; 1 pp. 355-370.
It is reported that in the Arctic the behavior of oils spilled in cold water in the presence of ice will differ from the behavior of oils spilled in warmer water. Thus, the fate of the oil will be influenced by prevailing conditions.

Skalski, J. R. **Statistical considerations in the design and analysis of environmental damage assessment studies.** *Journal of Environmental Management.* January 1995; 43(1):67-85; ISSN: 0301-4797.
Alternative approaches to the design of damage assessment studies that examine spatial and/or temporal trends in biological responses centered around an oil or chemical spill are discussed.

Skvortsov, V. V. **Meiobenthos communities of some subarctic lakes.** *Hydrobiologia.* January 17, 1997; 342:117-124. ISSN: 0018-8158.
Meiobenthos communities were studied in 19 relatively small tundra lakes in Eureopean Russia. Each lake was separated into deep and shallow waters. The study was to characterize structure, abundance, and spatial distribution of meiofauna in subartic lakes in relation with essential environmental factors and to investigate the pollution response patterns of meiobenthos communities.

Solow, A. R. **Saturday effect in tanker oil spills.** *Journal of Environmental Economics Management.* 1994; 26(3):293-296; ISSN: 0095-0696.
This comment concerns the 'saturday effect', which has been identified and proposed by Goodstein. Described are two ways in which the validity of the statistical analysis used to identify and confirm the 'Saturday effect' can be strengthened.

Stone, Richard. **Russian Arctic battles pipeline leak.** *Geotimes.* August 1995; 40(8):4; ISSN: 00168556.
Beginning last August, an estimated 100,000 barrels of oil have leaked from a corroded pipeline in nine spills covering 70 hectares of peat bog in northern Russia's Komi Republic, threatening salmon fisheries and marshlands used for grazing cattle and reindeer. In April, the World Bank agreed to loan $99 million to the Russian firm that produces the oil and maintains the deteriorating pipeline to help repair the damage. Cleanup efforts began in March.

Stromgren, T. and others. **Acute toxic effects of produced water in relation to chemical composition and dispersion.** *Marine Environmental Research.* 1995; 40(2):147-169; ISSN: 0141-1136.
A study of produced water from oil fields in the Norwegian North Sea concludes that there is a large variation in chemical composition and toxicity towards test organisms (algae and bivalves). Biodegradation changed the chemical composition and generally reduced the toxicity of the produced water. Acute toxicity should only be expected in the immediate vicinity of the produced water outlets, and toxic effects are considered negligible at distances .2 km from the source.

Subramanyam, V. and others. **Gas-to-particle partitioning of polycyclic aromatic hydrocarbons in an urban atmosphere.** *Atmospheric Environment.* 28(19):3083-3091.
Researchers reported that sampling near urban sources of PAH and TSP show particulate associated PAH levels several orders of magnitude higher than background concentrations. Partition coefficients of semi-volatile atmospheric PAHs should be more closely related to temperature and the total suspended particulate concentration. Use of the conventional high-volume air sampler can cause significant errors in estimates of partition coefficients of SOCs; more accurate measures can be obtained with a modified low-volume sampler and annular denuder technology.

Swinbanks, D. **Oil spill threatens Japanese nuclear plants.** *Nature.* January 1997; 385(6613):191; ISSN: 0028-0836.
On January 2, 1997, the Russian oil tanker *Nakhodka* split in two causing Japan's worst-ever oil spill. Presented is a brief description of the spill, the ensuing cleanup, and the spill ramifications, including the possible shut down of nuclear power plants along the coast of the Japan Sea because of large oil slicks approaching the seawater intakes of these plants.

Systems Applications International and others. Gulf of Mexico air quality study, final report. New Orleans, LA: US Department of the Interior, Mineral Management Service; 19953 vols.(OCS Study; MMS 95-0038,39,40).
Volume I: summary of data analysis and modeling; Volume II: data analysis, appendices A-M; Volume III: inventory preparation, appendices N-P.

ENVIRONMENT/ECOSYSTEM MANAGEMENT/SPILLS

Tanker spills fall to record low in 1995. *Marine Pollution Bulletin.* September 1996; 32(8/9):584; ISSN: 0025-326X.
Ocean Orbit, the International Tanker Owner's Pollution Federation (ITOPF) annual newsletter, reports a dramatic decrease in the incidence of accidental oil spills in 1995. With only two major tanker spills from South Korea, the total amount of oil spilled was the lowest recorded since ITOPF started collecting data in 1970.

Technical product news: petroleum in freshwater environment, an annotated bibliography. *Spill Science and Technology Bulletin.* September 1994; 1(1):91; ISSN: 1353-2561.
The availability is noted for a bibliography compiled by the American Petroleum Institute (API) which contains about 600 citations to literature from 1946 to 1993 concerning the impact to the environment and human health of surface freshwater oil spills.

Technical product news: software for shoreline response decision support and data management. *Spill Science and Technology Bulletin.* September 1994; 1(1):89; ISSN: 1353-2561.
The shoreline spill response decision support software package, SHORECLEAN, is described.

Technical product news: the Barrier Boom (TM). *Spill Science and Technology Bulletin.* September 1994; 1(1):89-90; ISSN: 1353-2561.
An inflatable boom for at-sea oil containment, the Barrier Boom (TM), is described.

Testa, J. W.; Holleman, D. F.; Bowyer, R. T.; Faro, J. B. **Estimating populations of marine river otters in Prince William Sound, Alaska, using radiotracer implants.** *Journal of Mammalogy.* November 1994; 75(4):1021-1032; ISSN: 0022-2372.
One year after the *Exxon Valdez* oil spill, radiotransmitters and radiotracer labels were implemented to mark river otters, *Lutra canadensis*, at Knight Island (oiled) and Ester Passage (unoiled). The researchers reported there was no evidence that densities of river otters at King Island were less than those at Ester Passage.

Tong, Junan. **The main source and distribution characteristics of pollutants in Laizhou Bay.** *Huang Bohai Haiyang.* 1994; 12(4):16-20; ISSN: 1000-7199.
The author presents the source and distribution of pollutants in the waters of Laizhou Bay. Petroleum and COD were found to be most prevalent, originating mainly from the mouths of the rivers along the southwestern coast (Xiao Qing River, Guang Li River).

Tumeo, M. A.; Larson, M. K. **Movement of fuel spills in the Ross Ice Shelf.** *Antarctic Journal of the United States.* 1994; 29(5):373-374; ISSN: 0003-5335.
Researchers studied the resulting oil 11400 L spill from a fuel-line connection failure on the Ross Shelf (3 December 1993).

Tumeo, M. A.; Wolk, A. E. **Assessment of the presence of oil-degradating microbes at McMurdo Station.** *Antarctic Journal of the United States.* 1994; 29(5):375-377; ISSN: 0003-5335.

Turrell, W. R. **Modelling the *Braer oil*-spill: a comment on Proctor et al. (1994).** *Marine Pollution Bulletin.* January 1995; 30(1):92-93; ISSN: 0025-326X.
Comments regarding articles authored by Proctor et al. (1994) and Turrell (1994).

UK counts cost of oil spill from Sea Empress. *Oil and Gas Journal.* 4 March 1996; 94 (10):41; ISSN: 0030-1388.
A brief news account of the February 1996 Sea Empress spill. The Sea Empress lost much of its 132,000 metric tons of crude oil cargo when bad weather caused it to run aground off the south Wales coast.

US logs 7 years without massive oil spill. *Oil & Gas Journal.* August 19, 1996; 94(34):36-38; ISSN: 0030-1388.
A brief review of a study by World Information Systems (Cambridge, MA).

US Environmental Protection Agency. **The Hydrocarbon Spill Screening Model (HSSM), volume 1: user's guide.** [Washington, DC]: US Environmental Protection Agency; April 1994; EPA/600/R-94/039a.
A guide to the use of EPA's Hydrocarbon Spill Screening Model.

US Environmental Protection Agency. **Laboratory study on the use of hot water to recover light oily wastes from sands.** [Washington, DC]: US Environmental Protection Agency; February 1993; EPA/600/R-93/021.
The use of hot water in the recovery of light oily wastes from sands is examined.

US Environmental Protection Agency. **Use of chemical dispersants for marine oil spills.** [Washington, DC]: US Environmental Protection Agency; November 1993; EPA/600/R-93/195.
The EPA's guidelines for use of chemical dispersants in the treatment of marine oil spills is presented.

US spill cleanup capability shows marked improvement. *Oil and Gas Journal.* January 1996; 94(1):22-25; ISSN: 0030-1388.
As a result of new organizations such as the Marine Spill Response Corporation (an independent oil spill reaction force established by major oil companies), the National Response Corporation, and roughly 70 other smaller firms, the U. S. is better prepared than ever to respond to oil spill accidents.

Vandermeulen, J. H.; Ross, C. W. **Oil spill response in freshwater: assessment of the impact of cleanup as a management tool.** *Journal of Environmental Management.* August 1995; 44(4):297-308; ISSN: 0301-4797.
The authors discuss and review the paucity of assessment plans focusing on the environmental impact of various cleanup methods implemented following an oil spill in freshwater.

Venosa, A. D.; Suidan, M. T.; King, D.; Wrenn, B. A. **Use of hopane as a conservative biomarker for monitoring the bioremediation effectiveness of crude oil contaminating a sandy beach.** *Journal of Industrial Microbiology & Biotechnology.* February-March 1997; 18(2-3):131-139. ISSN: 0169-4146.

Verburgh, J. J.; Hansen, B. G.; Karcher, W. **Clustering of environmental risks of PAH.** *Fresenius Environmental Bulletin.* September-October 1996; 5(9-10):505-510. ISSN: 1018-4619.

Walton, D. W. H.; Shears, J. **The need for environmental monitoring in Antarctica: baselines, environmental impact assessments, accidents and footprints.** *International Journal of Environmental Analytical Chemistry.* 1994; 55(1-4):77-90; ISSN: 0306-7319.
Examined are the background to environmental monitoring in Antarctica, the design of monitoring programs, the application of monitoring results to environmental management, and future research needs. Highlighted is the need for international collaboration to validate data, effectively utilize resources, and devise standard monitoring protocols.

Wania, Frank; Mackay D. **Tracking the distribution of persistent organic pollutants.** *Environmental Science & Technology.* September 1996; 30(9):390A-396A; ISSN: 0013-936X.
The authors report on the efforts to control a broad class of contaminants (persistant organic pollutants) known to migrate thousands of miles through the atmosphere.

Weiner, A.; Berg, C.; Gerlach, T.; Grunblatt, J.; Holbrook, K.; Kuwada, M. **The *Exxon Valdez* oil spill: Habitat protection as a restoration strategy.** *Restoration Ecology.* March 1997; 5(1):44-55. ISSN: 1061-2971.
This paper focuses on the alternative of habitat protection and acquisition. The intent of this alternative is to identify and protect, on private lands, the essential habitats of injured resources and services that are not adequately protected by existing laws and regulations.

Wells, P. G.; Butler, J. N., and Hughes, J. S. ***Exxon Valdez* oil spill: fate and effects in Alaskan waters.** West Conshohocken, PA: ASTM; 1995;960 p. ISBN: 0803118961.
A monograph consisting of a comprehensive overview of the 1989 oil spill with 25 selected papers on topics such as (a) chemistry and the fate of the spill, (b) shoreline impacts of the spill, (c) fish and fisheries, (d) effects on wildlife, and (e) archaeological site impact.

Weslawski, J. M.; Wiktor, J.; Zajaczkowski, M.; Futsaeter, G.; Moe, K. A. **Vulnerability assessment of Svalbard intertidal zone for oil spills.** *Estuarine Coastal and Shelf Science.* April 1997; 44(Suppl. A):33-41. ISSN: 0272-7714.
This paper discusses a plan to estimate the vulnerability of the interdial zone areas on the 3000 km coastline of the Svalbard archipelago, an undisturbed wilderness. The method presented in this paper is based on geomorphological maps and environmental data collected in the Svalbard intertida zone. Physical parameters and biological paramaters and a differnce in rank of importance were given with regard to oil sensitivity by index of vulnerability in each of the two categories.

Westphal, P.; Taylor, E., and Aurand, D. **Human health risk associated with burning as a spill countermeasure.** *In. Proceedings: Seventeenth Arctic and Marine Oil Spill Program Technical Seminar.* Ottawa: Environment Canada; 1994; 1 pp. 685-706.
Authors present a human health risk assessment to assist in evaluating burning as a spill countermeasure in a near-shore environment. Estimates of particulate matter and chemical concentrations were derived using data from a hypothetical burn of 10,000 gallons of crude oil. It was reported that estimated health risks at modeled exposure points are below levels of concern established by the US Environmental Protection Agency. However, concentrations of particulate matter could exceed US national and state ambient air quality criteria by a factor of two in certain situations.

Wiens, J. A.; Parker, K. R. **Analyzing the effects of accidental environmental impacts: approaches and assumptions.** *Ecological Applications.* November 1995; 5(4):1069-1083; ISSN: 1051-0761.
The authors present a review of several statistical designs for assessing and estimating the effects of accidental impacts, including oil spills.

Wise, W. R.; Guven, O.; Molz, F. J.; Mccutcheon, S. C. **Nutrient retention the in high-permeability, oil-fouled beach.** *Journal of Environmental Engineering.* November-December 1994; 120(6):1361-1379; ISSN: 0733-9372.
A description of a US Environmental Protection Agency initiated research project to evaluate the application of nutrients to the surface of Kittiwake Beach of Knight Island in Prince William Sound to stimulate biodegradation of the oil by indiginous microbial organisms.

Witt, G. **Polycyclic aromatic hydrocarbons in water and sediment of the Baltic Sea.** *Marine Pollution Bulletin.* April - December 1995; 31(4-12):237-248; ISSN: 0025-326X.
Fifteen polycyclic aromatic hydrocarbons (PAHs) and their distribution were investigated in the surface sediments and seawater of the Baltic Sea. The author discusses the PAH concentrations in relation to water depth and reports that elevated concentrations were observed in coastal regions, as were seasonal variation in PAHs in seawater (lowest concentration in summer; highest in November). In addition, a method for analyzing low concentrations of PAHs, which is based on high performance liquid chromatography with fluorescence detection, is presented.

Wolfe, D. A.; Long, E. R.; Thursby, G. B. **Sediment toxicity in the Hudson-Raritan Estuary: distribution and correlations with chemical contamination.** *Estuaries.* December 1996; 19(4):901-912. ISSN: 0160-8347.
Researchers assessed the spatial patterns of sediment toxicity in the Hudson-Raritan Estuary using amphipods, bivalve larvae, and luminescent bacteria. Results from the assessments indicate that the upper East River, Arthur Kill, Newark Bay, and Sandy Hook Bay exhibited the greatest sediment toxicity, whereas the lower Hudson River next to Manhattan Island, upper New York Harbor, lower New York Harbor off Staten Island, and parts of the Raritan Bay showed lower toxicity. In addition, results suggest that toxicity was primarily associated with polynuclear aromatic hydrocarbons and not metals, with the exception of mercury.

Wolfe, Douglas A. and others. **The fate of the oil spilled from the *Exxon Valdez*.** *Environmental Science and Technology.* 1994; 28(13):561A+; ISSN: 0013-936X.
The authors have reconstructed a spacial-temporal mass balance up through the summer of 1992 for the oill spill in Alaska's Prince William Sound. This article presents their conclusions to support their analysis.

WWII oil-filled tanker found near Monterey Bay sanctuary. *Fisheries.* April 1997; 22(4):51. ISSN: 0363-2415.
The *Montebello*, a recently discovered sunken World War II oil tanker, is thought to still hold more than 3 million gallons of crude oil that could threaten the fisheries and aquatic resources of Monterey Bay National Marine Sanctuary in California. Archaeologist, Jack Hunter recommends that the ship be monitored for the next 10 years until technology is developed to draw out the oil without danger or a spill.

Ye, Xinrong; Lu, Bing. **The concentration of oils around Nanji Islands.** *Donghai Marine Science.* 1994; 12(2):101-104; ISSN: 1001-909X.
Researchers conducted a fluorescent spectrographic analysis of oils surrounding the Nanji Islands and reported the distribution of the oil concentration.

Yunker, Mark B. and others. **Polycyclic aromatic hydrocarbon composition and potential sources for sediment samples from the Beaufort and Barents Seas.** *Environmental Science & Technology.* April 1996; 30(4):1310-1320; ISSN: 0013-936X.
Researchers interpreted polycyclic aromatic hydrocarbon distributions from Arctic marine sediments to ascertain their anthropogenic origins and transport pathways. Results indicated that the Beaufort Sea sediments contained greater concentrations of natural PAHs, which overwhelmed the anthropogenic sources, whereas the Barents Sea contained 2-20 times lower natural PAHs, while the anthropogenic contribution was greater.

Zengel, S. A.; Michel, J. **Vegetation cutting as a clean-up method for salt and brackish marshes impacted by oil spills: a review and case history of the effects on plant recovery.** *Marine Pollution Bulletin.* December 1996; 32(12):876-885; ISSN: 0025-326X.
A review of several studies focusing on the clean-up technique of manually cutting marsh vegetation contaminated by oil spills, including a case history of the *Grand Eagle* oil spill, where marsh vegetation cutting was implemented as a technique for clean-up. The authors conclude that cutting is often detrimental, and should only be used in areas where oil would persist, significant impact on wildlife is likely, and other methods of clean-up are ineffective.

Zengel, Scott A.; Michel, Jacqueline. **Vegetation cutting as a clean-up method for salt and brackish marshes impacted by oil spills: a review and case history of the effects on plant recovery.** *Marine Pollution Bulletin.* 1996; 32(12):876-885. ISSN: 0025-326X.
An investigation on the effects of the clean-up technique, and the survival and structural recovery of cutting on oil spill contaminated marsh vegetation is presented, along with a case history of the *Grand Eagle* oil spill.

Zielenziger, Michael. **Giant oil spill turns Tokyo Bay into environmental nightmare.** *The Times-Picayune.* New Orleans, LA; July 3, 1997; A: A-1 and A-22.
Maritime officials could not contain the spread of nearly 4 million gallons of light crude oil that spilled in Tokyo Bay after a supertanker ran aground July 2, 1997. This is the worst oil spill Japan has ever experienced. Safety precautions are being taken to protect the oil-fired electric generating plants and a series of giant petrochemical complexes. Endangerment of shellfish, sushi, and other seafood are of concern to officials.

SOCIOECONOMIC/REGULATION/GENERAL

Abbot, Alison. ***Brent Spar*: when science is not to blame**. *Nature*. 7 March 1996; 380(6569):13-14; ISSN: 0028-0836.
The author discusses the decision to temporarily refrain from disposing the *Brent Spar* in the deep-sea.

Abu Dhabi: the role of state oil companies. *Oil and Gas Journal*. August 16, 1993; 9162+; ISSN: 0030-1388.
An overview of Abu Dhabi National Oil Company (Adnoc) is presented.

Agencies cooperate, minimize spill impacts. *Gulfwatch*. November-December 1994; 5(6):3.
The problems associated with non-point source pollution from flooding in the Galveston Bay are discussed.

Agreement for cooperation in dealing with pollution of the North Sea by oil and other harmful substances, 1983. In. *The Marine Mammal Commission Compendium of Selected Treaties, International Agreements and Other Relevant Documents on Marine Resources, Wildlife and the Environment*. Washington, DC: US Government Printing Office, Superintendent of Documents; [1994];3 v.
The 1983 North Sea pollution document is presented in conjunction with other similar treaties and agreements.

Ahmad Khan, Sarah. **Nigeria: the political economy of oil**. New York: Oxford University Press; 1994;234 p. ISBN: 0197300146.
A detailed analysis of the problems and obstacles that a developing country faces in trying to exploit its natural resources.

Alaska commercial fishers awarded $286.8 Million in *Exxon oil* spill. *Fisheries*. November 1994; 19(11):48.
A brief press report on the awards given to commercial fishers, villagers and businesses by a federal jury .

Alidi, A. S.; Al-Faraj, T. N. **Locating oil spill response equipment and facilities: a cluster analysis approach** . *Geojournal*. 1994; 34(4):379-382; ISSN: 0343-2521.
Presented is a binary integer mathematical model based on the cluster analysis approach to aid in determining the optimal sites for locating oil spill response equipment and facilities within a semi-enclosed waterway. Application of this model has been illustrated using hypothetical data to determine optimal sites for locating oil spill response equipment in the Arabian Gulf region.

Allen, S. G. **CD-ROM and its application to the petroleum industry**. Giles, J. R. A. *Geological Data Management*. Avon, England: Geological Society Publishing House c1995 pp. 163-180. ISBN: 1-897799-34-X.

Alliance sought for focus on California production hurdles. *Oil and Gas Journal*. June 28, 1993; 9138; ISSN: 0030-1388.
It is reported that Lawrence Berkeley Laboratory (LBL) wants to form a coalition of oil and gas producers to identify, test and apply appropriate technology to oil and gas production problems unique to California.

Ambrose, P. **A cleaner UK offshore oil industry**. *Marine Pollution Bulletin*. July 1996; 32(7):524; ISSN: 0025-326X.
The author reports on the significant decline in the number of oil spills by the UK oil industry (discharges are now at 50% their levels 10 years ago), despite an increase in UK oil production.

API: industry improves environmental record. *Oil & Gas Journal*. June 1996; 94(26):28; ISSN: 0030-1388.
According to the American Petroleum Institute's fourth annual environmental performance report, the US oil and gas industry is improving its environmental, health, and safety records. Some highlights in this report include: (a) the oil industry spends as much on environmental protection as it did searching for oil ($10.6 billion), (b) refineries released 10% fewer chemicals into the environment in 1994 compared with the previous year, (c) refinery releases have declined 24% since 1988, and (d) there were 7,800 spills in 1994, down 17% from the previous year (although nearly twice as much oil was spilled).

Australia's National Oil Spill Plan subject to audit. *Marine Pollution Bulletin*. August 1995; 30(8):503.
In November 1994, the Australian National Audit Office released its report on an audit of Australia's National Plan to Combat Pollution of the Sea by Oil. The audit found that since the management of the national plan was assumed by the Australian Maritime Safety Authority, there have been significant improvements in communication and technical support. However, the audit found a number of areas where improvements are required including: AMSA has no clearly defined role as the National Plan managing agency, AMSA focuses too much on maritime operational matters, and AMSA's lack of strategic approach in managing the National Plan.

SOCIOECONOMIC/REGULATION/GENERAL

Azeri deals still on despite turmoil. *Oil and Gas Journal.* June 28, 1993; 9133-37; ISSN: 0030-1388.
It is reported that foreign oil companies operating in the former Soviet republic of Azerbaijan have met with difficulty recently due to the civil unrest there.

Bedborough, D. **The use of satellites to detect oil slicks at sea.** *Spill Science & Technology Bulletin.* 1996; 3(1/2):3-10. ISSN: 1353-2561.
The Marine Pollution Control Unit (MPCU) was organized by the UK Government to respond to oil and chemical spills from ships at sea. Their responsibility is to implement the UK's National Contingency Plan for dealing with oil spills that occur accidentally or intentionally. To effectively monitor the sea, the MPCU is utilizing a Cessna 404 remote sensing aircraft.

Bookman, C. A. **A sea change for oil tanker safety**. In: Della, Croce N. and others. *Coastal Ocean Space Utilization III: Proceedings of the Symposium (Genoa), March 1993*: E & FN Spon; 1995; pp. 189-195. ISBN: 041920900X.
Presented is an appraisal and review of three uses of coastal space (vessel traffic control systems, tanker safety zones, and offshore loading terminals) along with a review of the marine transportation oil spill record over the past 25 years, including the changes in government rules and the industry operating practices.

Bornholdt, M. A. and Lear, E. M. **Outer Continental Shelf Natural Gas and Oil Resource Management Program: Cumulative Effects, 1987-1991.** Herndon, VA: Minerals Management Service; 1995; OCS Report, MMS 95-0007. 228 p.

Brazil advances subsea technology in Marlim pilot. *Oil and Gas Journal.* March 29, 1993; 9138-39; ISSN: 0030-1388.
The water depth records set by Petroleo Brasileiro (Petrobras) during a pilot project in Marlim oil field in the Campos basin off Brazil in 1992 are described.

Bruce, Gregory; Shermer, Richard. **Strategic partnerships, alliances used to find ways to cut costs.** *Oil and Gas Journal.* November 8, 1993; 9171+; ISSN: 0030-1388.
Ideas for gaining a competitive advantage in the commoditized oil and gas industry are suggested.

Bugrov, L; Murav'-ev, W. B.; Lapshin, O. M. **Alternative using of petroleum-gas structures in the Caspian and Black seas for fish-farming and fishing: real experiences and rigs conversion prospects.** *Fifth International Conference of Aquatic Habitat Enhancement.* 1994; 55(2-3):1331-1332; ISSN: 0007-4977.
In light of the staggering costs associated with disassembling and removing petroleum platforms, the authors discuss the implications of converting the platforms into artificial reefs for fisheries purposes.

Burruss, R. C. **USGS oil and gas CD hits the charts.** *Geotimes.* July 1995; 40(7):14-16; ISSN: 0016-8556.
A review of the recently released CD-ROM: U.S. Geological Survey's 1995 Assessment of National Oil and Gas Resources.

Busch, Lisa. **Marine center is lightning rod in dispute over restoration.** *Science.* July 14, 1995; 269(5221):159; ISSN: 0036-8095.
A brief account and summary of the debate between the scientists, fishing industry, and environmental groups centering on the Alaska Sea Life Center (ASLC). The ASLC is a $47 million marine research and rehabilitation center currently being built near Prince William Sound in Alaska.

California imposes oil spill liability on certain pipelines. *Oil and Gas Journal.* October 1995; 93(43):44; ISSN: 0030-1388.
A brief report on a new California law imposing a liability, as much as $100 million, on pipelines that qualify as a public utility.

Call for R&D project descriptions - R&D abstract database. *Spill Science and Technology.* 1995; 2(4):217-221. ISSN: 1353-2561.
The Second International Oil Pollution R&D Abstract Database has been created for distribution to the attendees of the Second International Oil Spill Research and Development Forum (May 1995). Included on this database are records of 250 R&D projects, with each record containing fields such as research category, keywords, name of R&D sponsors/research organizations, funding levels, and completion date. Overall, the purpose of this database is to reduce redundant research and encourage collaborative efforts.

SOCIOECONOMIC/REGULATION/GENERAL

Canada hits polluters hard. *Marine Pollution Bulletin.* November 1996; 32(22):765; ISSN: 0025-326X.
David Anderson, Canada's transport minister, reports that new pollution laws will incorporate the 1992 Protocols of the Fund Convention, and include raising fine limits to $1 million (Canadian $) and require tankers to carry an approved oil pollution emergency plan. In addition, 25% of all foreign tankers will be inspected as will any vessel new to Canadian waters. So far this year 15% (33 of 218) of the inspected tankers have been detained until necessary improvements are made.

Caswell, M. F. **Economic Effects of Oil and Gas Development on Marine Aquaculture Leases**. Camarillo, California: Minerals Management Service; 1991; OCS Study, MMS 94-0036. 43 p.

Cedar-Southworth, Donna. **1995 promises good opportunities for offshore operators**. *MMS Today.* February 1995; 5(1):6-7.
Hank Bartholomew, Deputy Associate Director for Offshore Operations, discusses some of the high priorities for 1995, including interaction with states on oil spill response, OHMSETT plans, and training and safety programs.

Cedar-Southworth, Donna. **Preparation begins for OCS oil and gas leasing program**. *MMS Today.* February 1995; 5(1):1+.
A description and implications of the MMS 5-year Oil and Gas Leasing Program for 1997-2002 is presented.

Chapman, Peter M. and others. **Science and common sense in Port Valdez, Alaska**. *Marine Pollution Bulletin.* March 1996; 32(3):254-256; ISSN: 0025-326X.
The authors illuminate the potentially contentious situation concerning the Ballast Water Treatment Plant at the Valdez Terminal of the Trans Alaska Pipeline System.

Coe, T. J. **Lessons learned outfitting the U.S. Coast Guard with oil pollution equipment.** *Spill Science and Technology.* 1995; 2(4):233-239. ISSN: 1353-2561.
The US spent $30,500,000 for oil pollution recovery equipment for the USCG in response to the Oil Pollution Act of 1990. Presented are lessons learned from this expenditure. Also described are a generic requirements analysis, a process of selecting equipment, and the staging site selection process.

Coleman, E. **Shooting from the hip: toxic spills need quick decisions**. *Coast & Sea.* Fall 1996; 5(2):2-5.
Presented is a brief expose focusing on the emergency spill response team from Louisiana State University's Institute for Environmental Studies.

Conference Announcement: An International Workshop on Offshore Lease Abandonment and Platform Disposal: Technology, Regulation and Environmental Effects; 1996 Apr 15-1996 Apr 17; Doubletree Hotel, New Orleans, Louisiana.
The Outer Continental Shelf (OCS) of the United States has over 22,000 miles of pipelines and 4,000 offshore platforms, with a quarter of these more than 25 years old. Each year 100 to 150 of these platforms have been removed from the OCS. The goal of this workshop is to facilitate the discussion and evaluation of platform removal and disposal techniques, policies and regulations.

Conference on oil spill prevention. *Gulfline.* October 1995; 7(10):2.
Clean Gulf '95, the fifth annual conference and exhibition on oil spill prevention and response in previewed. The conference is scheduled for October 31 - November 1, 1995 in New Orleans, LA, and will be hosted by the State of Louisiana, Oil Spill Coordinator's Office, and the Texas General Land Office.

Cordner, L. G. **The Spratly Islands dispute and the Law of the Sea**. *Ocean Development and International Law.* 1994; 25(1):61-74; ISSN: 0090-8320.
The Spratly Islands in the South China Sea are possibly rich in hydrocarbon deposits. Six Chinese States have claimed overlapping territory on the islands and the aegis of the 1982 United Nations convention on the Law of the Sea has been ineffective in settling the dispute.

Cote d'Ivoire offers large tracts. *Oil and Gas Journal.* November 22, 1993; 9130-32; ISSN: 0030-1388.
It is reported that Cote d'Ivoire has opened an international bidding round for production sharing contracts (PSCs) on three blocks located mainly in the Gulf of Guinea.

Crain, William. **Managing for change in today's oil industry**. *Oil and Gas Journal.* November 22, 1993; 9134; ISSN: 0030-1388.
The vice-president of Chevron Corporation discusses the importance of dealing with change in the oil industry in the context of his company.

SOCIOECONOMIC/REGULATION/GENERAL

Crow, Patrick. **As the oil burns**. *Oil & Gas Journal.* September 30, 1996; 94(40):30; ISSN: 0030-1388.
The author reports on the unsuccessful attempt by the Washington state Department of Ecology to experiment with burning as a possible method to remove oil from marine environments. The Department of Ecology could not get permits from the Environmental Protection Agency and ran into local opposition.

Crow, Patrick. **Changes at MSRC** . *Oil & Gas Journal.* October 21, 1996; 94(43):31; ISSN: 0030-1388.
An editorial discussing the Marine Spill Response Organization and its recent changes is presented.

Crow, Patrick. **Spill response**. *Oil and Gas Journal.* 1 April 1996; 94 (14):33; ISSN: 0030-1388.
The author discusses the congressional legislation (draft bill) that would require the Coast Guard to issue rules by June 30 for the 87 remaining single hull barges in US waters in an effort to ensure 'substantial protection to the environment as is economically and technologically feasible' until they are phased out.

Davies, Gareth. **Offshore Kazakhstan-Ultimate challenge for the oil industry.** *Marine Pollution Bulletin.* March 1997; 34(3):145. ISSN: 0025-326X.
A consortium of international oil companies are negotiating and addressing several challenges before oil developments off Kazakhstan, in the Caspian Sea can proceed: 1) high levels of environmental sensitivity in the area and concurrent strict legislative regime; 2) extreme climatic cycle temperatures varying from 300° C in summer to -200° C in winter; 3) access to sites because of wide expanse of very shallow water, wind driven surges, retreats of water and long term sea level fluctuations; 4) high amounts of sulphur in adjacent onshore fields will require new technology to separate sulphur from hydrocarbons.

DeKoker, Brenda. **Going down: Japan invests in an alternative source of energy**. *Scientific American.* 1995; 273(2):36-37.
A brief report on Japan's interest and investment (an 87 million dollar project planned by the Japan National Oil Corporation) in gas hydrates, icy deposits of crystallized natural gas and water that form under the deep ocean and Arctic permafrost.

Douligeris, C.; Collins, J.; Iakovou, E.; Sun, P.; Riggs, R.; Mooers, C. N. K. **Development of OSIMS: an oil spill information system.** *Spill Science and Technology.* 1995; 2(4):255-263. ISSN: 1353-2561.
Presented is the structure of the Oil Spill Information Management System (OSIMS), which consists of an object-relational database management system, an intelligent decision support system, an advanced visualization system and a geographic information system. OSIMS is designed to provide comprehensive data pertaining to an oil spill event.

Drilling site on a National Seashore required extra environmental precautions. *Oil and Gas Journal.* November 6, 1995; 93(45):36-37; ISSN: 0030-1388.
An account of the comprehensive planning and procedures involved in the construction and use of an exploration well located on the Padre Island National Seashore.

Dubner, B. H. **Problem on the United States continental shelf -- measuring the environmental 'effectiveness' of the Outer Continental Shelf Act (OSCA).** *The Natural Resources Journal.* 1994; 34(3):519-524; ISSN: 0028-0739.
A review of the interplay of environmental standards with oil and gas leasing on the outer continental shelf.

D'Unger, Claude; Chapman, Duane; Carr, R. Scott. **Discharge of oilfield-produced water in Nueces Bay, Texas: a case study**. *Environmental Management.* January/February 1996; 20(1):143-150; ISSN: 0364-152X.
Authors developed a map of wells and produced-water discharge sites in and around Nueces Bay and identified unplugged wells suitable for conversion to produced-water disposal wells. In addition, the authors provide an evaluation and comparison of contemporary oil prices and the cost of converting existing wells into injection wells to determine economic feasibility.

Engelhardt, F. R. **Limitations and innovations in the control of environmental impacts for petroleum industry activities in the Arctic**. *Marine Pollution Bulletin.* 1994; 29(6-12):334-341; ISSN: 0025-326X.
Discussed is the petroleum industry's impact in the Arctic in relation to routine activities (e.g. seismic surveys, transportation, drilling and production discharges) and accidental occurrences such as oil spills.

SOCIOECONOMIC/REGULATION/GENERAL

EPA rule targets gulf, Cook Inlet E&P discharges. *Oil & Gas Journal.* 18 November 1996; 94(47):23; ISSN: 0030-1388.
Limits on pollution discharges from oil and gas production facilities on the Gulf of Mexico and Alaska's Cook Inlet have been issued under the Clean Water Act by the US Environmental Protection Agency. It has been reported that these limits are expected to reduce the current discharges of toxic pollutants (arsenic, cadmium, lead) by more than 200,000 lb/year, conventional pollutants (oil, grease, solids) by 2.8 million lb/year and non-conventional pollutants by (chlorides, ammonia, aluminum) by 1.5 billion lb/year. EPA has stated the rule will cost industry $16.2 million/year.

Expert panel to judge on deep sea disposal. *Nature.* October 26, 1995; 377(6551):670; ISSN: 0028-0836.
News account of Tim Eggar's (Britain Minister for Industry and Energy) creation of an international panel of scientists and engineers to evaluate the technical issues raised by the disposal of the *Brent Spar* oil storage platform and to appraise new proposals by Shell.

***Exxon Valdez* oil spill retrial bid denied.** *Marine Pollution Bulletin.* April 1996; 32(4):325; ISSN: 0025-326X.
Exxon's claim that misconduct by the jury that awarded a $5 billion fine on the company was grounds for a retrial has been denied by Federal Judge Russel Holland. Final judgement on the $5 billion punitive fine has not been entered.

Exxon Valdez Oil Spill Trustee Council. **Summary of public comment on alternatives of the draft *Exxon Valdez* Oil Spill Restoration Plan.** Anchorage, AK: The Council; [1993].
Compilation of public comments regarding proposed amendments to the draft of the *Exxon Valdez* Oil Spill Restoration Plan.

Falkland Islands spells out block offering details. *Oil and Gas Journal.* October 9, 1995; 93(41):36; ISSN: 0030-1388.
A brief description of the Falkland Islands' plan of offering 44,000 sq km of virgin offshore territory for exploration.

Fegan, D. **Pacific Rim countries debate oil and the environment.** *Marine Pollution Bulletin.* December 1996; 32(12):835; ISSN: 0025-326X.
Presented is a brief discussion of the recent International Conference on Oil and Gas Development in Southeast Asia (Ho Chi Mihn City). The conference was organized by the Texaco Foundation and the Asia Foundation and was created as a forum to find a consensus on environmental and industrial development issues of the oil and gas industry in Southeast Asia.

The FEIS is available on the proposed Institute of Marine Science infrastructure improvement project in Seward, AK ... *Coastal Zone Management.* September 15/30, 1994; 25(13/14):5.
Information is offered on the final environmental impact statement for the *Exxon Valdez* oil spill which will be compiled by the Department of the Interior on behalf of the *Exxon Valdez* Oil Spill Trustee Council.

Financial Times International Yearbook: Oil and Gas, 1995: The Longman Group; 1994;650 p. ISBN: 0582256364.
Compiled are production and financial information on over 700 oil and gas companies, over 80 oil and gas brokers and 75 international oil and gas associations.

Foreign firms ink tentative $7 billion Caspian pact. *Oil and Gas Journal.* November 8, 1993; 9138; ISSN: 0030-1388.
A joint venture between eight foreign petroleum companies and the government of Azerbaijan is described.

Freudenberg, W. R. and Gramling, R. **Oil in troubled waters: perceptions, politics, and the battle over offshore drilling.** Albany, NY: State University Press of New York; 1994.
A monograph focusing on the social and political history of, and the dilemmas associated with, oil and gas development in the Gulf of Mexico and along the California coast.

Gachter, R. A. **Facts About Offshore Natural Gas.** Herndon, VA: Minerals Management Service; 1994; OCS Report, MMS 94-0069. 24 p.

SOCIOECONOMIC/REGULATION/GENERAL

Gage, John D.; Gordon, John D. M. **Sound bites, science and the *Brent Spar*: environmental considerations relevant to the deep-sea disposal option.** *Marine Pollution Bulletin.* December 1995; 30(12):772-779; ISSN: 0025-326X.
Shell UK's decision and rationale to select a deep-sea disposal of the redundant structure *Brent Spar* are analyzed and discussed by the authors.

Gibson-Smith, C. S. **Prospects for the upstream oil industry.** *Petroleum Review.* 1994; 48(564):7-11; ISSN: 0020-3076.
First presented as a 1993 Institute of Petroleum student lecture, views on economic forces, supply and demand balance, productivity and profitability, longer-tern forecasting, redefining competition and a synopsis of North Sea achievements and its future prospects are offered.

Gramling, R. and others. **Oil in the Gulf: Past Developments, Future Prospects.** New Orleans: Minerals Management Service; 1995; OCS Study, MMS 95-0031. 72 p.

Guénette, Chantel C.; Sveum, Per. ***In situ* burning of emulsions R&D in Norway.** *Spill Science and Technology Bulletin.* March 1995; 2(1):75-77; ISSN: 1353-2561.
Authors review the *in situ* burning programs in Norway and the results of research and development in this subject.

Hanna, S. S. **Oil on the continental shelf: markets, politics, environment.** *Illahee - Journal for the Northwest Environment.* Fall/Winter 1995; 11(3-4):151-163; ISSN: 1073-0478.

Hart, Tom and others. **Human and organizational errors in loading and discharge operations at marine terminals.** LaJolla, CA: California Sea Grant; 1994; CUIMR-T-94-003. 89 p.
Presented is a description of tanker loading and discharging in general, as well as the individual, system, environmental, organizational and procedural factors that increase the chances of an oil spill incident.

Hatfield, Craig Bond. **Oil back on the global agenda.** *Nature.* 1997; 387(6629):pg. 121. ISSN: 0028-0836.
The author writes about the increase in global oil consumption, it's production peak into the early years of the 21st century, and the concern of the declining oil reserves. The anticipated deficit in the oil production rate and the economic and social implications demand serious planning by the world's government.

Hawkins, S. J.; Proud, S. V.; Spence, S. K., and Southward, A. J. **From the individual to the community and beyond: water quality, stress indicators and key species in coastal ecosystems.** In: Sutcliffe, D. W., Ed. *Water Quality and Stress Indicators in Marine and Freshwater Ecosystems: Linking Levels of Organisation Individuals, Populations, Communities.* Ambleside, UK: Freshwater Biological Association; 1994; pp. 35-62. ISBN: 0900386541.
By examining three case studies within the Northeast Atlantic, the authors assess water quality and stress indicators at various levels of organization, from the individual to the community and beyond. In addition, the use of barnacles as a means to measure offshore changes is discussed.

Henderson, S. **Action urged on US oil spill law.** *Marine Pollution Bulletin.* June 1996; 32(6):457; ISSN: 0025-326X.
A brief discussion concerning the proposed legislation to implement the stringent Oil Pollution Act (1990) requirements until 2010, when double-hulls become mandatory.

Hinton, D. **Special issue: pollutant responses in marine organisms (PRIMO 8).** *Marine Environmental Research.* June-October 1996; 42(1-4): ISSN: 0141-1136.
The entire issue is devoted to the eighth PRIMO symposium, which brought together scientists engaged in research on mechanisms of toxicity, detoxification and protection, and assessment of biochemical, physiological, cellular, genetic, and histopathological effects of pollutants in marine organisms. These proceedings contain short research communications and abstracts from the symposium.

Hodel, Donald P. and Deitz, Robert. **Crisis in the Oil Patch: How America's Energy Industry is Being Destroyed and What Must be Done to Save It.** Washington, DC: Regnery; 1994;185 p.
Hodel and Dietz explore how the energy industry in the US has changed and what can be done to revitalize it.

Holmes, B. **Oil spill damages set at billions.** *New Scientist.* September 24, 1994; 143(1944):5; ISSN: 0262-4079.
Brief article discussing the $5 billion in punitive damages that Exxon must distribute to a group of native Alaskans, people who fish for a living, and others affected by the *Exxon Valdez* oil spill.

SOCIOECONOMIC/REGULATION/GENERAL

Home Page of **the Interstate Oil and Gas Compact Commission** [World Wide Web]. Interstate Oil and Gas Compact Commission (IOGCC) Oklahoma: Interstate Oil and Gas Compact Commission (IOGCC); 1995URL=http://www.iogcc.oklaosf.state.ok.us.
Although this World Wide Web Home Page focuses primarily on the history, leadership, and projects associated with the Interstate Oil and Gas Compact Commission (IOGCC), this Internet site can be used as a starting point to other oil- and gas-related home pages.

The House passed a law increasing licensing requirements for barge operators... *Coastal Zone Management*. September 15/30, 1994; 25(13/14):6.
Information is offered on the development of an inspection program for vessels carrying petroleum or other hazardous materials.

Howell, David G. **The future of energy gases**. Denver, CO: US Geological Survey; 1993; US Professional Paper 1570. 898 p.
Addressed are questions concerning the origins and habitats of energy gases. Included are estimates of gas resources, environmental consequences of using natural gas and the economics of energy gases.

Indonesia: the role of state oil companies. *Oil and Gas Journal*. August 16, 1993; 9168-70; ISSN: 0030-1388.
An overview of Pertamina, Indonesia's state-owned oil and gas company, which oversees all oil and gas operations in Indonesia, is presented.

International convention on civil liability for oil pollution damage, 1969, with protocols of 1976, 1984 and 1992. In. *The Marine Mammal Commission Compendium of Selected Treaties, International Agreements and Other Relevant Documents on Marine Resources, Wildlife and the Environment*. Washington, DC: US Government Printing Office, Superintendent of Documents; [1994];3 v.
The 1969 civil liabilities document is presented in conjunction with other similar treaties and agreements as well as several updates of protocol.

International convention on oil pollution preparedness, response and cooperation, 1990. In. *The Marine Mammal Commission Compendium of Selected Treaties, International Agreements and Other Relevant Documents on Marine Resources, Wildlife and the Environment*. Washington, DC: US Government Printing Office, Superintendent of Documents; [1994];3 v.
The 1990 oil pollution document is presented in conjunction with other similar treaties and agreements.

International petroleum research directory 1995 [CD-ROM]. New York: Stockton Press; 1995.
Published in association with the Petroleum Science and Technology Institute, this CD-ROM directory contains details of 3000+ research projects and 700 profiles of academic, commercial and governmental organizations of interest to the petroleum industry.

International petroleum research directory 1995. 3rd ed. New York: Stockton Press; 1995;750 p.
Published in association with the Petroleum Science and Technology Institute, the directory provides worldwide coverage of research projects and facilities in academic, commercial and governmental institutions of interest to the petroleum industry.

International Petroleum Research Directory, 1994. 2nd ed. The Longman Group; 1994;416 p. ISBN: 0582238269.
Contains data on recently completed hydro-related projects on upstream petroleum activity. Indexed.

Iran: the role of state oil companies. *Oil and Gas Journal*. August 16, 1993; 9148-49; ISSN: 0030-1388.
An overview of Iran's state-owned oil industry is presented.

Jackson, Julia. **Perspectives on petroleum**. *Geotimes*. July 1995; 40(7):17-19; ISSN: 0016-8556.
Reginal Spiller, Deputy Assistant Secretary for Gas and Petroleum Technologies at the U.S. Department of Energy and Marcus E. Milling, Executive Director of the American Geological Institute, share their thoughts on the domestic oil industry and DOE's efforts to improve domestic production.

Johnson, Jeff. **Oil rig sinking blocked in Europe, accepted in U.S. Gulf coast**. *Environmental Science and Technology*. September 1995; 29(9):406A.
A brief discussion of the pros and cons of oil rig sinking in the Gulf of Mexico and the North Sea.

SOCIOECONOMIC/REGULATION/GENERAL

Judice, Mary. **Seminar tackles oil cleanup act**. *The Times-Picayune*. New Orleans, LA; June 6, 1997; C: C-1 & C-3.
Oil producers are unclear on the regulations and who must comply with the Oil Pollution Act of 1990. The Minerals Management Service held a seminar to clarify the bill requiring oil companies to have adequate insurance or other finances to clean up oil spills.

Kerr, Richard. **U.S. oil and gas fields double in size**. *Science*. February 24, 1995; 2671090-1091.
The United States oil and gas reserves are assessed in light of the USGA announcement that known oil and gas fields now look far larger than had been thought.

Ketkar, K. W. **Protection of marine resources: the US Oil Pollution Act of 1990 and the future of the maritime industry**. *Marine Policy*. 1995; 19(5):391-400.
The author examines OPA 1990 and discusses maritime oil transfer and the costs associated with oil pollution regulations, public awareness, navigational risks and oil spills.

Kharaka, Y. K.; Thordsen, J. J., and Ambats, G. **Environmental degradation associated with exploration for and production of energy sources in USA**. In: Kharaka, Y. K. and Chudaev, O. V. *Water-Rock Interaction. Proceedings of a Symposium*, Vladivostok, 1995: Balkema; 1995; pp. 25-30.
Authors present a general discussion on the environmental degradation potential associated with the exploration and mining of resources for the USA energy supply (including oil, gas, coal, nuclear fission, and geothermal activity).

Kildow, J. T. **Keeping the oceans oil-free**. *Technology Review*. 1993; 96(3):42-49.
The US Oil Pollution Act (OPA) of 1990 is explained and critiqued.

Knott, David. **Million-barrel tankers an endangered species**. *Oil & Gas Journal*. August 26, 1996; 94(35):23; ISSN: 0030-1388.
A brief report on: the million-barrel tanker and its predicted decline and elimination from the crude oil transportation market as a result of bigger competitors and tightening pollution regulations.

Knott, David. **Risky weapon in *Brent Spar* debate**. *Oil & Gas Journal*. July 1996; 94(29):29; ISSN: 0030-1388.
Shell U.K. Exploration & Production held a press conference to report that the offshore dismantling of the *Brent Spar* and later disposal was riskier than previously thought. Shell also reported that they have received over 100 ideas on how to dispose of or reuse the spar; however, none are practical. Therefore, a conference will be held to debate the shortlist of disposal plans.

Knott, David. **U.K. air quality plan has hidden teeth**. *Oil & Gas Journal*. September 2, 1996; 94(36):30; ISSN: 0030-1388.
The author discusses the ramifications of the Department of Environment's (UK) recently published air quality strategy to cut air pollution to levels in line with World Health Organization standards. Strategy target maximums are as follows: benzene 5 ppb; 1,3 butadiene 1 ppb; carbon monoxide 10 ppm; lead 0.5 mcg/m^3; nitrogen dioxide 104.6 ppb 1 hr. mean, 20 ppb annual mean; ozone 50 ppb; particulates 50 mcg/m^3; and sulfur dioxide 100 ppb. These proposed maximums, averaged out for various periods ranging from 15 min. to one year, are to be met by 2005.

Knott, David. **U.S. lessons for U.K. platform disposal**. *Oil and Gas Journal*. October 30, 1995; 93(44):17-18; ISSN: 0030-1388.
A brief discussion of the possible options available to the US to deal with the 4,000 production platforms and the 22,000 miles of oil and gas pipelines in the Gulf of Mexico.

Koen, A. D. **Higher gas prices fuel OCS Sale 142 bidding**. *Oil and Gas Journal*. March 29, 1993; 9127; ISSN: 0030-1388.
It is reported that higher US wellhead gas prices sparked participation at the mid-March 1993 federal offshore lease sale after more than three years of dwindling interest.

SOCIOECONOMIC/REGULATION/GENERAL

Kramek, Robert E. **Marine pollution contingency planning: dead reckoning through maturing waters.** *Sea Technology*. January 1997; 38(1):30-31. ISSN: 0093-3561.
A pollution contingency response plan that meets U.S. Coast Guard regulations as well as federal, state, and local agency requirements is being implemented. Industry generated and maintained an increased focus on hazardous substance response; incorporated marine fire-fighting elements, and outlined ramifications associated with endangered species, cultural and historic properties that are essential in preparedness in the development and exercise of a marine pollution event.

Kuwait: the role of state oil companies. *Oil and Gas Journal*. August 16, 1993; 9166-67; ISSN: 0030-1388.
An overview of Kuwait Petroleum Corporation (KPC), a public corporation established in 1980 to oversee all petroleum industry activities in Kuwait, is presented. The operations of KPC subsidiaries are also discussed.

Larson, D. W. **Texas' artificial reef program: it may not be the nation's worst much longer**. *Fifth International Conference of Aquatic Habitat Enhancement*. 1994; 55(2-3):1343; ISSN: 0007-4977.
Presented is a history of artificial reefs in Texas, including a discussion of Texas' poor record caused by the continuing loss of offshore marine habitat due to the removal of offshore petroleum structures. Also put forth are several remedies that would allow Texas to make a turnaround and have one of the best artificial reef programs.

Lieberman, James L. **A practical guide for hazardous waste management, administration and compliance**. Boca Raton: Lewis Publishers; 1994; 239 p. ISBN: 1566701155.
Guidance for establishing a hazardous waste management, administration and compliance program is provided focusing on economical solutions, reduction of liability concerns and compliance with regulations.

Lima, F. F.; Pereira, F. A.; Almeida, S. A. S. **Waste management in the chemical and petrochemical industries** . *Water Science and Technology*. 1994; 29(8): ISSN: 0273-1223.
Proceedings of the 3rd International Conference on Waste Management in the Chemical and Petrochemical Industries: New Technologies and Practices for Waste Minimization, 22-23 October, 1993, Salvadore, Bahia (Brazil).

MacDonald, J. M. **Artificial reef debate: habitat enhancement or waste disposal?** *Ocean Development and International Law*. 1994; 25(1):87-118; ISSN: 0090-8320.
The US and the international community have promulgated regulatory measures that are designed to prevent ocean dumping that is disguised as fishery habitat enhancement.

MacIlwain, Colin. **Risk: a suitable case for analysis**. *Nature*. 7 March 1996; 380(6569):10-11; ISSN: 0028-0836.
Using the dilemma involving the disposal of the *Brent Spar* oil storage platform, the author discusses risk analysis, which is now a central focus in the battle between the industrial and environmental lobbies.

Mair, Hamish and others. ***Sea Empress* controversy continues**. *Marine Pollution Bulletin*. June 1996; 32(6):454; ISSN: 0025-326X.
A brief news story concerning the thwarted campaign for an independent inquiry into the February 1996 grounding of the *Sea Empress* in Milford Haven .

Mair, Hamish. ***Sea Empress* grounding still causing reverberations**. *Marine Pollution Bulletin*. November 1996; 32(22):764; ISSN: 0025-326X.
The recent *Sea Empress* oil spill has now provoked opposition to National Power's plan to convert its Pembroke power station to run on bitumen-base fuel (orimulsion), which would require transport via shipping of orimulsion. An economic report released by the Cardiff Business School and the Welsch Institute of Rural Studies suggests that if the power station conversion plans are rejected then the economic impact would dwarf the sum total of all other impacts of the spill.

Malhotra, Mohan. **India's oil supply deficit spurs reforms to lure foreign capital.** *Oil and Gas Journal*. 2 June 1997; 95(22):25-30. ISSN: 0030-1388.
The author writes about India's rise in demand for refined products, the high rate of imports and the drop in production of crude oil. Radical government policy changes are being implemented to reform India's oil deficit and to improve fiscal terms for private/foreign investors.

Mannarelli, Tom and others. **Maritime shipping as a high reliability industry: a quantitative analysis**. LaJolla, CA: California Sea Grant; 1994; CUIMR-T-94-004. 27 p.

SOCIOECONOMIC/REGULATION/GENERAL

Mason, E.; Roberts, K., and Bea, R. **Reduction of tanker oil and chemical spills: development of accident and near-miss databases.** In: *California Sea Grant College Program. Human and Organizational Errors in Loading and Discharge Operations at Marine Terminals.* LaJolla, CA: California Sea Grant College Program; 1995;68 p.
The use of accident and near-miss databases can be utilized to assess the petroleum industry's progress in reducing the rate and quantity of oil spills.

Masood, Ehsan. **Shell keeps its options open for disposing of *Brent Spar*.** *Nature.* August 3, 1995; 376(6539):378; ISSN: 0028-0836.
Shell has announced that it may still dispose of its disused Brent Spar oil platform by sinking it in the deep Atlantic 150 miles off the coast of the UK. The plan has been endorsed by the British government, the Natural Environment Research Council and the University of Aberdeen, but is opposed by Greenpeace, which favors disposal on land. The platform contains 68,000 tons of concrete ballast, 100 tons of bituminous sludge, 30 tons of low-level radioactive scale, and smaller amounts of heavy metals and other materials. The rig is now anchored in Norway.

Matsen, Brad. **Alaska: jury says Exxon owes $5 billion.** *National Fisherman.* November 1994; 75(7):11; ISSN: 0027-9250.
In a ruling that Exxon will appeal, a jury has awarded punitive damages of $5 billion to the fishermen, villagers and businesses of Prince William Sound and the Gulf of Alaska for losses incurred by the *Exxon Valdez* oil spill.

Matsen, Brad. **Arctic Ocean oil drilling under fire.** *National Fisherman.* November 1994; 75(7):12, 14; ISSN: 0027-9250.
Fishermen, environmentalists and coastal villagers have joined to protest a US/Russian oil and gas lease sale in the Chukchi Sea which was to be delayed by the current federal administration until all conflicts were resolved.

McFaddin, Michelle. **Oil and gas field waste regulations handbook.** Tulsa, OK: PenWell Books; 1996;390 p. ISBN: 0878144617.
The author examines the majority of the federal environmental programs that pertain to oil and gas E&P waste management and disposal in an effort to document the evolution of federal and state environmental programs.

Mexico: the role of state oil companies. *Oil and Gas Journal.* August 16, 1993; 9155+; ISSN: 0030-1388.
An overview of Petroleos Mexicanos (Pemex), Mexico's largest taxpayer, is presented.

Minerals Management Service receives Federal award. *Sea Technology.* September 1994; 35(9):72; ISSN: 0093-3651.
It is reported that the MMS was awarded the 1994 Federal Environmental Quality Award for achieving excellence through implementation of the National Environmental Policy Act. The MMS's commitment to maintaining the nation's offshore energy resources is cited.

Mitchell, R. B. **Compliance with international treaties: lessons from intentional oil pollution.** *Environment.* May 1995; 37(4):10-41; ISSN: 0013-9157.
Using oil pollution as an example, the author analyzes and evaluates the use of international treaties for protecting the environment.

Mitchell, Ronald. **Intentional oil pollution at sea.** Cambridge, MA: The MIT Press; 199(5);260 p.
Global Environmental Accords series.
An analyses of international treaties for protecting the environment, and treaty compliance.

Mobil plans exploration program in deepwater area off Malaysia. *Oil and Gas Journal.* November 22, 1993; 9126; ISSN: 0030-1388.
It is reported that Mobil and the Malaysian state oil company, Petroliam Nasional Bhd., have embarked on a joint exploration project in the South China Sea.

Mobil pushes extended reach project off California. *Oil and Gas Journal.* July 5, 1993; 9120-21; ISSN: 0030-1388.
Reported is a tentative decision by Mobil Exploration and Producing to tap oil reserves off Santa Barbara, California, with extended reach drilling from shore. The project would end a six-year moratorium on drilling in California's state waters and confirm the feasibility of long reach extended drilling from shore.

More North Sea gas on stream. *Oil and Gas Journal.* August 16, 1993; 9130+; ISSN: 0030-1388.
Oil production activities in the North Sea in mid-1993 are discussed.

SOCIOECONOMIC/REGULATION/GENERAL

More oil spills in UK waters. *Marine Pollution Bulletin.* January 1997; 34(1):4. ISSN: 0025-326X.
Reported are some of the results from a 1995 annual survey (Buckinghamshire College) of oil pollution in British Isle waters. Among some of the significant findings: (a) 585 confirmed oil spills occurred around Britain's coast in 1995, (b) 65% of the spills were from identifiable sources, (c) only 23 spills were from tankers, (d) 142 cleanup operations were undertaken with 21% of the cost being covered by the polluters, and (e) only 9% of the spills caused significant shoreline pollution.

More tracts open in former USSR. *Oil and Gas Journal.* March 29, 1993; 9128-30; ISSN: 0030-1388.
It is reported that more exploration and development acreage is up for bids in the former Soviet Union.

Moritis, Guntis. **Gulf of Mexico platform operators cope with abandonment issues.** *Oil and Gas Journal.* May 6, 1996; 94(19):57-63; ISSN: 0030-1388.
The author reviews the general issues involved in platform abandonment and disposal, including a brief look at the Texas reefs and Louisiana programs.

Moyano, J. M. **Oil spill contingency planning in the Latin American petroleum industry: present situation and future prospects.** *Spill Science and Technology.* March 1995; 2(1):11-16; ISSN: 1353-2561.
An analysis of ARPEL's (Asistencia Reciproca Petrolera Empresarial Latinoamericana) ability to combat an oil spill, separately or collectively. The author suggests that the Latin American petroleum industry should move towards regional cooperation to improve institutional capacity and maximize government-industry collaboration.

NAFTA final approval assured in wake of House vote. *Oil and Gas Journal.* November 22, 1993; 9128; ISSN: 0030-1388.
Some of the effects of the North American Free Trade Agreemant (NAFTA) on the US oil industry are predicted.

National Petroleum Council presents pair of reports. *Sea Technology.* September 1994; 35(9):69; ISSN: 0093-3651.
It is reported that the National Petroleum Council (US) approved and presented two reports on oil pollution and marginal well production incentives to Energy Secretary Hazel O'Leary in July 1994.

NERAC, Inc. **Biodeterioration of oil spills (published search)Tolland, CT**: NERAC, Inc. 1993.
A bibliography containing 250 citations focusing on the degradation of petroleum products, including hydrocarbons, oil spills, and beach pollution. This bibliography is available through NTIS (order #: PB94854205XSP).

New UK measures to combat marine pollution. *Marine Pollution Bulletin.* December 1996; 32(12):833; ISSN: 0025-326X.
The Merchant Shipping and Maritime Security Bill, which was just published in the House of Lords, will establish temporary exclusion zones at sea to work as safety zones surrounding ships or structures and will also increase the intervention powers of the coast guard, as well as give wider powers for inspection and detention of substandard vessels. The bill will include a number of other measures involving "polluter pays" principles and stiffer penalties for polluters.

New web site updates U.S. environmental regulations weekly. *Oil & Gas Journal.* February 10, 1997; 95(6):60. ISSN: 0030-1388.
Environmental Resources Management Group now publishes a weekly summary of federal and state regulatory activities, including petroleum-related issues, on its Internet site (URL: http://www.erm.com).

Nicolaou, M. L.; Andreadakis, A. D., editors. **Pollution of the Mediterranean Sea (special issue).** *Water Science and Technology.* 1996; 32(9-10).
This special issue includes forty-one papers from the proceedings of the International Symposium on Pollution of the Mediterranean Sea, held in Nicosia, Cyprus, 2-4 November 1994. Some on the topics covered: legal, institutional and economic aspects of pollution control, monitoring, modeling studies, treatment, and chemical and microbial pollutants.

North sea pipeline lost. *Marine Pollution Bulletin.* August 1995; 30(8):501.
Brief news article concerning a section of the 86 km Troll field pipeline that was lost in 300 meters of water after a pipe-laying barge lost grip.

Norway to amend abandonment plans. *Marine Pollution Bulletin.* August 1995; 30(8):500-501.
Brief news article regarding Norway's plan to amend its petroleum law. Currently Norway's petroleum law calls for each platform to have an abandonment plan, but a committee on platform abandonment concluded that it would be too costly to remove all of the installation. Therefore, the committee has recommended that the only alternative would be to leave them *on site* after removing topside facilities.

SOCIOECONOMIC/REGULATION/GENERAL

Offshore Europe 95: securing the future. *Sea Technology*. August 1995; 36(8):55; ISSN: 0093-3651.
A preview of the Offshore Europe '95 Conference and Exhibition, to be held September 5-8, 1995, in Aberdeen, Scotland. The conference will have exhibits from 1800 companies from 22 countries and include sessions on every aspect of the oil and gas industry (drilling, exploration, management and economics, development and abandonment, well intervention, health, safety and environment, production and reservoir management).

Onshore dismantling 'the best option' for most oil platforms. *Nature*. July 1996; 382(6587):103; ISSN: 0028-0836.
A brief news story discussing the German-commissioned report, regulations for decommissioning offshore platforms in the North Sea and North Atlantic. The report states that disused oil installations made from large quantities of steel should not be disposed of in the sea but dismantled and recycled onshore.

OPEC panel: maintain production volume. *Oil and Gas Journal*. August 16, 1993; 9122-23; ISSN: 0030-1388.
It is reported that the ministerial monitoring subcommittee of the Organization of Petroleum Exporting Companies (OPEC) has recommended that the current production ceiling of 23.582 million bbl/day be continued into the fourth quarter of 1993.

Orstad, Ingrid. **Regulations concerning risk analysis and their application in environmental safety protection in Norway**. *Marine Pollution Bulletin*. 1994; 29(6-12):320-333; ISSN: 0025-326X.
Presented are the main requirements included in the Norwegian regulations (administered by the Norwegian Petroleum Directorate and the State Pollution Control Authorities) concerning risk analyses, with an emphasis on legislation concerning safety, the environment, assets, and financial interests.

Otto, G. H.; Arnold, K. E. **U.S. produced water discharge regulations have tough limits**. *Oil & Gas Journal*. July 1996; 94(29):54-60; ISSN: 0030-1388.
Based on a recent study, nearly 60% of the platforms in the Gulf of Mexico may have trouble meeting the new lower oil and grease concentration standards in produced water discharged during the course of the year. In light of this study, the authors trace the history of Gulf of Mexico statistical studies of oil and grease removal for produced water treatment systems from 1974 through a 1993 survey.

Pacific rim countries debate oil and the environment. *Marine Pollution Bulletin*. December 1996; 32(12):835-836. ISSN: 0025-326X.
Due to negligent environmental law enforcement, an international conference on oil and gas development met in Ho Chi Minh City, in Southeast Asia, to develop a flexible framework to encourage innovation and new technology while ensuring the best possible protection of the environment, along with public and employee safety.

Pagano, S. S. **Louisiana, Texas fabrication yards on busy upswing**. *Sea Technology*. April 1994; 35(4):23-26; ISSN: 0093-3651.
Natural gas platforms production in Louisiana and Texas has increased recently in response to increased demand for production of the gas reserves.

Palmlund, Ingar. **Ecuador oil exploration blocked by Indians and environmentalists**. *Human Environment: The International Environmental Policy Analysis Newsletter*. January 1994; 6.
The state of oil exploration in Ecuador by Petroecuador and Texaco is reported.

Palmlund, Ingar. **Vietnam's oil and gas to be tapped**. *Human Environment: The International Environmental Policy Analysis Newsletter*. January 1994; 6.
Predictions regarding oil and gas development in South Vietnam are suggested.

Parker, B. B. **Real-time oceanographic data for ports**. *Mariners Weather Log*. 1994; 38(3):12-16.
The author discusses the importance of providing accurate water level, tide and water current information for large ships and tankers entering or leaving port.

Parsons, K. C. **Recovering from oil spills: The role of proactive science in mitigating adverse effects**. *Colonial Waterbirds*. 1996; 19(1):149-153; ISSN: 0738-6028.
Presented is a discussion on how scientific preparedness, in addition to response planning, can improve the odds of repairing and recovering natural resources following a major oil spill.

SOCIOECONOMIC/REGULATION/GENERAL

Pennzoil settles pipeline spill suit. *Oil & Gas Journal.* March 10, 1997; 95(10):31. ISSN: 0030-1388.
Pennzoil Products Co. (Eureka Pipe Line Co.) has settled to pay $867,000 in fines for pipeline spills in Pennsylvania and West Virginia. In addition, if the proposed settlement is approved by the U.S. District Court, Pennzoil will be required to reduce the number of pipeline spills caused by corrosion on underground pipe.

Piatt, J. F. **Alternative interpretations of oil spill data.** *Bioscience.* April 1997; 47(4):202-203. ISSN: 0006-3568.
John Wien's review of the *Exxon Valdez* oil spill from his article; "Oil, Seabirds, and Science", is challenged with a different interpretation of the oil spill data received from Exxon-sponsored researchers and government scientists.

Pickard, R. D. **Gulf of Mexico deepwater project moving toward 1995 start-up.** *Oil and Gas Journal.* 1994; 92(25):35-39; ISSN: 0030-1388.
It is reported that production equipment, pipelines, and other preparations for a major Gulf of Mexico deepwater project are ready for a 1995 start up.

Pollack, Susan. **After the spill: Rhode Island's largest oil spill teaches fisherman and processors how to deal with disaster.** *National Fisherman.* October 1996; 77(6):30-34; ISSN: 0027-9250.
The author reports on how the Rhode Island commercial fishing industry is trying to deal with the largest oil spill (825,000 gallons) in that state's history, which closed an estimated 254 square miles of fishing grounds for up to five months and affected important species such as lobsters, quahogs, soft-shelled clams, surf clams, herring, flounder, and crabs.

Protest over Brent Spar disposal claims spotlight off NW Europe. *Oil and Gas Journal.* November 27, 1995; 93(48):23-25; ISSN: 0030-1388.
Public protest over a plan to dump an idle North Sea loading buoy, Brent Spar, is discussed.

Pulsipher, A.; Daniel, W.; Kiesler, J. E.; Mackey, V. **Explosives remain preferred method for platform abandonment.** *Oil and Gas Journal.* May 6, 1996; 94(19):64-70; ISSN: 0030-1388.
The authors discuss the use of explosives as the most practical and cost-effective method for the abandonment of oil and gas structures.

Rawson, Kenneth. **The Carriage of Bulk Oil and Chemicals at Sea**: Institute of Chemical Engineers; 1994;105 p. ISBN: 0852953186.
The change in the control of safety at sea is discussed in relation to the issue of secrecy in shipping.

Reader, C. **Offshore Europe '95.** *Petroleum Review.* 1995; 49(585):450-451; ISSN: 0020-3076.
Organized by Spearhead Exhibitions and the Society of Petroleum Engineers, Offshore Europe '95 included discussions (speeches and papers) concerning health and safety issues, the disposal of offshore installations (*Brent Spar*), CRINE, and the future strategies for productivity and environmental awareness. The conference was attended by members of the environmental community, the oil and gas industry, and government agencies.

Reader, C. **The why and wherefore of CRINE.** *Petroleum Review.* 1994; 48(564):12-14; ISSN: 0020-3076.
Cost Reduction in the New Era (CRINE) for the North Sea oil and gas industry is described and the CRINE recommendations are enumerated.

Record fine levied in Puerto Rico spill. *Oil & Gas Journal.* October 7, 1996; 94(41):43; ISSN: 0030-1388.
Presented is a brief discussion of the $75 million fine, the largest ever for an environmental crime, given to a group of three corporations (Bunker Group Puerto Rico, Bunker Group, Inc., New England Marine Services). The fine was a result of "negligent conduct" by this group in the January 1994 oil spill off of Puerto Rico. Also briefly discussed is the 4000 bbl petroleum spill occurring in the Fore River harbor at Portland, Maine.

Record-breaking exports for UK oil and gas industry predicted. *Sea Technology.* October 1994; 35(10):55-56; ISSN: 0093-3651.
The industry initiative, CRINE, Cost Reduction Initiative for the New Era, is projected to contribute to a dramatic decrease in oil and gas industry expenditures in the UK by the turn of the century.

Reeves, T. S. **Petrochemicals.** *Water Environmental Research.* 1995; 67(4):529-531; ISSN: 1061-4303.
An annual review on the treatment of wastes generated by the petrochemical industry.

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Renner, Rebecca. **EPA, environmentalists clash over proposal to test contaminated dredged sediments.** *Environmental Science & Technology.* May 1996; 30(5):197A-198A; ISSN: 0013-936X.
The author presents an account of the dispute between environmentalists and the Environmental Protection Agency regarding the proposed changes in testing standards for dredged sediments. Environmentalists claim the rule changes will allow contaminated sediments to be dumped at sea; the EPA denies this will occur.

Report of the Second International Oil Spill Research and Development Forum: between now and the year 2000 - research requirements for advancing the state-of-the-art in oil spill response capability. *Spill Science and Technology.* 1995; 2(4):195-206. ISSN: 1353-2561.
In May of 1995, researchers, responders, and research program managers gathered in London to participate in the Second International Oil Spill Research and Development Forum, a conference designed to identify gaps in oil spill response technology and capability and how to go about filling these gaps. Presented is a report of the proceedings.

Saeed, T.; Al-Yakoob, S.; Al-Hashash, H.; Al-Bahloul, M. **Preliminary exposure assessment for Kuwaiti consumers to polycyclic aromatic hydrocarbons in seafood.** *Environment International.* 1995; 21(3):255-263; ISSN: 0160-4120.
Polycyclic aromatic hydrocarbon (PAH) concentrations in seafood in the Kuwaiti market were assessed. Results indicated that most of the samples contained significant levels of PAHs, with naphthalene producing the highest numbers. In terms of the average consumer, a daily intake of .231 mu g/d of total PAH from seafood was reported, with the B(a)P equivalent intake at .0167 mu g/d.

Saudi Arabia: the role of state oil companies. *Oil and Gas Journal.* August 16, 1993; 9138+; ISSN: 0030-1388.
An overview of Saudi Arabia's five major state oil companies, including Saudi Arabian Oil, is presented.

Scantland, S.; Biegert, E. **Radar locates offshore oil slicks.** *Earth Observation Magazine.* 1996; 5(7):30-32.
Presented is a description of the Gulf Offshore Satellite Applications Project (GOSAP), a cooperative project, consisting of oil and gas companies, research organizations, universities, data suppliers, etc., created to evaluate how to best utilize satellite information technology for offshore oil and gas operations and clean up.

Schneider, David. **Tempest on the high sea.** *Scientific American.* December 1995; 273(6):14-15; ISSN: 0036-8733.
An account of the recent near disastrous voyage of the Resolution, the scientific research vessel of the Ocean Drilling Program, in the east Greenland Sea.

Schroder, D. **Response to marine pollution by oil and other harmful substances in Germany.** *Spill Science and Technology.* 1995; 2(4):223-231. ISSN: 1353-2561.
A description of the development of Germany's strategy to protect the coastal environment from oil and chemical pollution.

Schussler, F. **Will nature restore itself over time?** *Scandinavian Oil-Gas Magazine.* 1995; 23(5-6):58-62.
The author discusses precautions, pollution control measures, and rules and regulations with respect to the Norwegian offshore industry and the developments in Norwegian waters. Included in this discussion are accidental spills, waste discharges, cutting and drilling fluids, chemicals in pipes, air pollution, as well as an outline of the current trends in operational discharges. Also, reported are the results of environmental surveys conducted off Norway by the Pollution Control Authority, which show a 76% decrease in total oil cuttings discharges between 1991 and 1992.

Seydlitz, Ruth and others. **Social and economic impacts of oil 'boom and bust' cycles.** New Orleans: Minerals Management Service; 1994; OCS Study, MMS 94-0016. 131 p.

Seydlitz, Ruth. **Characteristics and possible impacts of a restructured OCS oil and gas industry in the Gulf of Mexico. New Orleans, LA**: US Department of the Interior, Mineral Management Service; 1995204 p.(OCS Study; MMS 95-0055).

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Shell Expro unveils spar disposal plans. *Oil & Gas Journal.* January 20, 1997; 95(3):24. ISSN: 0030-1388.
Six contractors have been selected to develop detailed plans for the reuse or disposal of the *Brent Spar* oil storage buoy. The six proposals include: (a) raising and rotating the spar into a horizontal position using compressed gas for dismantling/scrapping onshore (Brown and Root Energy Services); (b) raising and rotating using compressed gas then either scrap the spar onshore or: use topsides as a training center, hull as a dock gate, use hull sections as a fish farm, and or use hull as a quay extension (Kvaerner Stolt Seaway Alliance); (c) raising and rotating using compressed gas then using the spar's hull as a quay extension (McAlpine Doris JV); (d) raising the spar vertically using a jacked cable lift, then using topsides as a training center and a hull as a quay extension (Wood-GMC) (e) raising the spar vertically using a jacked cable lift and scrapping it onshore (Thyssen Stahlunion GmbH); and (f) using the spar's hull as coastal protection (AMEC Process and Energy).

Simmons, Matthew R. **Offshore oil and gas market heating up.** *Sea Technology.* September 1995; 36(9):19-23; ISSN: 0093-3651.
An examination of the surprising health of the oil and gas markets in the Gulf of Mexico and the North Sea.

Singhota, G. S. **IMO's role in promoting oil spill preparedness.** *Spill Science and Technology.* 1995; 2(4):207-215. ISSN: 1353-2561.
Described in detail is the strategy adopted by the International Maritime Organization (IMO) in the implementation of objectives initiated at the International Convention on Oil Pollution Preparedness, Response and Cooperation (1990).

Smith, E. R. **Trends in public opinion on offshore development in California, final technical summary**. Camarillo, CA: US Department of the Interior, Mineral Management Service; 1995;82 p.(OCS Study; MMS 95-0037).

Smith, E.; Garcia, S. R. **Evolving California opinion on offshore oil development** . *Ocean & Coastal Management.* 1995; 26(1):41-56.
The authors report that the public opinion and support for oil development in coastal California has declined sharply.

Smith, Robert. **Putting the pieces together for an offshore upturn.** *Marine Log.* April 1995; 34-40; ISSN: 0897-0491.
Discussed is the recent optimistic outlook of offshore industry leaders, as well as the mechanisms, such as company consolidation, utilized by offshore oil and gas companies to improve the economic environment.

State oil companies have major role in oil world. *Oil and Gas Journal.* August 16, 1993; 9137-70; ISSN: 0030-1388.
The significant role of state oil companies in the oil industry is reported.

Stephan, C. D.; Osburn, H. R. **Use of petroleum platforms by Texas recreational anglers.** *Fifth International Conference of Aquatic Habitat Enhancement.* 1994; 55(2-3):1353-1354; ISSN: 0007-4977.
The authors investigated the use of petroleum platforms by Texas recreational anglers. From a three-year study (1984-87) consisting of interviewing 61,008 private boat and 2,329 partyboat anglers, investigators indicated that roughly 18% of the total anglers fished at a platform during their trip.

Synthetic-based drilling fluids have many environmental plusses. *Oil and Gas Journal.* November 27, 1995; 93(48):59-64; ISSN: 0030-1388.
Spent drilling fluids and cuttings (muds) pose a serious and costly (environmentally and financially) disposal problem for offshore operators. However, since 1990, several non-toxic, biodegradable, synthetic-based muds with desirable environmental qualities have entered the market.

Taiwan oil port blockade. *Marine Pollution Bulletin.* November 1996; 32(22):766; ISSN: 0025-326X.
Despite Chinese Petroleum's agreement to pay $8 million to compensate fisherman affected by an oil spill at one of their facilities last August, nearly 300 fishing boats have congregated in the spill area to demand a quicker resolution for compensation.

Tanker ownership reflects fear of penalties. *Oil and Gas Journal.* January 1996; 94(3):23; ISSN: 0030-1388.
Brief account of the decline of tanker ownership by oil majors as a result of the industry's insistence on higher standards of safety and environmental protection by tanker operators.

Thomassem, Magne. **Offshore and shipping activities in the Norwegian Arctic areas: the Environmental dimension**. *Marine Pollution Bulletin*. 1994; 29(6-12):354-360; ISSN: 0025-326X.
A description of how Norsk Hydro planned and executed the safety, environment and emergency preparedness matters related to the exploration drilling of the most northern well drilled on the Norwegian continental shelf.

Thompson, Russell G. **Study notes separability of oil company profitability, efficiency**. *Oil and Gas Journal*. November 8, 1993; 9162-64+; ISSN: 0030-1388.
Using a worldwide oil and gas modeling application, the outputs, inputs, profits and market values of eleven publicly traded oil companies for 1990, 1991 and 1992 are analyzed.

Thomson, B. **Environmental concerns are tanker priority**. *Motorship*. 1994; 75(884):51-57.
Discussed is US OPA'90, a ruling to improve the quality and safety of vessels trading in US waters. The author argues that because of the severity of this ruling and the difficulties for shipowners to comply, a deteriorating fleet of vessels has and will occur.

3D seismic yields more oil for Oryx off Texas. *Oil and Gas Journal*. November 8, 1993; 9133; ISSN: 0030-1388.
Reported is confirmation of a 25-30 million bbl oil discovery in the Gulf of Mexico by Oryx Energy, Dallas, employing a 3D seismic survey.

Three petroleum wastes proposed as hazardous. *Environmental Science & Technology*. January 1996; 30(1):A11; ISSN: 0013-936X.
Under a proposed EPA rule published Nov. 14 (Federal Register), three waste streams (clarified slurry oil sludge, hydrorefining and hydrotreating catalysts) common to all petroleum refining operations would be listed as hazardous and subject to strict handling and disposal regulations.

U.K. study to target offshore blast risk. *Oil & Gas Journal*. February 3, 1997; 95(5):31. ISSN: 0030-1388.
Reducing the risk of explosions on offshore oil and gas installations is the focus of a joint industry project planned by AEA Technology plc, Didcot, U.K. This is a result of last year's announcement by the U.K. Health and Safety Executive that the methods used to calculate blast resistance to meet regulations were inaccurate.

UK operators look beyond mature areas. *Oil and Gas Journal*. June 28, 1993; 9140; ISSN: 0030-1388.
It is reported that the results of the UK's fourteenth offshore licensing round indicate that operators are increasingly interested in acreage outside of mature North Sea areas.

UK operators react to PRT changes. *Oil and Gas Journal*. March 29, 1993; 9133-34; ISSN: 0030-1388.
The adjustments made by UK petroleum operators to the Petroleum Revenue Tax (PRT) are described.

Unocal eyes $1.75 billion in outlays of Thailand. *Oil and Gas Journal*. August 16, 1993; 9128; ISSN: 0030-1388.
Unocal's plans to embark on oil production off Thailand over the next five years are discussed.

US firms boosting US production, reserves. *Oil and Gas Journal*. November 8, 1993; 91101; ISSN: 0030-1388.
It is reported that some major US petroleum companies are reaping big production gains from investment in US exploration and development.

US Geological Survey, National Oil and Gas Resource Assessment Team. **1995 National Assessment of United States Oil and Gas Resources: overview of the 1995 National Assessment of Potential Additions to Technically Recoverable Resources of Oil and Gas--Onshore and State Waters of the United States**. Denver, CO: USGS Information Services; 1995; Circular 1118. 20 p.
This circular is the fourth in a series of systematic assessments of undiscovered oil and gas in the United States .

US Geological Survey. **Energy and the environment: application of geosciences to decision-making**. Washington, DC: U.S. Geological Survey; 1995; Circular 1108. 134 p.
This circular contains 67 extended abstracts from the oral and poster presentations of the 10th annual V.E. McKelvey forum on mineral and energy resources, held in Washington, D.C., February 13-17, 1995. The focus of the forum included our energy resources and the environment, new research techniques, and cooperative efforts between the USGS and industry, state and federal agencies, universities, and other countries.

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US Government Accounting Office. **Energy policy: ranking options to improve the readiness of and expand the Strategic Petroleum Reserve.** [Washington, DC]: US Government Accounting Office; August 18, 1994; GAO/RCED-94-259. 28 p.
Several near- and long-term options for improving the readiness and expansion of the US Strategic Petroleum Reserve are discussed.

US poll on ocean pollution. *Marine Pollution Bulletin.* December 1996; 32(12):836; ISSN: 0025-326X.
A recent survey conducted by the Mellman Group, Inc. found that 72% of Americans (1300) believe that sea exploration is more important than space exploration and 85% agreed that the US government is not doing enough to protect the sea. When asked what is the most important environmental problem, the respondents listed the disposal of toxic waste at the top (33%), followed by air pollution (31%), and water pollution (26%). In addition, 58% believe that the oceans had deteriorated over the past few years.

USCG-certified 'near shore' oil spill control vessel built. *Sea Technology.* October 1994; 35(10):63; ISSN: 0093-3651.
Workboats Northwest, Inc. of Seattle has designed a Cook Inlet, Alaska, capable vessel that is meant to assist in oil spill response under the terms promulgated in the Oil Pollution Act of 1990.

Venezuela: the role of state oil companies. *Oil and Gas Journal.* August 16, 1993; 9150-52+; ISSN: 0030-1388.
An overview of Venezuela's national oil company, Petroleos de Venezuela SA (PDVSA), one of the world's largest integrated oil companies, is presented.

Wild, Simon R.; Jones, Kevin C. **Polynuclear aromatic hydrocarbons in the United Kingdom environment: a preliminary source inventory and budget.** *Environmental Pollution.* 1995; 8891-108; ISSN: 0269-7491.
Presented is the first attempt to quantify the production, cycling, storage and loss of polynuclear aromatic hydrocarbons in the United Kingdom.

Wilman, E. A. **Liability versus property rule protection for surface entitlements.** *Canadian Journal of Agricultural Economics.* July 1994; 42(2):177-189; ISSN: 0008-3976.
Presented is a case for changing the system to allow property rule protection for the surface owner, a contrast to the current tradition of favoring the mineral owner or lessee only with the property rule protection.

Zorpette, Glenn. **Buy high, sell low.** *Scientific American.* December 1995; 273(6):28; ISSN: 0036-8733.
A discussion of the financial and environmental implications of the strategic petroleum reserve, a collection of underground reservoirs that store a total of 590 million barrels.

The Department of the Interior Mission

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

The Minerals Management Service Mission

As a bureau of the Department of the Interior, the Minerals Management Service's (MMS) primary responsibilities are to manage the mineral resources located on the Nation's Outer Continental Shelf (OCS), collect revenue from the Federal OCS and onshore Federal and Indian lands, and distribute those revenues.

Moreover, in working to meet its responsibilities, the **Offshore Minerals Management Program** administers the OCS competitive leasing program and oversees the safe and environmentally sound exploration and production of our Nation's offshore natural gas, oil and other mineral resources. The MMS **Royalty Management Program** meets its responsibilities by ensuring the efficient, timely and accurate collection and disbursement of revenue from mineral leasing and production due to Indian tribes and allottees, States and the U.S. Treasury.

The MMS strives to fulfill its responsibilities through the general guiding principles of: (1) being responsive to the public's concerns and interests by maintaining a dialogue with all potentially affected parties and (2) carrying out its programs with an emphasis on working to enhance the quality of life for all Americans by lending MMS assistance and expertise to economic development and environmental protection.