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Oil Spills: Environmental Effects
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22. PROBLEMS OF LAKE PEIPUS-PIHKVA (PROBLEMY PSKOVSKO-CHUDSKOGO OZERA)

see p 21-22

CITATIONS

DISTRIBUTION OF CR, PB, CD, ZN, FE AND MN IN LAKE VICTORIA SEDIMENTS, EAST AFRICA. - W89-12441

Onyari, J. M. Wandiga, S. O.

Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 42, No. 6, p 807-813, June 1989. 1 fig, 4 tab, 15 ref. JOURNAL ISSUE- w2212 CORPORATE AUTHOR(S)- Nairobi Univ. (Kenya). Dept. of Chemistry. NDN- 036-0011-0953-9

A study was initiated to investigate the distribution patterns of lead and other metals in Lake Victoria, East Africa, using grab samples analyzed by atomic absorption spectrophotometry. There were statistically significant differences among the mean contents from different locations. Elevated concentrations of some trace elements at some localities indicates a localized pollution problem. Of the metals studied, cadmium content was the lowest, but significant variations were observed between the different sites. Deeper regions of the Winam Gulf were characterized by low metal content, while some shallow regions contained elevated levels of lead, cadmium, zinc, and copper. Maximum values of lead (228 mg/kg), copper (62.8 mg/kg), and zinc (370 mg/kg) were previously obtained at the Shell Oil jetty at Kisumu port. All five stations located inside the port region contained significantly elevated levels of heavy metals compared to other localities. Although discharge of treated wastewater through Kasat River is partly responsible, port activities are of greater significance, especially discharge of ship bilge waters and oil spillages. (Doria-PTT)

EMPIRICAL EVALUATION OF OIL SLICK SPREADING INDUCED BY WAVES. - W89-12625

Palczynski, R. J.

Journal of Environmental Science and Health (A) JESEDU, Vol. 24, No. 4, p 331-348, May 1989. 7 fig, 11 ref. JOURNAL ISSUE- w2212 CORPORATE AUTHOR(S)- Acadia Univ., Wolfville (Nova Scotia). School of Engineering. NDN- 036-0011-0770-1

The spreading of an oil slick on calm water surfaces and in the presence of shallow water waves was simulated under laboratory conditions. A long channel provided with mechanical waves generator was filled with tap water and the spreading rates of different types of crude oils released instantaneously were measured on the surface of calm water. The experiments were repeated under various dynamic conditions of the water surface modeled with the waves generator. The spreading rate of oil in the direction of wave propagation was usually greater under the wavy conditions compared to calm water conditions. The measured spreading rate increments due to gravity wave action was usually higher than the surface drift velocities predicted by the Stokes theory. It was confirmed that the velocity of an oil slick increases exponentially with the wave steepness. However, physical properties of crude oil such as viscosity surface tension and specific gravity do not significantly influence the surface drift of spilled oil induced by the shallow waves. (Author's abstract)

DIFFERENCES IN HYDROCARBON UPTAKE AND MIXED FUNCTION OXIDASE ACTIVITY BETWEEN JUVENILE AND SPAWNING ADULT COHO SALMON (ONCORHYNCHUS KISUTCH) EXPOSED TO COOK INLET CRUDE OIL. W89-12833

Thomas, R. E. Rice, S. D. Babcock, M. M. Moles, A.

Comparative Biochemistry and Physiology (C) CBPCEE, Vol. 93, No. 1, p 155-159, 1989. 3 fig, 1 tab, 28 ref. JOURNAL ISSUE- w2212 CORPORATE AUTHOR(S)- California State Univ., Chico. Dept. of Biological Science. NDN- 036-0011-0566-2

Juvenile and adult spawning coho salmon were exposed to crude oil water-soluble fraction in flow-through systems (0.41 ppm for up to 12 days, and 0.42 ppm for up to 20 days, respectively). Aromatic hydrocarbon concentrations in liver, gut and muscle were determined by gas chromatography. Coho salmon smolts accumulated up to 30 times more hydrocarbon in selected tissues than did coho salmon jacks when exposed to water-soluble fraction of Cook Inlet crude oil. Aryl hydrocarbon hydroxylase activit continued to increase during 12 days of exposure in coho smolts, in contrast to jack in which aryl hydrocarbon hydroxylase activity peaked at 2 days and remained elevate during 20 days of exposure. Cytochrome P-450 concentrations peaked in 48 hr and returned to control levels in exposed smolts. In exposed and control jacks, cytochrome P-450 decreased during the 20 day experimental period. Concentrations of P-450 were significantly greater, however, in exposed jacks than in control jacks. Aryl hydrocarbon hydroxylase activity and cytochrome P-450 concentrations were greater in non-exposed coho smolts and jacks than in non-exposed pre-spawning adults Coho jacks were not as responsive as coho smolts in terms of P-450 induction.

period was characterized by a return to control values. The term 'toxicosm' is proposed to describe this approach to aquatic toxicological hazard evaluation, and a valuable tool for screening aquatic contaminants. (Author's abstract)

MARINE HYDROCARBON-DEGRADING MICROORGANISMS: COMMUNITY STRUCTURE AND BIOMASS DETERMINATION. - W89-11130

Carpenter, M. Robertson, J.

Water Science and Technology WSTED4, Vol. 20, No. 11/12, p 433-435, 1988. 2 tab, 5 ref. JOURNAL ISSUE- w2211 CORPORATE AUTHOR(S)- Oklahoma Univ., Norman. School of Civil Engineering and Environmental Science. NDN- 036-0010-9942-0

A mixed community of microorganisms was collected from the harbor at the San Diego Navy Base and was monitored in a test ecosystem containing an oily bilge waste obtained from off-loading ships. The cultures were examined in the presence and absence of the algae, to determine if the algae could enhance the degradation of th oily waste by providing oxygen and possibly a nutrient source from dying algae for the bacterial community. The bilge wastes obtained contained, within detectable limits, kerosene, bromoform, tetrachloroethylene, toluene, benzene, methylene chloride and phenol. Mixed organism communities were exposed to the waste for 6 wee in a 12 h light, 12 h dark cycle and biomass measurements were recorded before and after exposure. A comparison was made of several media designed for use in the most probable number (MPN) determination of petroleum-degrading microorganims. The dominant algae prior to hydrocarbon exposure were Oscillatoria sp., blue-green filamentous algae, and lesser amounts of Chlamydomonas sp. and Chlorella sp. After six weeks of exposure to bilge, Chlamydomonas sp. and Chlorella sp. had increased b a factor of 20 (in phenol-treated cultures) and 55 (in waste-phenol treated cultures). The analysis of the chlorophylls indicated a significant increase in all chlorophylls. The biomass data indicated that mixed communities containing algae, fungi, and bacteria appear capable of growth on the bilge waste, although the community structure changes significantly. (Friedmann-PTT)

BACTERIAL BIODEGRADATION OF PETROLEUM HYDROCARBONS IN GROUNDWATER: IN SITU AUGMENTED BIORECLAMATION WITH ENRICHMENT ISOLATES IN CALIFORNIA. - W89-11147

von Wedel, R. J. Mosquera, J. F. Goldsmith, C. D. Hater, G. R. Wong, A.

Water Science and Technology WSTED4, Vol. 20, No. 11/12, p 501-503, 1988. 4 fig. JOURNAL ISSUE- w2211 CORPORATE AUTHOR(S)- CytoCulture International, Inc., San Francisco, CA. NDN- 036-0010-9925-0

Commercial blends of enrichment isolates of aerobic bacteria are being used for in situ biodegradation of petroleum hydrocarbons contaminating soil and groundwater at several industrial sites in California. Contaminated groundwater in above-ground chemostats are maintained with cultures of some strains of Pseudomonas bacteria. After the bioreclamation process, the water is reinfiltrated into the ground to augment the in situ biodegradation of petroleum absorbed into the soil. Preliminary results of one such bioreclamation project are reviewed to demonstrate its feasibility for aquifers contaminated with fuels, solvents, and other petroleum products. Contaminated groundwater is collected through a network of French drains and treated in a series of chemostat bioreactors designed to maximize the residence time of the exogenous bacterial cultures. Reclaimed, treated effluent water which h attained low levels of dissolved hydrocarbon is blended with additional bacterial cultures and nutrients to augment the effectiveness of the process. In one petroleu products distribution site with extensive gasoline leakage in Southern California, bioreclamation resulted in benzene, toluene, xylene, and total hydrocarbon reductio of 85, 98, 33 and 93 percent, respectively. A new augmented bioreclamation project using bacteria is now underway at a former trucking terminal in Northern California (Friedmann-PTT)

MANAGING WATER QUALITY IN RELATION TO THE PETROCHEMICAL INDUSTRY. - W89-11245

Matthews, P. J.

Water Science and Technology WSTED4, Vol. 20, No. 10, p 261-269, 1988. 2 tab, 33 re JOURNAL ISSUE- w2211 CORPORATE AUTHOR(S)- Anglian Water Authority, Norwich (England). Norwich Sewage Div. NDN- 036-0010-9829-3

The impact of petrochemicals on the aquatic environment from the viewpoint of the water manager, is reviewed with emphasis on the effects of refinery effluents. Oil products can disrupt the ecology of environmental waters and render the management sewerage and sewage treatment systems difficult. Water management can utilize different approaches to the avoidance of deleterious effects and that favored by the UK involves the use of quality objectives. These can be used to calculate acceptable effluent quality limits. Continued achievement of the objectives must rely on satisfactory monitoring and analytical methods. With the international nature of oil pollution, international analytical methods are being introduced. Accurate monitorir

marshes must have been related to the oil spill, their sedimentary record differed little from that of equivalent sites in normal dynamic equilibrium with fluctuating intertidal conditions. The greatest lingering effects apparently were recorded not in sedimentary sequences or physical and biogenic sedimentary structures but, rather, at the level of molecular physiology and sedimentary biochemistry. (White-Reimer-PTT)

OVERVIEW OF MARINE ENVIRONMENTAL QUALITY IN THE CANADIAN ARCTIC - W89-11865

Packman, G. A. Shearer, R. G.

IN: Canadian Conference on Marine Environmental Quality: Proceedings, February 29-March 3, 1988, Halifax, Nova Scotia. The International Institute for Transportation and Ocean Policy Studies, 1236 Henry St., Halifax, Nova Scotia, Canada, 1988. p 229-242, 1 fig, 1 tab, 45 ref. JOURNAL ISSUE- W2211 CORPORATE AUTHOR(S)- Environmental Protection Service, Yellowknife (Northwest Territories). NDN- 036-0010-9213-8

While the Arctic marine environment has remained relatively untouched by modern industrial development to date, both direct and indirect impacts from development ar beginning to appear. Development has been initiated primarily by oil and gas exploration activity in the Beaufort Sea and Arctic Islands, as well as by lead/zinc mining on Little Cornwallis Island and Baffin Island. Shorebase support facilities for offshore oil and gas exploration, fuel transfer facilities, two lead/zinc mines, and municipalities constitute the primary land-based point sources of pollution. Offshore oil and gas exploration wells and production facilities constitute the othe class of point source inputs, resulting in increased hydrocarbon loading from chroni spills, the use and disposal of oil-based drilling muds, and the discharge of produced water. Trace metal loadings to the sediments may also result from the discharge of spent drilling muds. Trace metal concentrations increase around mining operations as a result of the discharge of effluent from tailings ponds and the loss of ore concentrates during ship loading. Municipalities discharge raw sewage or effluent from sewage lagoons into the marine environment. The physical, chemical, an biological impacts around point sources are generally confined to their immediate vicinity. It is becoming increasingly clear that nonpoint source impacts from land-based activities warrant attention. This paper provides an analysis of anthropogenic inputs and their impact, a brief description of the legislative base and management structure for addressing development-related impacts, and an assessment of priority needs to ensure that the quality of the Arctic marine environment is well understood and protected. (See also W89-11852) (Lantz-PTT)

ENVIRONMENTAL EVALUATION OF POTENTIAL PETROLEUM DEVELOPMENT ON THE NATIONAL PETROLEUM RESERVE IN ALASKA. - W89-11897

Kamrin, M. A.

December 15, 1979. 238p. 14 fig, 8 tab, 35 ref, 3 append. JOURNAL ISSUE- W2211 NDN- 036-0010-9181-0

This is an environmental analysis of potential development, production, transportation, and distribution of petroleum resources from the National Petroleum Reserve in Alaska (NPRA). Because no specific programs have been developed to date i NPRA, no site-specific analyses of impacts are possible. Such analyses will be possible only when specific lease sites and programs are identified. This impact analysis therefore considers those anticipated impacts that could likely be associated with future potential development. The principal environmental concerns stemming from development and production are: impacts on the Inupiat culture and lifestyle, particularly through effects on subsistence pursuits; impacts on wildlife especially on caribou and waterbirds; and depletion of gravel and water resources, which are in limited supply. (Lantz-PTT)

LIABILITY FOR AND CLEANUP OF OIL AND HAZARDOUS WASTE: LEGAL AND TECHNICAL ANSWERS TO A COMPLEX QUESTION. - W89-11924

Rogers, A. Loitherstein, J.

IN: Proceedings of the FOCUS Conference on Eastern Regional Ground Water Issues, September 27-29, 1988, Stamford, Connecticut. National Water Well Association, Dublin, Ohio, 1988. p 155-157, 3 fig. JOURNAL ISSUE- W2211 CORPORATE AUTHOR(S) Nutter, McClennen and Fish, Boston, MA. NDN- 036-0010-9154-7

This paper addresses legal and technical issues raised by the discovery of oil or hazardous substances or waste on property where the owner seeks refinancing or plans to convey the property. The statutory framework that is the background for these events is slightly different in each state, but as a general matter, the state statutes are based upon and similar to the federal hazardous waste cleanup statute, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). In the context of liability, the lawyer and the engineer must work together in a cooperative spirit to further the client's interest, and their respective tasks

overlap at several points. In many cases, the engineer will be retained by the attorney on behalf of the client in order to make all of the engineer's written work confidential and to protect it from discovery by other parties. Two case studies are presented which highlight some of the ways in which engineers and attorneys can work together for the benefit of their clients. (See also W89-11916) (Lantz-PTT)

TRANSPORT OF A NON-AQUEOUS PHASE LIQUID WITHIN A COMBINED PERCHED AND WATER TABLE AQUIFER SYSTEM. - W89-11946

Maguire, T. F.

IN: Proceedings of the FOCUS Conference on Eastern Regional Ground Water Issues, September 27-29, 1988, Stamford, Connecticut. National Water Well Association, Dublin, Ohio. 1988. p 539-558. 11 fig, 1 tab. JOURNAL ISSUE- W2211 CORPORATE AUTHOR(S)- Environmental Resources Management, Inc., Exton, PA. NDN-036-0010-9152-8

A case study addresses the anomalous nature of free phase fuel oil migration within glacial till sequence in northwestern New Jersey. The site-specific geohydrologic setting is characterized by a combined perched groundwater and water table aquifer system. The presence of a superpositioned saturated horizon has acted to significantly alter contaminant migration pathways as well as transport velocities. As a result of an underground storage tank failure, a significant volume of fuel oil was released to the subsurface. The presence of a low permeability horizon, partially encapsulating the tank pit, functioned to retain the majority of the non-aqueous phase liquid within the more permeable tank pit fill. Elevation fluctuations, due to precipitation events, within the perched groundwater system provided a mechanism for horizontal contaminant transport. As a result, lateral rather than vertical product migration predominated adjacent to the loss point. The configuration of the low permeability 'perching' strata in conjunction with the hydraulic gradient of the perched groundwater system functioned to distribute product in both up and downgradient directions relative to the underlying water table aquifer. Upon encountering monitoring well locations, the product was preferentially transported down the well bore/annulus, in response to a permeability gradient, subsequently accumulating on the water table. The presence of increased permeability conduits (monitoring wells), facilitated rapid vertical product transport through the perching horizon to the underlying water table aquifer. In addition, substantial artificial product accumulations, as great as 20 ft in thickness, were observed in the monitoring wells. Due to the isolated nature of free product accumulation on the water table as well as the presence of perched nonaqueous liquid, a portable rather than a centralized remedial system was deployed. The portable system accelerates site remedial activities while minimizing the adsorption and dispersion of contaminants within the subsurface, a common problem associated with a centralized recovery system. (Author's abstract)

EFFECTS OF HYDROCARBONS ON THE SETTING OF THE AMERICAN OYSTER, CRASSOSTREA VIRGINICA, I INTERTIDAL HABITATS IN SOUTHEASTERN NORTH CAROLINA - W89-10672

Smith, C. M. Hackney, C. T.

Estuaries ESTUDO, Vol. 12, No. 1, p 42-48, March 1989. 8 tab, 21 ref. JOURNAL ISSUE- W2210 CORPORATE AUTHOR(S)- North Carolina Univ., Wilmington. Dept. of Biology. NDN- 036-0010-8774-0

Effects of petroleum covered substrate on intertidal oyster spat (Crassostrea virginica) set were measured at three intertidal elevations in a southeastern North Carolina estuary. Mercenaria mercenaria shells were coated with Bunker C crude oil o a 40:1 mixture of gasoline:2-cycle engine oil and placed intertidally for seven 13-d periods. Spat densities were significantly lower on oil treatments versus control an gas-treated shells in the high intertidal zone. This was principally attributed to a increased sediment coat on oiled shells. Maximum spat size was smaller on oil-treate shells at all elevations when compared to gas and control shells, indicating that setting may be delayed on oiled shells. For all experimental 13-d periods in the low intertidal zone and for three periods in the mid-tidal zone, barnacle densities (primarily Balanus improvisus and B. eburneus) were significantly greater on oiled shells than on control shells. (Author's abstract)

PLASTIC PARTICLE AND TAR POLLUTION ON BEACHES OF KUWAIT - W89-10757

Shiber, J. G.

Environmental Pollution EMPOEK, Vol. 57, No. 4, p 341-351, 1989. 2 fig, 1 tab, 33 ref. JOURNAL ISSUE- W2210 CORPORATE AUTHOR(S)- Shiber Consultants, Safat (Kuwait). NDN- 036-0010-8691-6

Twelve beaches on the northwestern Arabian Gulf coast of Kuwait were surveyed for th occurrence of plastic particles, tar balls, and tar lumps. Particles were found on all beaches and were abundant on four: Sulaikhat, Fintas, Fahaheel, and New Al

khiran. Most particles were composed of low-density polyethylene, but a few were of high-density polyethylene, polypropylene, and polystyrene. Many were weathered and had traces of tar. Tar lumps and balls were present on all beaches, but were not as abundant as expected, considering the heavy volume of oil tanker traffic in this region of the Arabian Gulf. Tar appeared to be less abundant than it was in 1979. With at least 33 plastics factories operating on the coast of Kuwait, it is possible that plastic particles occur more abundantly than was observed in this study. The high winds and concurrent wave activity, which often vary in strength and direction, but regularly occur here, probably play an important role in dispersing plastic particles, thus making accurate estimation of abundance difficult. (Author's abstract)

POLLUTION OF THE SEA: TOXICITY OF WATER-INSOLUBLE FUEL AND OF MERCURIC CHLORIDE (POLLUTION DU MILIEU MARIN TOXICITE DU FUEL ROSE ET DU DICHLORURE DE MERCURE) - W89-10850

Beji, O.

Bulletin de l'Institut National Scientifique et Technique d'Oceanographie et de Pech BNSSEE, vol. 12, p 53-61, 1985. 1 fig, 2 tab, 12 ref. English summary. JOURNAL ISSUE- w2210 CORPORATE AUTHOR(S)- Institut National Scientifique et Technique d'Oceanographie et de Peche, Salammbo (Tunisia). NDN- 036-0010-8598-5

In laboratory tests of the toxicity of mercuric chloride (0.001-50 mg/L) for salt water fish there was at first an apparent phase of inactivity. This phase correspond to the time during which the mercury is absorbed and accumulated by the fish (sea bass, tuna, etc). The mercury compound operated slowly and its toxicity increased with time of exposure in the toxic solution (24 to 48 hr). The water insoluble fuel was found to be non-toxic in 24 to 48 h exposures, even for the maximal dose tested (2 ml/L). (Peters-PTT)

SOURCES, OCCURRENCE AND EFFECTS OF POLYCYCLIC AROMATIC HYDROCARBONS (PAH) IN THE AQUATI ENVIRONMENT-A PRELIMINARY REVIEW - W89-11014

Knutzen, J.

Available from the National Technical Information Service, Springfield, VA 22161, as DE88-752845. Price codes: A03 in paper copy, A01 in microfiche. Report No. NIVA-E--87700/1, April 21, 1987. 21p, 1 tab, 35 ref. JOURNAL ISSUE- w2210 CORPORATE AUTHOR(S)- Norsk Inst. for Vannforskning, Oslo. NDN- 036-0010-8436-1

Polycyclic aromatic hydrocarbons (PAH) are ubiquitous in the environment, mainly due to their formation in practically all incomplete combustions of organic material. Th most problematic anthropogenic sources in the aquatic environment is connected with oil and industrial processes involving use of fossil fuels (including smelters with Soderberg electrodes or anode production). Due to low water solubility (parts per billion (ppb)-parts per million (ppm) range, depending on molecular size) most of PA in water is associated with particulate matter, particularly in contaminated environments. In pristine areas, surface water, groundwater and seawater will contai < 0.05-0.1 micrograms/L (ug/L) total PAH. Total PAH content of organisms will vary somewhat with the species, even in uncontaminated environment, typical values for mussels (< 0.5-1.0 mg/kg dry weight) and fish (< 0.02(0.05) mg/kg dry weight). Potentially carcinogenic PAHs usually constitute < 5-20% of total, benzo(a)pyrene < 1-5%. PAHs are metabolized by certain bacteria and fungi, most groups of invertebrat animals and by fish. Mollusks (snails and in particular mussels) show low activity o the necessary enzymes. Fish rarely show more than moderate excess concentrations eve in contaminated environment, whereas PAH in mussels and snails may reach 3 orders of magnitude higher concentrations than the 'normal' levels; crustacea having an intermediate position. Half-lives of PAH under experimental conditions have been observed to be of the order 1-4 weeks in fish and mussels (fastest release from fish). Organisms with no or little metabolic activity (mussels), which at the same time have a long history of contamination, may show slower purification. Acute toxicity is moderate in the sense that lethal concentration will be rare in nature, even in recipients with a high PAH loading (oil spills represent an exception). Although many individual PAHs have shown effects on growth and cell division in the 1-100 ppb range, consequences on the community level has been difficult to demonstrate. (See also W89-11013) (Lantz-PTT)

SURVIVAL AND ACTIVITY OF STREPTOCOCCUS FAECALIS AND ESCHERICHIA COLI IN PETROLEUM-CONTA MINATED TROPICAL MARINE WATERS - W89-09285

Domingo, J. W. S. Fuentes, F. A. Hazen, T. C.

Environmental Pollution ENPOEK, Vol. 56, No. 4, p 263-281, 1989. 9 fig, 1 tab, 41 ref. Sea Grant R/LR-08-87-THA1, Public Health Service grants RR-2657 and RR-8102, an DOE contract DE-AC09-76SR00001. JOURNAL ISSUE- w2209 CORPORATE AUTHOR(S)- Puerto Rico Univ., Rio Piedras. Dept. of Biology. NDN- 036-0010-8368-J

The in situ survival and activity of Streptococcus faecalis and Escherichia coli wer studied using membrane diffusion chambers in tropical marine waters receiving oil refinery effluents. Protein synthesis, DNA synthesis, respiration or fermentation, [NI-reduced per cell, and ATP per cell were used to measure physiological activity. Cell densities decreased significantly over time at both sites for both S. faecalis and E. coli; however, no significant differences in survival pattern were observed between S. faecalis and E. coli. Differences in protein synthesis between the two were only observed at a study site which was not heavily oiled. E. coli was more active in protein synthesis and respiration than S. faecalis at both oiled and unoiled sites, and the percentage of the E. coli population that was respiring was significantly higher than S. faecalis fermenting cells at both sites. However, S. faecalis cells were more active in DNA synthesis and higher in ATP content than E. coli cells at both sites. Although fecal streptococci have been suggested as a bette indicator of fecal contamination than fecal coliforms in marine waters, in this stud both E. coli and S. faecalis survived and remained physiologically active. (Author's abstract)

EFFECTS OF INGESTED CRUDE AND DISPERSED CRUDE OIL ON THERMOREGULATION IN DUCKS (ANAS PLATYRHYNCHOS) - W89-09561

Jenssen, B. M.

Environmental Research ENVRAL, Vol. 48, No. 1, p 49-56, February 1989. 2 tab, 27 ref JOURNAL ISSUE- w2209 CORPORATE AUTHOR(S)- Trondheim Univ. (Norway). Dept. of Zoology. NDN- 036-0010-8293-5

The effects of oil pollution on adult seabirds are divided into two categories: damage caused by the toxicity of the oil, and damage due to effects of oil on the plumage and in turn on the heat balance. Thermoregulatory effects of ingested doses of Statfjord A crude oil and of this oil mixed with the dispersant Finasol OSR-5 wer studied in adult domestic ducks (Anas platyrhynchos) exposed to ambient temperatures of 16 C and -17C. The data show that ingestion of both the crude and the oil-dispersant mixture resulted in an increased body temperature during exposure to the low ambient temperature (-17 C). Neither contaminant had any effect on body temperature during exposure to 16 C. Ingestion of the contaminants had no effect on metabolic heat production at either ambient temperature. The breast skin temperature of the ducks in both contaminated groups was significantly decreased when the ducks were exposed to the low ambient temperature. This indicates that the increase in bod temperature observed in the contaminated ducks at the low ambient temperature is due to an increase in peripheral vasoconstriction. (Author's abstract)

EFFECTS OF QATAR LIGHT CRUDE OIL ON THE SALTMARSH CRAB SESARMA CATENATA AND ITS IMPLICATIONS IN THE FIELD: TOXICITY TO ADULTS AND LARVAE - W89-09597

Malan, D. E.

South African Journal of Marine Science SJMSE7, Vol. 7, p 37-44, 1988. 3 fig, 1 tab, 36 ref. JOURNAL ISSUE- w2209 CORPORATE AUTHOR(S)- Port Elizabeth Univ. (South Africa). Dept. of Zoology. NDN- 036-0010-8061-6

The toxicity of Qatar Light crude oil to adult and larval Sesarma catenata was determined under different conditions of test solution preparation. Evaporation of the oil and its water-soluble fraction (WSF) were studied and an estimate made of oi content in artificial burrows approximating field volumes. In the experiments with adults, where crude oil was added to the surface of the water and WSF was not renewed, 50% mortality was not obtained, but the crabs were sub-lethally affected (righting response and escape mechanism). These sub-lethally affected crabs usually recovered after a few hours as the WSF of the crude oil escaped rapidly from the seawater, only 32% remaining after 24 h. In the experiment where the experimental solution was renewed every 8 hours, the 24-h and 96-h LC50 values were 12.0 and 9.2 mg/L. Ecological toxicity (animals affected, not killed) was in all cases lower than acute toxicity, larvae being much more sensitive than adults. In the event of an oil spill, it is unlikely that the oil in the seawater contained in the crab burrows wil reach the high concentrations required to produce death in these crabs. (Author's abstract)

HYDROCARBONS IN MUSSELS AROUND THE CAPE PENINSULA, SOUTH AFRICA - W89-09599

Mason, R. P.

South African Journal of Marine Science SJMSE7, Vol. 7, p 139-151, 1988. 9 fig, 6 tab, 19 ref. JOURNAL ISSUE- w2209 CORPORATE AUTHOR(S)- Sea Fisheries Research Inst., Cape Town (South Africa). NDN- 036-0010-8059-8

Two surveys of petroleum hydrocarbon levels in mussels around the Cape Peninsula revealed that harbors are the major source of petroleum hydrocarbons. Other significant sources are industrial effluents and sewage. Levels in mussel tissue, as determined by fluorescence spectroscopy, ranged from 10-100 microgram/g dry weight a

the relatively unpolluted sites to 5000 microgram/g at sites inside Cape Town Harbor. Gas chromatographic analysis of some of the samples revealed a similar trend and concentration range and provided qualitative information on the type of petroleum hydrocarbons present. Based on the results of these surveys and previous work, it is possible to determine an acceptable concentration in mussel tissue which reflects a corresponding acceptable water concentration of petroleum hydrocarbons. (Author's abstract)

ECOLOGICAL EFFECTS OF A MAJOR OIL SPILL ON PANAMANIAN COASTAL MARINE COMMUNITIES - W89-09629

Jackson, J. B. C. Cubit, J. D. Keller, B. D. Batista, V. Burns, K.

Science SCIEAS, Vol. 243, No. 4887, p 37-44, January 6, 1989. 8 fig, 2 tab, 59 ref. JOURNAL ISSUE- w2209 CORPORATE AUTHOR(S)- Smithsonian Tropical Research Inst., Balboa (Panama). NDN- 036-0010-8029-0

In 1986, more than 8 million liters of crude oil spilled into a complex region of mangroves, seagresses, and coral reefs just east of the Caribbean entrance to the Panama Canal. This was the largest recorded spill into coastal habitats in the tropical Americas. Many populations of plants and animals in both oiled and unoiled sites had been studied previously, thereby providing an unprecedented measure of ecological variation before the spill. Documentation of the spread of oil and its biological effects began immediately. Intertidal mangroves, seagrasses, algae, and associated invertebrates were covered by oil and died soon after. More surprisingly, there was also extensive mortality of shallow subtidal reef corals and infauna of seagrass beds. After 1.5 years, only some organisms in areas exposed to the open sea have recovered. The response of organisms to an oil spill, or any other major disturbance, will depend on the conditions in which they normally live. Moreover, the suite of organisms able to survive under conditions of chronic pollution, and their resistance to further stress, is typically different from that in similar unpolluted habitats. Much of the region has been subjected to human disturbance, beginning with decades of excavation, dredging, and landfilling for the construction of the Panama Canal and the City of Colon, drainage and spraying of mangroves for mosquito control, construction of the refinery and a large cement plant on landfill, a major oil spill in 1968, and unknown amounts of chronic oil pollution from the refinery and ships passing to and from the Canal. It is a measure of the severity of the 1986 oil spill that the biological consequences were so detectable despite this history of environmental abuse. (Doria-PTT)

POLYCYCLIC AROMATIC HYDROCARBONS IN PERCH (PERCA FLUVIATILIS) FOLLOWING AND OIL-SPILL I VAASA ARCHIPELAGO, FINLAND - W89-09717

Lindstrom-Seppa, P. Hanninen, O. Tuominen, J. Pyysalo, H.

Toxicological and Environmental Chemistry TXECBP, Vol. 19, No. 1-2, p 83-86, 1989. 1 tab, 7 ref. JOURNAL ISSUE- w2209 CORPORATE AUTHOR(S)- Kuopio Univ. (Finland). Dept. of Physiology. NDN- 036-0010-7942-0

Oil contamination of the local fish (perch, Perca fluviatilis) was determined following and autumn, 1984 fuel oil leakage over an area of 1500 km in the Vaasa Archipelago, Gulf of Bothnia, Finland. Frozen muscle and gall bladder samples were used for analysis. Final analyses were made using high resolution gas chromatography-mass spectrometry. The total polycyclic aromatic hydrocarbon (PAH) levels found in all muscle samples were low, corresponding with the normal backgroun levels of the area. The bile of the perch, however, showed increased PAH levels, but the concentrations did not follow the gas chromatographic profile of the spilled oil. Most likely, the fish accumulating the most PAH did not survive, and fish captured for this study were those with only minor concentrations; also, the cold climate may have had an effect on the oil spilled by clumping it, driving most of it away from the study area. (Friedmann-PTT)

EVALUATING ECOSYSTEM RESPONSE TO TOXICANT STRESS: A STATE SPACE APPROACH - W89-10063

Johnson, A. R.

IN: Aquatic Toxicology and Hazard Assessment: 10th Volume. American Society for Testing and Materials, Philadelphia, PA, 1988. p 275-285, 4 fig, 15 ref. DOE contrac DE-AC05-84OR21400. JOURNAL ISSUE- w2209 CORPORATE AUTHOR(S)- Oak Ridge Nationa Lab., IN. Environmental Sciences Div. NDN- 036-0010-7608-0

Within a state space representation, the response of an ecosystem to a perturbing influence, such as a toxicant, can be viewed as a displacement of the state vector away from its unperturbed trajectory. This approach was used to analyze data from a study of the response of experimental ponds and microcosms to chronic additions of a coal-derived synthetic oil. Ecosystem-level response surfaces and dose-response curves were derived based on the average separation (distance of displacement) of exposed ecosystems relative to controls. Transformation of the data prior to the

calculation of state space displacements is an important aspect of the analysis. A Mahalanobis transformation was used for two reasons: (1) the transformed data are then uncorrelated, so that a displacement of a given magnitude is associated with a unique probability of occurrence independent of direction; and (2) the transformed data are standardized relative to the variance of the controls. The results exhibite patterns analogous to those observed in classical toxicology based on organism response and could be used to define acceptable exposure conditions. the state space approach described provides a coherent and objective framework for summarizing a large multivariate data set, and it should be of general use in providing both qualitative and quantitative descriptions of the behavior of perturbed ecosystems. (See also W89-10042) (White-Reimer-PTT)

USE OF CONTROLLED SOURCE AUDIO MAGNETOTELLURICS (CSAMT) TO DELINEATE ZONES OF GROUND-WATER CONTAMINATION--A CASE HISTORY - W89-10161

Tinlin, R. M. Hughes, L. J. Anzzolin, A. R.

IN: Ground-Water Contamination: Field Methods, American Society for Testing and Materials, Philadelphia, PA, 1988, p 101-118, 12 fig, 3 tab, 5 ref. JOURNAL ISSUE- W2209 CORPORATE AUTHOR(S)- Engineering Enterprises, Inc., Norman, OK. NDN-036-0010-7511-6

A significant potential for the pollution of fresh-water aquifers exists due to oilfield waterflood operations. The sources of potential pollution are surface spills, a lack of mechanical integrity of injection wells, and improperly plugged wells which are in communication with the injection zone. Surface spills are relatively easy to detect and control. Procedures for checking the mechanical integrity of a properly constructed injection well are available. Making a determination in the absence of good records as to whether or not a well is improperly plugged, providing a conduit for the vertical migration of formation brines from the production zone to shallower fresh-water aquifers, is very difficult Electrical surface geophysical methods offer considerable promise in detecting the movement of formation brines into fresh-water aquifers, through improperly abandoned or plugged wells. An electrical surface geophysical technique, Controlled Source Audio-Frequency Magnetotellurics (CSMAT) has been applied to locate the presence of anomalies resulting from the upward movement of formation brines through improperly plugged wells. The primary objective in a CSMAT survey is to provide apparent resistivity and the phase angle between the electric and magnetic fields over a prospect area. CSMAT has the advantages of excellent lateral resolution, good depth penetration (a kilometer or more) and is relatively inexpensive. The frequency and resistivity of the subsurface control the depth of penetration. The lower the frequency, the deeper the penetration. A CSMAT survey was run in an oil-producing field in east central Oklahoma, which is currently on waterflood and has many abandoned and apparently improperly plugged wells. The water in the Vamoosa aquifer underlying the study area has a high chloride content. The objective of running the CSMAT survey was to locate suspected low-resistivity anomalies due to formation brines in the vicinity of improperly plugged wells and to attempt to map their extent. (See also W89-10153) (Author's abstract)

NATURAL OIL SEEPS IN THE ALASKAN MARINE ENVIRONMENT - W89-10309

Becker, P. R. Manen, C. -A.

Available from the National Technical Information Service, Springfield, VA 22161, as PB88-235965. Price codes: A06 in paper copy, A01 in microfiche. Final Report, May 1988. 114p, 33 fig, 10 tab, 154 ref. JOURNAL ISSUE- W2209 CORPORATE AUTHOR(S)- National Ocean Service, Anchorage, AK. Ocean Assessments Div. NDN-036-0010-7564-8

Marine and coastal oil seeps in Alaska and the effects of chronic oil pollution on Arctic marine biotic communities and ecological processes, are discussed. Of 29 oil seepage areas reported along the Alaskan coast, 14 have been confirmed as containing actual oil seeps. Large areas of coastal seepage have been identified in the central Gulf of Alaska and Arctic regions. When compared to known seepage rates on the California coast, the amount of oil entering the Alaska marine environment from know coastal seeps is probably rather small. Also, the organic enrichment of the benthic communities demonstrated at California seeps might not be as evident at Arctic seeps because of slower rate of oil degradation in the latter. Oil released in the Arctic would impact the pelagic, intertidal, benthic and under-ice habitats. The under-ice habitat is the most acutely vulnerable. The potential exists for oil to interact wit the components of this community for a length of time sufficient to lose that portio of the total annual productivity contributed by this community. The pelagic environment is the least vulnerable. The increased persistence of the oil and the long generation times of many species of Arctic zooplankton will contribute to an increased impact, as compared to more temperate waters, but the similarities in the distributions of temperate and Arctic species indicate that the impact would not be significant. The impoverishment of high latitude intertidal zones would alleviate th impact of oil on these areas. The benthic habitat exhibits the potential for chronic

Analyses of dissolved inorganic constituents in the contaminated zone at the Bemidji Minnesota, research site show that significant rock-water interaction is occurring i response to organic contamination (crude oil spill). Dominant geochemical processes were determined from the general mineralogy, bulk-mineral chemistry, and surface morphologies of individual grains of sediment collected from the water table at the site. Laboratory experiments were used to investigate a novel organic/silica interaction identified at the site. Optical and scanning electron microscope (SEM) sediment mineralogy produced comparable results, showing that the relative mineral abundances do not differ significantly between sampling points along the plume. The bulk chemistry is fairly consistent down the plume axis. Trends seen in iron-oxide percentages, which are elevated at sites closest to the oil pool, indicate possible precipitation of an unknown iron phase. The surface features of individual sand grains from each sampling site were examined using SEM. Quartz grains from uncontaminated background locations have surface features indicative of recent glacial origin, as did grains from within the oil body. In contrast, quartz grains from sampling points immediately downgradient from the oil body show clear evidence of rapid chemical weathering. Precipitation of silica occurs on quartz grains 30-50 downgradient from the oil body. The grain-surface analysis indicated a significant interaction between dissolved organic carbon generated from the degradation of oil and the solid silicate phases. Simple dissolution experiments showed that dilute organic acids dissolve quartz far more rapidly than does pure water at neutral pH. (See also W89-10313) (Rochester-PTT)

COMPOSITION AND FATE OF HYDROCARBONS IN A SHALLOW GLACIAL-OUTWASH AQUIFER - W89-10338

Baedecker, M. J. Cozzarelli, I. M. Hopple, J. A.

IN: U.S. Geological Survey Program on Toxic Waste--Ground-Water Contamination: Proceedings of the Third Technical Meeting, Pensacola, Florida, March 23-27, 1987. Available from Books and Open File Report Section, USGS, Box 25425, Denver, CO 80225 1987. p C-23-C-24, 2 ref. JOURNAL ISSUE- W2209 CORPORATE AUTHOR(S)- Geological Survey, Reston, VA. MDN- 036-0010-7335-1

Crude oil at the water table of a shallow aquifer in glacial outwash near Bemidji, Minnesota, has resulted in a contaminant plume downgradient of the oil body. An anoxic plume has developed under the oil and extends 90 m downgradient. Several type of acids and phenol were found in water analyzed by an ether-extraction technique. The highest concentrations of acids are immediately downgradient of the oil body in the anoxic plume. Acetic acid is the main aliphatic monocarboxylic acid and its concentration is between 20 and 130 microgram/L in the anoxic plume. Although higher-molecular weight hydrocarbons (greater than C10) from crude oil are found in water only where the water is in contact with sediment containing oil or an oil film these hydrocarbons are found on sediment further downgradient. Within 65 m of the source, the concentrations of hydrocarbons in sediment decrease by a factor of 1000 to levels of naturally occurring hydrocarbons (100 nanogram/g sediment). The fate an movement of hydrocarbons in a shallow aquifer are controlled by several reactions an processes, including dissolution, volatilization, and sorption. The selective remova of hydrocarbons and the presence of the products from microbial processes indicate that degradation is a major mechanism for the attenuation of hydrocarbons. (See also W89-10313) (Rochester-PTT)

MICROBIAL OXIDATION OF PETROLEUM VAPORS IN THE UNSATURATED ZONE - W89-10339

Hult, M. F.

IN: U.S. Geological Survey Program on Toxic Waste--Ground-Water Contamination: Proceedings of the Third Technical Meeting, Pensacola, Florida, March 23-27, 1987. Available from Books and Open File Report Section, USGS, Box 25425, Denver, CO 80225 1987. p C-25-C-26. JOURNAL ISSUE- W2209 CORPORATE AUTHOR(S)- Geological Survey St. Paul, MN. MDN- 036-0010-7334-0

The long-term fate of many organic groundwater contaminants is controlled by microbially mediated oxidation. Conversion to carbon dioxide of petroleum vapors in the unsaturated zone has been documented at a research site near Bemidji, Minnesota. Crude oil spilled there in 1979 and is floating on the water table about 8 m below land surface in a glacial outwash aquifer. The oil is dissolving in the moving groundwater and vaporizing into the unsaturated zone. The oil is becoming denser, more viscous, and depleted in compounds with low molecular weights. Aromatic compounds preferentially dissolve in the groundwater, whereas alkanes of comparable molecular weight partition to the soil gas. Gas samples analyzed in a mobile laboratory immediately after collection using multiple-column gas chromatography and flame-ionization, photo-ionization, and thermal-conductivity detectors to determine the concentration of methane, major aliphatic and aromatic hydrocarbons, oxygen, carbon dioxide, and nitrogen. Oxygen is diffusing downward from the land surface and is used by microbes in the unsaturated zone to oxidize volatile hydrocarbons that ar diffusing upward from the oil and contaminated groundwater. The partial pressure of oxygen decreases from 0.21 both near land surface and at the water table 70 m downgradient from the floating oil, to less than 0.01 immediately above the floating

and their highest concentrations were: benzene (120 micrograms/L (ug/L)); 1,2-trans-dichloroethylene (2,700 ug/L); xylenes (690 ug/L); vinyl chloride (40 ug/L); and chloroethane (8 ug/L). Based on the Phase II State 1 confirmation study the following conclusions have been drawn: (1) groundwater occurs under unconfined water table conditions in deltaic sands which underlie the FDTA/Old Landfill. Groundwater flow within the shallow localized water table is generally to the north and northeast; (2) a strong downward hydraulic gradient occurs between the shallow water table and the semi-confined to confined water within the underlying glacial tills and bedrock; (3) Levels of total volatile priority pollutant organics were detected at the FDTA/Old Landfill Site ranging from 7 ug/L in BP-2 to 3580 ug/L in BP-7. These ranges do not include trace levels (< 10 ug/L) of various compounds fo which quantification could not be precisely made; (4) Surface water sampling in and around the FDTA/Old Landfill and the Construction Rubble Landfill has revealed limited impacts based upon the presence of EPA Priority Pollutant List volatile organic compounds. (Lantz-PTT)

THREE-PHASE FLOW ANALYSIS OF OIL SPILLS IN PARTIALLY WATER-SATURATED SOILS - W89-08246

Lujan-Sierraalta, C. A.

Available from University Microfilms International, 300 N. Zeeb Road, Ann Arbor, MI 48106. Order No. 8607657. Ph.D. Dissertation, 1985. 132p, 29 fig, 3 tab, 120 ref. JOURNAL ISSUE- w2209 CORPORATE AUTHOR(S)- Colorado State Univ., Fort Collins. Dept. of Civil Engineering. NDN- 036-0010-7137-8

A model was developed of the flow of three-phase immiscible fluids in partially water-saturated soils, in which the movement of oil after a spill can be predicted. Sensitivity analysis showed that air confinement does not significantly reduce the oil infiltration rate. Therefore, a two-phase version of the Galerkin finite elemer program OILSPL could be developed. The three-phase model would be used for situatic in which the changes in air pressure and flow play a significant role. The difficulties of simulating the advancement of an oil front in soils with values of lambda greater than five should not be a major restriction of the use of the numerical model, given that most spills have lambda values of less than four. The numerical model OILSPL should prove to be helpful in predicting the response of oil to diverse conditions such as a fluctuating water table, air or water injections, a rain; as well as to estimate the time required for the front to reach the water table. (Cremmins-AEPCO)

SUBLETHAL BIOLOGICAL EFFECTS MONITORING IN THE REGION OF SULLOM VOE SHETLAND, JULY 198 - W89-08544

Widdows, J. Dixon, D. Donkin, P. Evans, S. V. Lowe, D.

Available from the National Technical Information Service, Springfield, VA 22161, a PB88-147905. Price codes: E05 in paper copy, A01 in microfiche. March 1987. 19p, 3 fig, 9 tab. JOURNAL ISSUE- w2209 CORPORATE AUTHOR(S)- Institute for Marine Environmental Research, Plymouth (England). NDN- 036-0010-6844-6

The overall objective of the field program is to use the common mussel Mytilus edulis, as a sentinel organism to monitor the sublethal biological effects of oil pollution in the littoral environment in the vicinity of the oil terminal at Sullom Voe, in order to detect any effects of industrial activity in the area. However, th 1986 mussel samples proved far from ideal for intercalibration purposes due to the low levels of petroleum contamination and presence of biogenic interferences. Nevertheless, mussels from Tanker Jetty 3 were the most contaminated, and those fro Gluss Voe the least contaminated. The degree of oil contamination of the littoral environment around Sullom Voe appears to have declined between July 1985 and July 1986. These observations appear to be in agreement with the reduction in quantities of crude oil spilled at the Sullom Voe oil terminal during this period. However, a complete set of Sullom Voe oil pollution reports is not available at present. Calna Taing, the most contaminated site measured in 1985, following the 'BP Vision' spill had considerably lower levels of contamination in July 1986 (i.e., 20% of 1985 values). This demonstrates the relatively rapid recovery of contaminated mollusks i littoral environments. Mussels from Gluss Voe and Voxter Voe continue to have low a background concentrations of aromatic hydrocarbons in their tissues. There is generally little relationship between the concentrations of aromatic hydrocarbons accumulated in the body tissues of Mytilus (a suspension feeder in the surface waters) and the concentrations of petroleum hydrocarbons in the sediments of Sullom Voe. However, Garth's Voe was identified as the most contaminated area. Studies of embryo and larval development suggested that at the elevated concentrations of hydrocarbons found in the vicinity of the tanker loading jetties (i.e., at the lowe 1986 levels) there were measurable toxic effects which need further investigation. (Lantz-PTT)

FATE AND EFFECT OF PETROLEUM HYDROCARBONS AND TOXIC ORGANICS ON LOUISIANA COASTAL ENVIRONMENTS - W89-07253

Delaune, R. D. Gambrell, R. P. Patrick, W. H. Pardue, J.

IN: Preprints of Papers Presented at the 194th ACS National Meeting, Vol. 27, No. 2, Division of Environmental Chemistry, American Chemical Society, Washington, DC. 1987 p. 83-84. JOURNAL ISSUE- W2207 CORPORATE AUTHOR(S)- Louisiana State Univ., Baton Rouge. Center for Wetland Resources. NDN- 036-0010-5853-2

The degradation, toxicology and transport of petroleum hydrocarbons, pesticides, and industrial organics entering Louisiana coastal environments as a result of major spills or chronic low-level runoff are discussed. Oxidation-reduction potential and pH were important factors governing the activity of hydrocarbon-degrading microorganisms and subsequent mineralization rates in sediment from Louisiana's Barataria basin. Because the herbicides 2,4-D and trifluralin are mineralized or degraded at slower rates under anaerobic conditions, surface runoff of these herbicide residues and their incorporation into anaerobic sediments will retard thei degradation relative to degradation rates of the residues that remain associated wit upland aerobic soils. A recent study on degradation of PCP (a wood preserving compound) following a major spill showed that degradation was strongly influenced by sediment pH and oxidation-reduction potential conditions. Sediment pH and redox potential also determined the rate of PCB mineralization. Results suggest that the PCB-degrading microbial population is not comprised entirely of aerobic microorganisms. Sediment conditions in the oxidized surface microlayer would promote PCB mineralization. There are conflicting reports on the ecological effects of toxic organics in Louisiana coastal areas. In a recent study in which petroleum was applie to replicated plots in a Spartina alterniflora salt marsh, it was found that oiling in the marsh caused no reduction in macrophyte production as compared with the non-oiled plots. A site study was conducted on the effects of creosote (a wood preservative) contamination in a bayou more than 10 years after a major spill occurred. Levels of specified polynuclear aromatic hydrocarbon compounds still exceeded several thousand microg/g at the most contaminated sites. The creosote adversely affected biological processes in the bayou sediment as indicated by sediment oxidation-reduction potential measurements, organic matter accumulation measurements of microbial enzyme activity, and counts of meiobenthic organisms. (See also W89-07234) (Miller-PTT)

LONG-TERM EFFECTS OF OFFSHORE OIL AND GAS DEVELOPMENT: A SYNTHESIS - W89-07254

Boesch, D. F. Rabalais, N. N.

IN: Preprints of Papers Presented at the 194th ACS National Meeting, Vol. 27, No. 2, Division of Environmental Chemistry, American Chemical Society, Washington, DC. 1987 p. 85-86. JOURNAL ISSUE- W2207 CORPORATE AUTHOR(S)- Louisiana Universities Marine Consortium, Chauvin. NDN- 036-0010-5852-0

A synthesis of a four year effort to assemble and understand long-term environmental effects of offshore oil and gas development activities is presented. Of the many issues regarding the potential effects of expanded offshore development, the potential for long-term and insidious effects on the marine environment has frustrated resolution. A team of experts from throughout North America provided a critical evaluation of the large body of information assembled. A smaller group critically evaluated the effects to identify long-term environmental consequences. Nine general long-term effects were identified as being of priority for future investigations: (1) chronic biological effects resulting from the persistence of medium and high molecular weight hydrocarbons and heterocyclics and their degradatio products in sediments and cold environments, (2) residual damage from oil spills to biogenically structured communities such as coastal wetlands, reefs and vegetation beds, (3) effects of channelization for pipeline routing and navigation on coastal wetlands, (4) effects of physical fouling by oil of birds, mammals and turtles, especially in species in which a large percentage of the population aggregates at certain times, (5) effects on benthos of drilling discharges accumulated through field development, (6) effects of produced water discharges generated offshore but discharged into nearshore environments, (7) effects of noise and other physical disturbances on populations of birds, mammals and turtles, (8) reduction of fishery stocks due to mortality of eggs and larvae as a result of oil spills, and (9) effect of man-made, usually gravel, islands and causeways in the Arctic on benthos and anadromous fish species. Several recommendations, which were made to guide future research, have been implemented in Department of the Interior studies in the Gulf of Mexico and off southern California. (See also W89-07234) (Miller-PTT)

NATURAL RECOVERY PROCESSES OF MARINE SEDIMENT CONTAMINATED DURING OFFSHORE DRILLING ACTIVITIES - W89-07279

Baron, J. A. Reible, D. D. Thibodeaux, L. J.

IN: Preprints of Papers Presented at the 194th ACS National Meeting, Vol. 27, No. 2, Division of Environmental Chemistry, American Chemical Society, Washington, DC. 1987 p. 171-173. 5 ref. JOURNAL ISSUE- W2207 CORPORATE AUTHOR(S)- Louisiana State Univ., Baton Rouge. Dept. of Chemical Engineering. NDN- 036-0010-5827-1

Laboratory experimentation to define the rate of sediment leaching was conducted and preliminary results are described. In addition, a model of the leaching process is described and compared to the preliminary experimental results. A preliminary model of the leaching process indicated that both naphthalene and dichlorobenzene would be lost to an overlying water column within a period of weeks, a lifetime convenient fo the experiment. The sediment was also inoculated with antibiotics to eliminate biological activity. The inoculated waste was mixed, sampled for characterization of initial levels and then added to a refrigerated aquarium that allowed maintenance of seafloor temperature. The leaching experiment was initiated through the addition of salt water to fill the aquarium. The overlying water was mixed slowly and replaced, when necessary, to avoid development of water side mass transfer resistance. The movement of the chemicals from the sediment to the water was followed by analysis of vertical cores taken at various time intervals. The measured vertical concentration profiles of the chemical contaminants will be used to determine mass loss flux as a function of time. This is simply the integration of the observed difference between the initial concentration profile and that observed at a later time. Since the preliminary model predicts mass loss flux as a function of time, it can be used to compare to the observed mass loss. (See also W89-07234) (Miller-PTT)

PETROLEUM DRILLING/PRODUCTION OPERATION ON THE GULF OF MEXICO AND THE GULF COAST - W89-07280

Fang, C. S.

IN: Preprints of Papers Presented at the 194th ACS National Meeting, Vol. 27, No. 2, Division of Environmental Chemistry, American Chemical Society, Washington, DC. 1987 p. 174-175. JOURNAL ISSUE- W2207 CORPORATE AUTHOR(S)- University of Southwestern Louisiana, Lafayette. Dept. of Chemical Engineering. NDN- 036-0010-5826-0

The environmental impact of offshore and onshore petroleum drilling and production i the Gulf of Mexico and on the Gulf Coast is discussed. In production of oil and gas, a large amount of produced water is generated, which is discharged directly, or through rivers to the Gulf of Mexico. In produced water, there are 'free' oil, emulsified oil, and dissolved hydrocarbons. In production, hydrogen condensates and crude oil have intimate contact with brine in the long production tubing strings, when they flow upward together to the wellhead. Sometimes that are mixed by turbulence and contraction in tubing. Free oil and emulsified oil are separated from brine by a gravity oil separator and gas flotation units. Some hydrocarbons in soil, such as naphthenes and aromatics, are extracted by brine because of their relatively high solubilities. These dissolved hydrocarbons become a part of total organic carbo in produced water. Most of these extracted hydrocarbons appear to be removed from brine by the heating in heaters and interphase mass transfer in flotation units. Mos chemicals added in production wells and service pipelines are organic compounds. The are added to protect the equipment and to assure smooth production. They are: (1) biocides (formic acid, acetic acid, hydrochloric acid), (2) corrosion inhibitors (amines), (3) antifreezes (methanol, ethanol, ethylene glycol), and (4) coupling solvents (isopropanol). Because they are polar molecules, they survive the heating and flotation and are found in produced water in a fairly high level, 1000 to 2000 ppm. Coagulants-flocculants and emulsion breakers used in the surface equipment are polyamines, polyacrylates, and various organic polymers. They also contribute to the total organic carbon in produced water. Since industrial grade of these chemicals is used, their impurities, such as acetone, are also found in produced water. Occasionally, acidization is needed to treat a production well. Hydrofluoric acid, hydrochloric acid or sulfuric acid is used. It is concluded there is a definite environmental impact on the Gulf of Mexico and on the Gulf Coast by petroleum drilling in the past decades and the present on-going oil and gas production. The industry has made significant improvement in pollution control in the 1970s and the early 1980s. (See also W89-07234) (Miller-PTT)

REVIEW OF MICROBIAL POLYNUCLEAR HYDROCARBON DEGRADATION - W89-07309

Bleam, R. D. Li, K. M. Pirnik, M. P.

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correlated with total extractable sedimentary hydrocarbons (TEH) measured at each station and for each correspond.ng depth interval. All parameters exhibited seasona differences that may have been temperature-dependent. The greater concentrations of TEH, sulfide, and alkalinity with increasing sedimentary depth indicate that seep sediments are a source of these constituents to the water column and a sink for O2 and SO4(--). The strong heterotrophic, and possibly chemoautotrophic, character of seep sediments resembles that of other organically enriched systems. The diagenesis of petroleum hydrocarbons is a function of the biogeochemical patterns and microbia heterotrophic activities in surficial sediments. (Author's abstract)

OIL POLLUTION AND PLANKTON DYNAMICS. V. CONTROLLED ECOSYSTEM EXPERIMENTS IN LINDASPOLLENE, NORWAY, JUNE 1980: EFFECTS OF OIL, OIL/NUTRIENTS, AND OIL/DISPERSANT ON MICROPLANKTON - W89-07835

Dale, T.

Sarsia SARIA3, Vol. 73, No. 3, p 169-178, 1988. 1 fig, 4 tab, 48 ref. Norwegian Research Council for Science and the Humanities grant D.51.44.035. JOURNAL ISSUE w2207 CORPORATE AUTHOR(S)- Bergen Univ. (Norway). Inst. of Marine Biology. NDN- 036-0010-5278-5

The responses of some marine microplankters to oil, oil/nutrients, and oil/dispersa were tested during the summer using enclosed water columns (20 m long, 0.78 sq m surface). Addition of 0.5 l crude oil to the surface in one bag caused the heterotrophic ciliates at 0.5 and 2 m depths to disappear after 3 and 10 days in samples with concentrations of oil-derived material of 0.207 and 0.728 mg per l, respectively. Myrionecta rubra (Lohmann) Jankowski appeared to be more sensitive to oil-derived material than the heterotrophic ciliates. The disappearance of the ciliates from the surface layer in the oil bag was probably due to migration to deeper strata. Compared to the effects from oil alone, addition of oil and dispersa (Corexit 9527) caused a faster depopulation of ciliations of the oil-derived material, however, the dispersed oil appeared less harmful to the ciliates and the dinophysids than the oil alone. M. rubra appeared to be less sensitive to the dispersed oil than the heterotrophic ciliates. As the heterotrophic ciliates never reappeared at 0.5 m in either the oil bag or the oil/dispersant bag but reappeared the end of the experiment in the oil/nutrient bag, it is assumed that the nutrients ameliorated the negative effects of the oil. (Author's abstract)

OIL POLLUTION AND PLANKTON DYANAMICS. VI. CONTROLLED ECOSYSTEM EXPERIMENTS IN LINDASPOLLENE, NORWAY, JUNE 1981: EFFECTS ON PLANKTONIC CILIATES FOLLOWING NUTRIENT ADDITION TO NATURAL AND OIL-POLLUTED ENCLOSED WATER COLUMNS - W89-07836

Dale, T.

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The abundance pattern of planktonic ciliates was studied outside and inside 4 plast enclosures (20 m deep, 1 m diameter), which received different treatments (no additions, addition of nutrients, addition of oil, addition of oil and nutrients). Except for increased abundances of Myrionecta rubra (Lohmann) Jandowski and Tiarina sp. in the control bag compared to outside, no marked bag effects were observed. Addition of nutrients was associated with increased abundance of the total assembla of heterotrophic ciliates, but not of the autotrophic ciliate, M. rubra. Heterotrophic ciliates and M. rubra disappeared from 0.5 and 2 m depth four days after oil addition. The concentration of oil-derived material at the time of disappearance was 0.45 mg/l. M. rubra appeared to be more sensitive to the oil than the heterotrophic ciliates. Addition of nutrients to the oil decreased the negative effects from the oil on the heterotrophic ciliates, but not on M. rubra. A bloom of tintinnids occurred in the bag with added oil and nutrients. It is proposed that the loricated choreotrichs are better protected towards oil-derived material than non-loricated choreotrichs. Tiarina sp. apparently is a predator on M. rubra. The total assemblage of all heterotrophic ciliates and the individual species, Tiarina sp. and Acanthostomella norvegica (Daday), exhibited minimum generation times of 65, 51, 27 hrs respectively, at temperatures between 14 and 17 C. (Author's abstract)

EFFECTS OF OIL CONTAMINATION AND CLEANING ON SEA OTTERS (ENHYDRA LUTRIS): I. THERMOREGULATORY IMPLICATIONS BASED ON PELT STUDIES - W89-07942

Williams, T. M. Kastelein, R. A. Davis, R. W. Thomas, J. A.

Canadian Journal of Zoology CJZOAG, Vol. 66, No. 12, p 2776-2781, December 1988. 2 fig, 1 tab, 23 ref. U.S. Dept. of the Interior contract 14-12-0001-30157. JOURNAL ISSUE- w2207 CORPORATE AUTHOR(S)- Hubbs/Sea World Research Inst., San Diego, CA. NDN- 036-0010-5172-0

The contamination of sea otter (Enhydra lutris) fur with crude oil or dispersants

reduces its insulation and could subject the animal to hypothermia. Four detergents and two pretreatments were tested on sea otter pelts soiled with fresh crude, 5-day weathered crude, and an oil-dispersant (CORExIT 9527) solution. To examine the effects of oiling and cleaning on the thermal properties of fur, the thermal conductance of untreated, oiled, and cleaned pelt samples was determined with a heat-flow transducer. Changes in lipid concentration in the fur resulting from contamination and cleaning were also assessed. The results demonstrated that Dawn dishwashing detergent was the most effective agent in removing crude oil from sea otter fur. This detergent removed similar amounts of oil with 15 or 40 C rinse wate and was less effective when used in conjunction with mineral oil or soap pretreatments. Oil contamination caused a two- to four-fold increase in thermal conductance over base-line levels (7.64 + or - 1.30 W/(sq m times C)). Following cleaning, the thermal conductance of the pelt was not significantly different from that of untreated fur. However, mean lipid weight decreased from 7.4 mg lipid/g fur in untreated pelts to 2.0 mg lipid/g fur in cleaned pelts. This study demonstrated that even though natural oils may be lost during the cleaning process, proper cleaning and rinsing restores the water repellency of the sea otter pelt after exposure to crude. (Author's abstract)

EFFECTS OF OIL CONTAMINATION AND CLEANING ON SEA OTTERS (ENHYDRA LUTRIS): II. METABOLISM, THERMOREGULATION, AND BEHAVIOR. - W89-07943

Davis, R. W. Williams, T. M. Thomas, J. A. Kastelein, R. A. Cornell, L. H.

Canadian Journal of Zoology CJZOAG, Vol. 66, No. 12, p 2782-2790, December 1988. 5 fig, 6 tab, 29 ref. Dept. of the Interior contract 14-12-0001-30157. JOURNAL ISSUE- w2207 CORPORATE AUTHOR(S)- Hubbs/Sea World Research Inst., San Diego, CA. NDN- 036-0010-5171-9

The purpose of this study was to develop a method to clean and rehabilitate sea otters (Enhydra lutris) that might become contaminated during an oil spill and to determine which physiological and behavioral factors were important in restoring the insulation provided by the fur. Tests were conducted on 12 sea otters captured in Alaska and brought to the Sea World Research Institute in San Diego. Measurements of average metabolic rate, core body temperature, behavior, and squalene (the major lipid of sebum) concentration on the fur were made under three conditions: (i) before oiling (base line), (ii) 1-3 days after 20% of the body surface area was covered with fresh crude oil, and (iii) after cleaning. Under base-line conditions in water at 1[illegible] C, average metabolic rate was 8.0 W/kg, core body temperature was 38.9 C, and whole body thermal conductance was 10.7 W/(sq m times C). Otters spent 35% of their time grooming, 45% resting, 10% swimming, and 10% feeding. The squalene concentration on the fur averaged 3.7 mg/g fur. Oiling increased thermal conductance 1.8 times. To compensate for the loss of insulation and maintain a normal core body temperature (3[illegible] C), the otters increased average metabolic rate (1.9 times) through voluntary activity and shivering; the time spent grooming and swimming increased 1.7 times. Using Dawn detergent, we were able to clean the oiled fur during 40 min of washing and rinsing. Grooming activity by the otters was essential for restoring the water-repellent quality of the fur. Core body temperature, average metabolic rate, and thermal conductance returned to base-line levels 3-6 days after cleaning. Squalene was removed by cleaning and did not return to normal levels in the oiled area after 7 days. Veterinary care was important to keep the otters healthy. At least 1-2 weeks should be allowed for otters to restore the insulation of their fur and for recovery from the stress of oiling and cleaning. (Author's abstract)

PROBLEMS OF LAKE PEIPUS-PIHKVA (PROBLEMY PSKOVSKO-CHUDSKOGO OZERA) - W89-08005

Simm, H.

Eesti NSV Teaduste Akadeemia Toimetised, Bioloogia ETATAW, Vol. 6, No. 2, p 105-110, 1987. 15 ref. English summary. JOURNAL ISSUE- w2207 CORPORATE AUTHOR(S)- Akademiya Nauk Estonskoi SSR, Tartu. Inst. Zoologii i Botaniki. NDN- 036-0010-5109-4

The quality of water of Lake Peipsi-Pihkva has deteriorated in recent years due to human impact. In order to solve the problems of this lake, a complex research progra was established in which more than 20 institutions of the Estonian SSR participate. The main task of the research is to estimate the present state of the ecosystem and to forecast its future state taking into account the influence of natural factors an human activities. In order to achieve results it is necessary to obtain knowledge on the metabolism and synergism in the lake and its basin and the causal connections an regularities in the ecosystem. Measures for the protection of the lake are being worked out based on this knowledge. The main process in the lake is the anthropogeni eutrophication. Investigations of this secondary pollution and the ecological change in the lake form the major part of the research. Research has centered on the hydrological, hydrochemical and hydrobiological properties of the lake. Special attention has been paid to the contents of nutrients that cause the eutrophication, their dynamics in the lake ecosystem and their loading level. The dynamics of the concentration of other substances - heavy metal salts, trace elements, oil, and