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COVER Color-enhanced tissue section from a human ovarian epithelial carcinoma. The tumor cells contain >fivefold amplification of the HER-2/*neu* proto-oncogene. The section is immunostained with antibody to the HER-2/*neu* protein. The typical cystic nature of the tumor can be seen, and there is intense membrane staining (brown color) of the tumor cells lining the cystic structures. Stromal cells and nonmalignant elements are unstained, indicating the absence of the protein (×100). See page 707. [Photograph by D. J. Slamon, Department of Medicine, UCLA School of Medicine, Los Angeles, CA 90024, and M. F. Press, Department of Pathology, University of Southern California School of Medicine, Los Angeles, CA 90033]

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Oil Spills

The Alaskan oil spill has become the most studied and managed event of its kind. Some 30 teams from various state and federal agencies have, as their goal, assessment of damage accruing from it. Each morning at Valdez there have been briefing sessions attended by 60 to 70 scientists. The cleanup is being managed by a committee that includes representatives from about 12 state and federal agencies.

Thus far the sequence of events following the spill has been governed by local factors such as wind, temperature, ocean currents, geology, and the composition of the Prudhoe Bay crude oil. Nevertheless events have been following a pattern similar to those observed in spills of crude oil elsewhere.

Crude oils differ, but in general they contain hundreds, even thousands, of different compounds. Some are straight-chain hydrocarbons with carbon numbers ranging from 4 or 5 to 35 or more. Other hydrocarbons have branched chains with a wide range of carbon numbers. Aromatic compounds such as benzene, toluene, and polynuclear hydrocarbons are substantially present. Other constituents include waxes and complex, high molecular weight asphaltenes. All of these substances and more are present in Prudhoe Bay crude oil. When ingested, most of the compounds are nontoxic. Notable exceptions are some of the aromatic compounds, including benzene and toluene.

After a crude oil is spilled in a marine environment, many processes follow. A typical crude has a density of about 0.85, more or less, and this factor combined with winds, wave action, and currents leads to spreading, which is particularly rapid during the first 24 hours. During that period most of the components having boiling points below 200°C volatilize. As a result some of the toxic chemicals such as benzene are removed. The composition of the floating mixture is further changed immediately and later by photooxidation, biodegradation, dispersion, and dissolution. About a day after the spill, depending on temperature and wave action, an emulsification of oil and sea water occurs, leading to formation of a highly viscous material that contains about 70% water. This material is very sticky, and it adheres to almost all objects that it encounters, including birds and sea otters. There has been one report of a minor fish kill in Prince William Sound. Observations at other oil spills indicate that dispersed oil is not toxic to zooplankton when ingested. It is eliminated in the feces. In general, oil chemicals are not concentrated in the food chain.

In Prince William Sound local factors have affected the movement and behavior of the spill. Part of the time, the sea is relatively calm, but often it is roiled by winds that create waves 20 feet high and more. The amplitude of the tide is about 15 feet. The Alaska Current enters the Sound on the east and exits on the west. This flow has protected some of the Sound from major contamination and has carried part of the spill out of the Sound. As a result of various physical , biological, and chemical processes, the inventory of oil in Prince William Sound (originally 10 million gallons) dropped about 70% during the first 4 weeks after the spill. The U.S. Forest Service, one agency active at the site, quotes an Exxon estimate as follows: evaporated, 35%; recovered, 17%; burned, 8%; biodegraded, 5%; dispersed, 5%. The total in the form of oil slicks on Prince William Sound amounted to 10% of the original spill; that on the shoreline, 18%. A large fleet of vessels was mopping up the slicks, and in good weather was capturing about 120,000 gallons a day. Previous experience has shown that once the slicks become thin (some micrometers) they are fairly rapidly destroyed by photooxidation and microbial action. However, the tarry oil on 300 miles of shoreline will only slowly be removed by wave action and by a workforce of about 4000.

Insofar as part of the oil leaves Prince William Sound and affects other portions of the Alaska coastline, Exxon will have additional problems. However, due to the cleanup, the flushing action of the Alaska Current, and the fact that some of Prince William Sound has escaped major contamination, it is likely that in a few years or less, the fauna of the Sound will be substantially restored. But television viewers will not soon forget heartrending scenes of oiled birds and sick otters.—PHILIP H. ABELSON