properties that might be expected to lead to endocrine disruption in an intact organism or its progeny or subpopulations.

The global inventory of research on endocrine disruptors is intended to serve as a communications tool, providing information exchange among scientists worldwide. This will allow for the examination of current research efforts, and aid in identifying research gaps and developing strategies to address such gaps. The steering committee was asked to address four main issues concerning the inventory—structure and content of the inventory, criteria for inclusion of research projects, a communications strategy, and a timetable and oversight for the inventory.

The global inventory will be built on ongoing inventory efforts in the United States, Canada, and the European Union. The steering committee determined that the top priority in developing the inventory should be to integrate existing databases from these three sources into a single online database, which will be available to researchers worldwide as well as to the general public. The integration of the database is being coordinated by the U.S. EPA. Robert Kavlock, director of the reproductive toxicology division of the EPA, says he and others are now in "data collection mode" and are working to update and combine databases from both government and nongovernmental organizations. Kavlock says the database will be useful for funding organizations to ensure that research they support is complementary to other research efforts, and to individual investigators in identifying others around the world with common research interests. Kavlock says he is optimistic that the database will be completed by the end of this year. The current U.S. database is available on line at http://www.epa.gov/endocrine.

The IPCS is simultaneously working to develop a state of the science assessment report. The steering committee members discussed the objectives of the report, and determined that the document is intended to build on existing assessment documents—including what is known about the health and ecological effects of endocrine disruptors—and identify what uncertainties remain. The document is intended to help direct future research on endocrine disruptors. The committee members stressed that the document will focus on science and not on risk assessment. They also noted that the document will emphasize global issues, such as transboundary migration of environmental contaminants.

The committee members also discussed the development process of the document. The process will provide opportunities for multisectoral input, and will also include rigorous international peer review. The document will require the participation of approximately 25 authors, according to Terri Damstra, team leader of the WHO/IPCS Interregional Research Unit, who is the responsible IPCS officer overseeing the project. Damstra says the steering committee is now working to select potential authors, who will be chosen on the basis of scientific expertise. The committee has developed a preliminary outline, which will be expanded upon by prospective authors in the next few months.

The steering committee noted that, although the first meeting was limited to scientific experts, the future process will be open to the public and include input from multiple interests. The final document will be published as a WHO document that organizers hope will be available in the spring of 2000.

An International Assessment of the State of the Science of Endocrine-Disrupting Chemicals (EDCs)

- will provide a scientific evaluation of peer-reviewed, publicly available data on the human health and ecological effects of EDCs
- will be developed simultaneously with a global inventory of research on EDCs
- will build on existing assessment of EDC documents
- will address global concerns
- will provide an opportunity for stakeholder input
- will be published as a peer-reviewed WHO document (not intended as a risk assessment or consensus document)

Landfills: Is Wetter Better?

Over the past 30 years, garbage landfill designers have gone to great lengths to halt groundwater pollution. In a well-designed modern landfill, caps keep water out, liners and liquid removal systems control any water that does enter, and groundwater pollution is not a significant problem. But new landfills are so dry that garbage can take many decades to decompose. That may be too long, according to Robert Ham, professor emeritus of civil and environmental engineering at the University of Wisconsin at Madison, and author of a new study on landfill decomposition that has been accepted for publication in the Journal of Environmental Engineering.

At intervals of one, two, and six years after placing bags of waste in landfills in Florida, Pennsylvania, and Wisconsin, Ham and his colleagues exhumed the bags and weighed the garbage that remained. They found that most food items had degraded significantly, with faster decay occurring in moister conditions. Newspaper, however, was the most decay-resistant of all the materials tested—even more so than disposable diapers. In a dry, well-capped Wisconsin landfill, newspapers lost only 5.6% of its dry weight in six years. But in a Florida landfill that lacked the clay cap that is required on new landfills, newspapers lost 7.4% of its weight in the first year, and 17% by the second year (the six-year samples could not be located in Florida). Ham says the study shows that garbage does degrade in a dry, modern landfill, but that it degrades much faster when moisture is present. Thus, Ham calls moisture the "master variable" in the decomposition rate.

The rate of decomposition has been largely ignored in the quest for safer landfills. But Ham says faster decomposition is better, because landfills produce the highest concentrations of various substances in toxic leachate (water that contains dissolved chemicals from the garbage) and the greenhouse gas methane while the garbage is actively decomposing. When anaerobic bacteria devour garbage, they produce methane, which is often recovered from landfills and burned to generate electricity. Ham says rapid decomposition would raise the rate of methane generation, improving the economics for recovery and, thus, reducing emissions to the atmosphere.

The present policy of dry landfills may be good for groundwater, Ham says, but it is "causing problems over the long haul by postponing decomposition until years after the waste is emplaced." He expects that decay could take as long as 50 years in modern landfills.

Instead of the "dry tomb" approach described above, Ham advocates building "bioreactors" where decomposition would be accelerated. The idea interests some landfill operators. "It's very important for financial reasons," says Martin Felker, manager of landfill engineering at Waste Management, a garbage hauling corporation based in Oakbrook, Illinois. The faster the waste degrades, Felker notes, the more waste will fit in a particular site. Furthermore, rapid degradation could also reduce the duration of monitoring groundwater and methane around landfills.
Monitoring and recovering contaminated leachate at closed landfills costs Waste Management hundreds of millions of dollars every year, Felker adds. The EPA requires monitoring for 30 years after a landfill is closed; if decay was more rapid, the hazard would abate faster, he points out. Rapid decomposition could also benefit neighbors of landfills. Presently, Ham says, the parties responsible for a landfill may be out of business before leakages of leachate or methane occur, preventing the recovery of damages.

But will bioreactors be safe? Ham thinks they can be. For one thing, they would retain the key features of modern landfills, including the methane recovery equipment and the clay and plastic bottom liners that prevent leachate from escaping. The major alteration would be to modify the cap that now prevents rainwater from entering, and to recirculate leachate or even add water to keep the garbage wet enough to decay.

The idea of bioreactors is catching on fast. Debra Reinhart, associate dean of the school of engineering at the University of Central Florida in Orlando, who has consulted on the issue for the EPA, says about 100 landfills nationwide are using some form of accelerated decomposition, with no reports of leakage. While short-term concerns such as possible clogging of recirculation systems remain to be investigated, she says, "[In the long term] this is certainly protective of groundwater, because you are treating the source of the contamination over a shorter period. When the barriers fail, the leachate will be less toxic... This will become the state of the art in the near future."

The landfill industry is intrigued by the idea of shifting to bioreactors. "There's no reason it should not be done, or can't be done," says Ed Repa, director of environmental programs at the Environmental Industries Association. Another industry group, the Solid Waste Association of North America, expects to publish a white paper on bioreactors in June.

To help determine safety and optimize the technology, Ham is now consulting with a major waste hauler about building a state-of-the-art landfill to test a variety of advanced decomposition techniques. If the landfill fails, he says, liners and a leachate collection system would already be in place to prevent groundwater contamination. And if it works, it could save future generations the expense of monitoring thousands of landfills for at least 30 years after closure.

In 1966, Congress signed the National Sea Grant College and Program Act, which authorized "the establishment and operation of sea grant colleges and programs by initiating and supporting programs of education and research in the various fields relating to the development of marine resources." Today's National Sea Grant College Program, a consortium of 29 U.S. universities in partnership with the National Oceanic and Atmospheric Administration (NOAA), addresses such issues as aquatic resource management, environmental quality, and economic competitiveness. NOAA administrator James Baker calls it "one of the best examples in the country of a successful partnership between the federal government and the nation's best universities." The program's Web site, located at http://www.mdsg.umd.edu/NSGO/index.html, is not only a treasure trove of data from the past three decades' work but also a springboard for the work that still needs to be done.

The What Is Sea Grant? link describes the goals and mission of the National Sea Grant Program and the means, such as science education and technology transfer, by which the program meets those goals and achieves that mission. From this page, users may browse the Sea Grant's 1995–2005 Network Plan, which outlines how the program plans to address the issues of economic leadership, coastal ecosystem health and public safety, and education and human resources over the next few years. The Sea Grant Results—Making A Difference link leads to a newsy e-zine that describes ongoing research by various Sea Grant branches.

The 29 Sea Grant Colleges link enables users to access the Web sites of each of the member programs. This page also contains links to related projects and programs within the National Sea Grant Program. For instance, the Louisiana Sea Grant Legal Program, located at the Louisiana State University Law Center in Baton Rouge, maintains a page of resources for those interested in the judicial aspects of protecting U.S. waters.

The National Sea Grant Depository link leads to an archive, located at the University of Rhode Island in Narrangansett, of all the documents generated by Sea Grant-funded projects. By following the National Sea Grant Depository link, users may search a database of depository holdings, browse recent additions to the collection, submit a request to borrow archive materials, or order a subscription to the quarterly Sea Grant Abstracts, which summarizes most of the literature received by the National Sea Grant Depository.

The Sea Grant Sponsored Research link lists current research and outreach projects, such as the Oyster Disease Research Program and the Nonindigenous Species Research and Outreach Program. This link also includes searchable bibliographies of literature generated by Sea Grant-sponsored research projects.

The News link takes users to the Sea Grant Media Center, which is packed with National Sea Grant news releases, tip sheets, and radio interview transcripts, as well as links to online publications and related Web sites, and a calendar of marine science-related events. This link also lets users order Sea Grant Program publications and subscribe to the Sea Grant News e-mail news service. The What Is New? link on the home page allows readers to browse the most recent news releases.

The Funding & Fellowships link lists open requests for proposals, as well as employment vacancies within the National Sea Grant Program and overviews of the National Sea Grant Federal Fellows and Industrial Fellows programs. The Directories link offers searchable databases of program staff across the nation, and the Selected Publications link allows quick, direct access to the most commonly requested publications.