<u>Point and non-point sources of pollution</u>

Point Source vs. Nonpoint Source Pollution

Point Source Pollution

Point sources release pollutants from discrete conveyances, such as a discharge pipe, and are regulated by water governing agencies. The main point source dischargers are factories and sewage treatment plants, which release treated wastewater.

Nonpoint Source Pollution

Nonpoint source pollution is a combination of pollutants from a large area rather than from specific identifiable sources such as discharge pipes. Runoff is generally associated with nonpoint source pollution, as water is emptied into streams or rivers after accumulating contaminants from sources like gardens, parking lots or construction sites.

Almost everything humans do, from growing food to manufacturing products to generating electricity, has the potential to release pollution into the environment. Regulatory agencies charged with protecting the environment identify two main categories of pollution: point-source and nonpoint-source pollution. Point-source pollution is easy to identify. As the name suggests, it comes from a single place. Nonpoint-source pollution is harder to identify and harder to address. It is pollution that comes from many places, all at once. Factories and power plants can be a source of point-source pollution, affecting both air and water. Smokestacks may spew carbon monoxide, heavy metal, sulphur dioxide, nitrogen dioxide, or “particulate matter” (small particles) into the air. Oil refineries, paper mills, and auto plants that use water as part of their manufacturing processes can discharge effluent—wastewater containing harmful chemical pollutants—into rivers, lakes, or the ocean. Municipal wastewater treatment plants are another common source of point-source pollution. Effluent from a treatment plant can introduce nutrients and harmful microbes into waterways. Nutrients can cause a rampant growth of algae in water. Nonpoint-source pollution is the opposite of point-source pollution, with pollutants released in a wide area. As an example, picture a city street during a thunderstorm. As rainwater flows over asphalt, it washes away drops of oil that leaked from car engines, particles of tire rubber, dog waste, and trash. The runoff goes into a storm sewer and ends up in a nearby river. Runoff is a major cause of nonpoint-source pollution. It is a big problem in cities because of all the hard surfaces, including streets and roofs. The number of pollutants washed from a single city block might be small, but when you add up the miles and miles of pavement in a big city you get a big problem.

In rural areas, runoff can wash sediment from the roads in a logged-over forest tract. It can also carry acid from abandoned mines and flush pesticides and fertilizer from farm fields. All of this pollution is likely to wind up in streams, rivers, and lakes. Airborne pollutants are major contributors to acid rain. It forms in the atmosphere when sulphur dioxide and nitrogen oxides combine with water. Because acid rain results from the long-range movement of those pollutants from many factories and power plants, it is considered nonpoint-source pollution.

Preventing and Controlling Pollution

Over the years, laws and regulations have been established and a process created for the environmental Protection by numerous bodies to regulate point sources of pollution through issuing of permits that limit the types and amounts of pollutants a facility can discharge. In addition, there are many laws and regulations that mandate the ways that hazardous materials are handled, stored, and used. Those same laws and regulations often encourage voluntary pollution-prevention efforts to reduce and minimize the use of potential pollutants.

These laws, regulations, and voluntary efforts have helped clean up major water quality problems and reduced the number of pollutants directly discharged to surface water and groundwater. However, we are still far from meeting water quality standards. Nonpoint sources of pollution have been identified as the primary reason for these continued problems.

Addressing Nonpoint Sources.

Best management practices and pollution prevention can be applied at the local, counties, and national level to reduce and prevent nonpoint-source pollution. We need to empower and sensitize the masses on the importance of addressing pollution of our water bodies. Some activities are national and local government responsibilities, such as ensuring that public lands are properly managed to reduce soil erosion, or developing legislation to govern chemical use. Many other regulatory approaches are best handled locally, such as by zoning or erosion-control ordinances. Each person can play an important role by being active in the community, learning more about the local watershed, practicing conservation, and by preventing pollution in homes, yards, and neighbourhoods.

Ways We Can Reduce Water Pollution

Everyone understands that clean water is vitally important. Yet, many things we do can contribute to water pollution in different ways. If you want to help keep our waters clean, there are many things you can do to help. You can prevent water pollution of nearby rivers and lakes as well as groundwater and drinking water by following some simple guidelines in your everyday life.

Laws and conventions

There are many laws that protect the world's oceans, rivers and lakes from unnecessary water pollution. Each continent and country may differ in which laws they enforce but they aim to have the same overall positive influence.

Conserve water by turning off the tap when running water is not necessary.

This helps prevent water shortages and reduces the amount of contaminated water that needs treatment.

Dispose of Toxic Chemicals Properly:

Household solvents, pesticides, and cleaners might not seem that bad. But, bleach, paint, paint thinner, ammonia, and many chemicals are becoming a serious problem. If you combine millions of people every month dumping toxic chemicals down the drain or flushing them down the toilet, the effects add up. This is why proper disposal is important. Many household chemicals can be recycled. Your community may have a recycling center that can take the old paint, used motor oil, and other chemicals and recycle them. Community collection centers and drop-off sites also exist in some areas. Your community may even have a hazardous waste collection day where those toxic old chemicals can be dropped off for safe disposal.

Shop with Water Pollution in Mind:

You can avoid issues with household chemicals and pesticides by not buying products that contain persistent and dangerous chemicals in the first place. Many companies now sell non-toxic cleaners and biodegradable cleaners and pesticides. Spending a little extra money on those products automatically cuts down on water pollution.

Do Not Pour Fat and Grease Down the Drain:

Grease, fat, and used cooking oil should be disposed of in the trash or kept in a "fat jar" for disposal with other solid waste. Your pipes might clog and cause sewer pipes to clog and back up into yards and basements. The waste also contaminates local bodies of water.

Use Phosphate-Free Detergent and Dish Cleaner:

You can further cut down on water pollution by using just enough of these cleaners to do the job. Phosphates aren't the only harmful chemicals in cleaners. Phosphates lead to algae blooms and kill fish and other aquatic animals by reducing the oxygen in the water.

Check Your Sump Pump or Cellar Drain:

Sometimes these devices drain into the town's sanitary sewer pipes. This connection dumps biological wastes, heavy metals, cleaning chemicals and more into the system. If you have a sump pump or cellar drain and aren't sure where they drain to, you should be able to find out by checking with the city's pollution control department.

Dispose of Medical Waste Properly:

Never flush medicines down the toilet, and never dump them in the nearest pond or creek. The drugs tend to accumulate in the water, and in fish and other wildlife. Hormones and other compounds end up causing a variety of health problems in fish and birds and contaminate drinking water that people and livestock use.

Eat More Organic Food:

While chemicals can be used on organic foods, they tend to be produced with few synthetic chemicals. Eating organic reduces the amount of chemical pollution that ends up in the water.

The food we choose to eat has a huge impact on environmental quality, between the chemicals used to grow food, the fuel used to transport the crops, and the fuel used to power farm equipment on industrial farms.

Report Water Polluters:

Many cases of illegal waste disposal and other forms of water pollution go unreported and often aren't cleaned up. Report people who pour oil in storm drains, toss bags of trash in a stream, and so on.

Support Environmental Charities:

No matter where you live in the country, there are going to be charities working on watershed protection, water pollution cleans up, and similar causes. Find an organization that's active in your area and make a donation or better, be part of the movement. Help clean your local area together with the groups doing it. Remember, there can never be a little change to not matter. Your support may even lead to expanded anti-pollution work.

Try to Avoid Plastic Containers:

Plastic shopping bags and plastic rings from six-packs of beverages cause inordinate problems in the nation's lakes and seas. Plastic bottles can last for decades in the water. Buy some reusable cloth or plastic grocery bags instead. They can be cheaper even as compared to the traditional paper bag, so there is a minimal cost involved. Use reusable, insulated containers to hold drinks and make your own filtered water at home.

Keep Your Vehicles from Leaking:

Oil and other fluids leak from motor vehicles and end up in the local water table, or running off into creeks and streams. This runoff problem is easy to treat; just be diligent about maintaining and repairing your vehicles. Leaky seals, hoses, and gaskets tend to cause expensive mechanical problems anyway, so replacing the worn parts can save you money and at the same time save the environment.

Cut Down on the Chemicals:

Homeowners like to keep the yard looking green and healthy. This desire for a green lawn produces water pollution in two ways: Fertilizers and pesticides inevitably run off the shrubs and lawns and into the water. Select landscaping that is adapted to the climate. No matter where you live, there are bound to be attractive plants that can thrive with minimal help from added chemicals. This makes the plants cheaper to care for. As a bonus, you will waste less water keeping those plants alive. Take great care not to overuse pesticides and fertilisers. This will prevent runoffs of the material into nearby water sources.

Plant Some Trees:

Trees reduce erosion that washes pollution into the water and reduces erosion. You can also volunteer your time in a local tree-planting effort. If you own land along a river or pond, plant trees, bushes, or grass along the bank.

Help Clean Up Beaches and Rivers:

Supporting charities devoted to protecting the water is important because they can do work that is beyond the power of the average homeowner. If you choose not to donate money, or really can’t afford it, volunteer to help plant trees or clean up the local river or help collect leftover chemicals from local residents. Some environmental groups might have collection days where they need volunteer labour.

References.

Aas, W. and A. Semb. 2001. Standardisation of Methods for Long-term monitoring. Water, Air, and Soil Pollution 130:1595-1600.

American Water Works Association (AWWA). 1990. Water Quality and Treatment: A Handbook of Community Water Supplies. 4th ed. McGraw-Hill.

APHA (American Public Health Association, American Water Works Association, Water for the Environment Foundation). 2000. Standard Methods for the Examination of Water and Wastewater. 20th edition. Editors: L. Clesceri, A. Greenberg, and A. Eaton. , Washington, DC.

ASTM. 2000. Water: Inorganic Analytes. Volume 11.01. American Society for Testing and Materials, Conshohocken, PA. Bartholomay, R.C., Knobel, L.L., and Rousseau, J.P., 2003, Field methods and Quality-Assurance Plan for quality-of-water activities, U.S. Geological Survey, Idaho National Engineering and Environmental Laboratory, Idaho: U.S. Geological Survey Open-File Report 03-42 (DOE/ID-22182), 45 p.

Battaglin, W.A., Furlong, E.T., Burkhardt, M.R., and Peter, C.J., 2000, Occurrence of sulfonylurea, sulfonamide, imidazolinone, and other herbicides in rivers, reservoirs and ground water in the Midwestern United States, 1998: The Science of the Total Environment, v. 248, no. 2-3, p. 123-133. Brass, H.J., Ardourel, H., Diamond, J., Eaton, A., Keith, L., Peters, C. 2000. Activities of the Interagency Methods and Data Comparability Board. Proceedings of the American Water Works Association, Water Quality Technology Conference, Salt Lake City, Utah.

Bushon, Rebecca, 2003, Fecal Indicator Viruses, in> National field manual for the collection of water-quality data: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A7.

Cantillo, A. Lauenstein, G. 1998. Performance-Based Quality Assurance: The NOAA National Status and Trends Program Experience. In: Proceedings of the NWQMC National Monitoring Conference, Monitoring: Critical Foundations to Protect Our Waters. U.S. Environmental Protection Agency, Washington, DC. pp. 63-74.

Crumbling, D. M. 2001. Current Perspectives in Site Remediation Monitoring, EPA 542-R-01-014, October 2001.

D. Yaron. Salinity in Irrigation and Water Resources. Marcel Dekker, Inc., NY., 1981.

Dobson, J., M. Garner, B. Miller, N. Jessup, and R. Toft. 1999. An approach to the assessment of the quality of environmental data. J. Environ. Monitoring 1:91-95.

Eaton, A. and Diamond, J. 1999.Reservoir dogs and performance-based systems. Environ. Testing and Analysis, 8: 18-19.

GAO. 2001. Environmental Protection: Wider Use of Advanced Technologies can Improve Emissions Monitoring. U.S. General Accounting Office, Report GAO-01-313, Washington, DC.

G.M. Friedman, J.E. Sanders, and D.C. Kopaska-Merkel. Principle of Sedimentary Deposits. Macmillan Publishing Company, NY., 1992.

Grumbly, T. 1994. Institutionalizing the Data Quality Objectives Process for EM's Environmental Data Collection Activities. Memorandum September 7, 1994, United States Department of Energy, Washington, D. C.

G.W. Harvey. Technical Review of Sediment Criteria, for Consideration for Inclusion in Idaho Water Quality Standards. Idaho Dept. of Health and Welfare, Water Quality Bureau, Boise, ID., 1989.

Heinz CSEE. 2002. The state of the nation's ecosystems: measuring the lands, waters, and living resources for the United States. H. J. Heinz III Center for Science, Economics, and the Environment. Cambridge University Press, Cambridge, UK.

ITFM. 1995a. The Strategy for Improving Water Quality Monitoring in the U.S. Report #OFR95-742, U.S. Geological Survey, Reston, VA. ITFM. 1995b. Performance-based approach to water quality monitoring. In: Strategy for Improving Water Quality Monitoring in the U.S., Appendix M, Report #OFR95-742, Interagency Task Force on Monitoring Water Quality, U.S. Geological Survey, Reston, VA.

J.H. Sherrard, D.R. Moore, and T.A. Dillaha. Total dissolved solids: determinations, sources, effects, and removal. Journal of Environmental Education 18(2):19-24, 1987.

Keith, L. 1993. Principles of environmental sampling. ACS Professional Reference Book, American Chemical Society, 458pp.

Koterba, M.T., Wilde, F.D., and Lapham, W.W. 1995. Ground-Water Data-Collection Protocols and Procedures for the National Water-Quality Assessment Program: Collection and Documentation of Water-Quality Samples and Related Data. OFR 95-399, U.S. Geological Survey, Reston, VA.

Lenz, B.N. and M. Miller. 1996. Comparison of Aquatic Macroinvertebrate Samples Collected Using Different Field Methods. USGS Fact Sheet FS-216-96, http://wi.water.usgs.gov/pubs/FS-216-96/, U.S. Geological Survey, Reston, VA.

MDCB (Methods and Data Comparability Board). 2002. Method Verification Within a Performance-Based System Framework: Pilot Study Using Chemical Oxygen Demand (COD) Methods. http://wi.water.usgs.gov/methodsboard/reston/codpilot.htm

M. Sittig, Handbook of Toxic and Hazardous Chemicals. Noyes Publications. Park Ridge, N.J., 1981.

NELAC. 2000. Chapter 5: Quality Systems Standard. National Environmental Laboratory Conference, http://www.epa.gov/ttn/nelac/standard/5qs_14-0.pdf. June 28, 2000.

North Carolina Administrative Code Section T15A NCAC 02B .0100 & .0200, amended 2002. "RedBook" Surface Water and Wetlands Standards. North Carolina Department of Environment and Natural Resources, Division of Water Quality. Accessed: http://h2o.enr.state.nc.us/admin/rules/rb010102.pdf.

NRC (National Research Council). 1995. Review of EPA’s environmental monitoring and assessment program: overall evaluation. National Academy Press, Washington, D.C.

NWQMC-Methods Board. 2001. Towards a definition of a performance-based approach to laboratory methods. Methods and Data Comparability Board, National Water Quality Monitoring Council, Technical Report 01-02, US Geological Survey, Water Information Office, Reston, VA.

NWQMC-Methods Board. 2002a. Data Elements for Reporting Water Quality Results of Chemical and Microbiological Analytes. National Water quality Monitoring Council.
NWQMC-Methods Board. 2002b. Accreditation of Federal Laboratories for Water Quality Monitoring. National Water Quality Monitoring Council, February 14, 2002.

O. Postolache, P.M. Girão, J.M. Dias Pereira, H.G. Ramos. "Multibeam Optical System and Neural Processing for Turbidity Measurement", IEEE Sensors Journal, Vol. 7, No. 5, pp. 677 - 684, May, 2007.

Pirkey, K.D. and Glodt, S.R. 2003. Quality Control at the U.S. Geological Survey National Water Quality Laboratory: USGS Fact Sheet 026-98, http://nwql.usgs.gov/Public/pubs/QC_Fact/tet.html

Pritt, J.W. and Raese, J.W. 1995. Quality Assurance/Quality Control Manual—National Water Quality Laboratory: U.S. Geological Survey Open-File Report 95-443, 35 p.

USDOE. 2000. Guide for developing data quality objective for ecological risk assessment at DOE Oak Ridge Operations Facilities. Report ES/ER/TM-185/R1. US Department of Energy, Oak Ridge National Laboratory, Oak Ridge, TN.

USEPA. 1994. Guidelines establishing test procedures for the analysis of pollutants under the Clean Water Act. Final Rule. U.S. Environmental Protection Agency, 40 CFR Part 136, Federal Register. 59:20 4504.

USEPA. 1996. National Primary Drinking Water Regulations: Monitoring Requirements for Public Drinking Water Supplies: Final Rule. U.S. Environmental Protection Agency, 40 CFR Part 141,Federal Register 61(94): 24353-24388.

USEPA. 1997a. Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments. EPA 540-R-97-006. U.S. Environmental Protection Agency Environmental Response Team, Edison, NJ.

USEPA. 1997 b. Streamlining EPA's Test Methods Approval Program. EPA-821-F-97- 001, U.S. Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 1998. Synopsis of clarifications to certain Update III SW-846 methods. July, 1998. Office of Solid Waste, Washington, DC.

USEPA. 1999. Protocol for EPA approval of Alternate Test Procedures for Organic and Inorganic Analytes in Wastewater and Drinking water. EPA-821-B-98-002, Office of Water, U.S. Environmental Protection Agency, Washington, DC.

USEPA. 2000. Guidance for the Data Quality Objectives Process (EPA QA/G-4), EPA/600/R-96/055. Quality Assurance Management Staff, Office of Environmental Information. U.S. Environmental Protection Agency, Washington DC. http://www.epa.gov/quality/qs-docs/g4-final.pdf

USEPA. 2002. Unregulated Contaminant Monitoring Regulation: Approval of Analytical Method for Aeromonas; National Primary and Secondary Drinking Water Regulations: Approval of Analytical Methods for Chemical and Microbiological Contaminants: Final

R.E. Carlson, “The Secchi disk and the volunteer monitor”. LakeLine. 15(1): 28-29, 35-37, 1995.

R.E. Carlson and J. Simpson, North American Lake Management Society, “A Coordinator's Guide to Volunteer Lake Monitoring Methods”, 96 pp, 1996.

R.L. Smith. Ecology and Field Biology. 4th ed. Harper Collins Publishers, NY., 1990.

Rule.40 CFR Part 141,U.S. Environmental Protection Agency, Federal Register67: (209): 65888-65902.

T. Dunne, and L.B. Leopold. Water in Environmental Planning. W.H. Freeman and Company, NY., 1978.

Ward, R.C. 1996. Water quality monitoring: where's the beef? American Water Resources Association. 32:673-680.

Wilde, F.D., Radtke, D.B., Gibs, Jacob, and R.T. Iwatsubo. 1998. Preparations for Water Sampling. In National Field Manual for the Collection of Water-Quality Data: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A1, 42 p. (http://water.usgs.gov/owq/FieldManual/chapter1/html/Ch1_contents.html)

Wilde, F.D., Radtke, D.B., Gibs, Jacob, and R.T. Iwatsubo. 1999. Collection of Water Samples. In National Field Manual for the Collection of Water-Quality Data: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A4, 151 p. (http://water.usgs.gov/owq/FieldManual/chapter4/html/Ch4_contents.html)

Wiley, M.J., P.W. Seelbach, K. Wehrly, and J.S. Martin. 2003. Regional ecological normalization using linear models: a meta- method for scaling stream assessment indicators. In: T. P. Simon (ed) Biological Response signatures, pp.201-224, CRC Press, Boca Raton, FL.

World Bank Group. 2007. Access to Safe Water Map. Available at: http://www.worldbank.org/depweb/english/modules/environm/water/map1.html