জলদূষণ:

জলদূষণ বলতে পানিতে বা জলে কোন বিষাক্ত দ্রব্য অথবা দূষিত বর্জ্য পদার্থ মিশ্রণের ফলে মানব ব্যবহারের অনুপযোগী হয়ে পড়ার প্রক্রিয়াকে বোঝায়।

জলদূষণ হল জলাশয়ের দূষণ (উদ্যান, নদী, মহাসাগর, জলজ এবং ভূগর্ভস্থ জল)। পরিবেশগত অবনতি এই ফর্ম যখন দূষণকারী সরাসরি বা পরোক্ষভাবে ক্ষতিকারক যৌগ **জলে** অপসারণ হয় তখন তা **জলে** মিশ্রণের ফলে মানব ব্যবহারের অনুপযোগী হয়ে উঠে, আর এটাকেই বলে **জলদূষণ**।

পানি দূষণ পুরো জীববৈচিত্রকে প্রভাবিত করে। এর মধ্যে উল্লেখযোগ্য হল জীবিত জীব ও উদ্ভিদ। প্রায় সব ক্ষেত্রেই এই প্রভাবটি কেবলমাত্র পৃথক প্রজাতি এবং জনসংখ্যার জন্যই যে ক্ষতিগ্রস্থ তা নয়, বরং প্রাকৃতিক অন্যান্য উপাদানসমূহ ও প্রভাবিত হচ্ছে।

জল দূষণ একটি প্রধান বৈশ্বিক সমস্যার কারণ যা চলমান মূল্যায়ন এবং পানি সম্পদের নীতিমালার সমস্ত স্তরের (আন্তর্জাতিক জলাধার এবং আন্তর্জাতিক কুয়োগুলি থেকে নিচে) পর্যায়ক্রমিকতার প্রয়োজন। এটি প্রমাণিত হয়েছে যে পানি দূষণ বিশ্বজুড়ে মৃত্যু এবং রোগের প্রধান কারণ। শুধুমাত্র **জল** দূষণের কারণেই প্রতিদিনই বিশ্বে প্রায় **১৪০০** এরও বেশি লোকের মৃত্যু হয়। আনুমানিক **৮০ জন** মানুষ পানি দূষণ সম্পর্কিত অসুস্থতা প্রতিদিনই মারা যায়। চীন শহরের প্রায় 90 শতাংশ জল দূষিত হয়। ২007 সালের হিসাবে, আধা-বিশ্বে চীনাদের নিরাপদ পানীয় জলের ব্যবহার ছিল উন্নয়নশীল দেশগুলো পানি দূষণ তীব্র সমস্যা ছাড়াও, উন্নত দেশগুলিও দূষণ সমস্যাগুলির সাথে সংগ্রাম চালিয়ে যাচ্ছে। উদাহরণস্বরূপ, মার্কিন যুক্তরাষ্ট্রে গুণমানের সবচেয়ে সাম্প্রতিক জাতীয় প্রতিবেদনে 44% মূল্যায়নকৃত স্ট্রিম মাইল, 64% মূল্যায়নকৃত হ্রদ একর এবং 30% মূল্যায়ন ব্যাস এবং এস্তুয়ারাইন বর্গ মাইলগুলি দূষিত হিসাবে শ্রেণীবদ্ধ করা হয়।

জল দূষকের শ্রেণিবিভাগ (Classification of Water Pollutants)

পানি যার দ্বারা দূষিত হয়, তাকে দূষক বলে। প্রকৃতির ওপর ভিত্তি করে দুষককে দু'ভাগে ভাগ করা যায়; যথা-

(১) তরল বর্জ্য পদার্থ (যেমন- মূত্র, বিভিন্ন প্রকার কীটনাশক, এসিড, পারদ ইত্যাদি) ও

(২) কঠিন বর্জ্য পদার্থ (যেমন- বিভিন্ন প্রকার লবণ, ধাতব পদার্থ, বিভিন্ন প্রকার সার ইত্যাদি)।

আবার, পচন ক্ষমতার ওপর ভিত্তি করে দূষককে দুভাগে ভাগ করা যায়; যথা-

(১) পচনশীল বর্জ্য (যেগুলো বিয়োজক দ্বারা বিয়োজিত হয়ে পরিবেশে ফিরে যেতে পারে, যেমন- উদ্ভিদ ও প্রাণীর মৃত দেহ, প্রাণীর মলমূত্র ইত্যাদি) এবং

(২) অপনশীল বর্জ্য (যেগুলো বিয়োজক দ্বারা বিয়োজিত হয়ে পরিবেশে ফিরে যেতে পারে না, যেমন- ডিডিটি)।

এছাড়া দুষকের উৎসের উপর ভিত্তি করে দুষককে দু'ভাগে ভাগ করা যায়; যথা-

(১) প্রাকৃতিক দুষক ও

(২) মনুষ্যসৃষ্ট দূষক।

দুষকের উৎস, স্বভাব, প্রকৃতিতে এদের প্রভাব ইত্যাদির ওপর ভিত্তি করে পানি দূষককে নিম্নলিখিতভাবে ভাগ করা যায় :

ক্রমিক	পানি দূষকের শ্রেণী	উদাহরণ
১	পরিপোষক	জৈব : মানুষ ও প্রাণীর বর্জ্য, লিটার, তলানি। অজৈব : নাইট্রোজেন, ফসফরাস, ডিটারজেন্ট।
২	রোগজীবাণু	রোগ সৃষ্টিকারী ব্যাকটেরিয়া, ভাইরাস, প্রোটোজোয়া, প্যারাসাইট ইত্যাদি।
৩	বিষাক্ত জৈব দূষক	কীটপতঙ্গনাশক, পলিক্লোরিনেটেড বাইফিনাইল, পলিসাইক্লিক অ্যারোমেটিক, হাইড্রোকার্বন, পেট্রোলিয়াম ইত্যাদি।
৪	বিষাক্ত অজৈব দূষক	ধাতব লবণ, পারদ, সীসা, তামা, ক্যাডিয়াম, ক্রোমিয়াম, আর্সেনিক, নাইট্রেট, নাইট্রাইট ইত্যাদি।
৫	তলানি বা গাদ	
৬	তাপ	

জলবাহিত রোগ

দূষিত জল পান করার মাধ্যমে অথবা সেই জল রান্না বা অন্যান্য কার্যে ব্যবহার করার ফলে বিভিন্ন ধরনের ব্যাধি সংক্রামিত হয়ে থাকে। এই ধরনের অসুখ সাধারণত জলে বিচরণশীল রোগসৃষ্টিকারী জীবাণুদের দ্বারা সংঘটিত হয়। বিশ্ব স্বাস্থ্য সংস্থার পরিসংখ্যান অনুসারে প্রত্যেক বছর পৃথিবীতে প্রায় দশ লক্ষ মানুষের মৃত্যুর কারণ হল **জলবাহিত রোগ**। সমীক্ষায় দেখা গেছে যে এই রোগ সংক্রমণের মূল কারণ হল উন্নয়নশীল দেশগুলিতে অপরিশুদ্ধ জল সরবরাহ এবং পরিচ্ছনতার অভাব। এর ফলে আক্রান্তদের মধ্যে শিশুদের সংখ্যাধিক্য লক্ষ্যণীয়। কেবল তাই নয়, ভারতীয় উপমহাদেশসহ বিশ্বের প্রায় সকল উন্নয়নশীল দেশের গ্রামাঞ্চলে স্বাস্থ্যসচেতনতার প্রভূত অভাব পরিলক্ষিত হয়। সাধারণত উক্ত অঞ্চলসমূহের মানুষ বিভিন্ন জলাশয়ের জল পান করে থাকে এবং রন্ধনকার্যেও তা ব্যবহার করে। আবার স্নান, কাপড় কাচা এবং গবাদি পশুর স্নানাদিও সেই একই জলাশয়ে সম্পন্ন হয়ে থাকে। ফলত জলাশয়ের জল দূষিত হয় এবং সেই জল মানবশরীরে প্রবেশ করার ফলে বিবিধ প্রকার জলবাহিত রোগও

দূষিত জলের মাধ্যমে মানবদেহে সংক্রামিত হয়। এইভাবে এইসমস্ত অঞ্চলের মানুষদের মধ্যে আন্ত্রিক, ইত্যাদি রোগের প্রকোপ বৃদ্ধি পায়। বাংলাদেশে **জল**বাহিত যে সকল রোগ লক্ষ্যনীয় তাদের মধ্যে উল্লেখযোগ্য হলঃ

- ডায়রিয়া,
- আমাশয়,
- পোলিও,
- হিপাটাইটিস এ ও ই,
- টাইফয়েড,
- প্যারাটাইপয়েড ইত্যাদি

Water pollution

Water pollution is the contamination of water bodies, usually as a result of human activities. Water bodies include for example lakes, rivers, oceans, aquifers and groundwater. Water pollution results when contaminants are introduced into the natural environment. For example, releasing inadequately treated wastewater into natural water bodies can lead to degradation of aquatic ecosystems. In turn, this can lead to public health problems for people living downstream. They may use the same polluted river water for drinking or bathing or irrigation. Water pollution is the leading worldwide cause of death and disease, e.g. due to water-borne diseases.[1][2]

Water pollution can be classified as surface water or groundwater pollution. Marine pollution and nutrient pollution are subsets of water pollution. Sources of water pollution are either point sources or non-point sources. Point sources have one identifiable cause of the pollution, such as a storm drain or a wastewater treatment plant. Non-point sources are more diffuse, such as agricultural runoff.[3] Pollution is the result of the cumulative effect over time. All plants and organisms living in or being exposed to polluted water bodies can be impacted. The effects can damage individual species and impact the natural biological communities they are part of.

The causes of water pollution include a wide range of chemicals and pathogens as well as physical parameters. Contaminants may include organic and inorganic substances. Elevated temperatures can also lead to polluted water. A common cause of thermal pollution is the use of water as a coolant by power plants and industrial manufacturers. Elevated water temperatures decrease oxygen levels, which can kill fish and alter food chain composition, reduce species biodiversity, and foster invasion by new thermophilic species.

Water pollution is measured by analysing water samples. Physical, chemical and biological tests can be conducted. Control of water pollution requires appropriate infrastructure and management plans. The infrastructure may include wastewater treatment plants. Sewage treatment plants and industrial wastewater treatment plants are usually required to protect water bodies from untreated wastewater. Agricultural wastewater treatment for farms, and erosion control at construction sites can also help prevent water pollution. Nature-based solutions are another approach to prevent water pollution.[6] Effective control of urban runoff includes reducing speed and quantity of flow. In the United States, best management practices for water pollution include approaches to reduce the quantity of water and improve water quality.

Water is typically referred to as polluted when it is impaired by anthropogenic contaminants. Due to these contaminants it either does not support a human use, such as drinking water, or undergoes a marked shift in its ability to support its biotic communities, such as fish. Natural phenomena such as volcanoes, algae blooms, storms, and earthquakes also cause major changes in water quality and the ecological status of water.

Water pollution is a major global problem. It requires ongoing evaluation and revision of water resource policy at all levels (international down to individual aquifers and wells). It has been suggested that water

pollution is the leading worldwide cause of death and diseases.[2][1] Water pollution accounted for the deaths of 1.8 million people in 2015.[8]

The organization Global Oceanic Environmental Survey (GOES) consider water pollution as one of the main environmental problems that can present a danger for the existence of life on earth in the next decades. One of the main concerns, is that water pollution, heart phytoplankton who produce 70% of oxygen and remove a large part of carbon dioxide on earth. The organization proposes a number of measures for fixing the situation, but they should be taken in the next 10 years for being effective.

India and China are two countries with high levels of water pollution. An estimated 580 people in India die of water pollution related illness (including waterborne diseases) every day. About 90 percent of the water in the cities of China is polluted. As of 2007, half a billion Chinese had no access to safe drinking water.[14]

In addition to the acute problems of water pollution in developing countries, developed countries also continue to struggle with pollution problems. For example, in a report on water quality in the United States in 2009, 44 percent of assessed stream miles, 64 percent of assessed lake acres, and 30 percent of assessed bays and estuarine square miles were classified as polluted.

Surface water pollution

Surface water pollution includes pollution of rivers, lakes and oceans. A subset of surface water pollution is marine pollution.

Marine pollution

One common path of entry by contaminants to the sea are rivers. An example is directly discharging sewage and industrial waste into the ocean. Pollution such as this occurs particularly in developing nations. In fact, the 10 largest emitters of oceanic plastic pollution worldwide are, from the most to the least, China, Indonesia, Philippines, Vietnam, Sri Lanka, Thailand, Egypt, Malaysia, Nigeria, and Bangladesh,[17] largely through the rivers Yangtze, Indus, Yellow, Hai, Nile, Ganges, Pearl, Amur, Niger, and the Mekong, and accounting for "90 percent of all the plastic that reaches the world's oceans."[18][19]

Large gyres (vortexes) in the oceans trap floating plastic debris. Plastic debris can absorb toxic chemicals from ocean pollution, potentially poisoning any creature that eats it.[20] Many of these long-lasting pieces end up in the stomachs of marine birds and animals. This results in obstruction of digestive pathways, which leads to reduced appetite or even starvation.

There are a variety of secondary effects stemming not from the original pollutant, but a derivative condition. An example is silt-bearing surface runoff, which can inhibit the penetration of sunlight through the water column, hampering photosynthesis in aquatic plants.

Groundwater pollution

Interactions between groundwater and surface water are complex. Consequently, groundwater pollution, also referred to as groundwater contamination, is not as easily classified as surface water pollution.[21] By its very nature, groundwater aquifers are susceptible to contamination from sources that may not directly affect surface water bodies. The distinction of point vs. non-point source may be irrelevant in some situations.

Analysis of groundwater contamination may focus on soil characteristics and site geology, hydrogeology, hydrology, and the nature of the contaminants. Causes of groundwater pollution include: naturally-occurring (geogenic), on-site sanitation systems, sewage, fertilizers and pesticide, commercial and industrial leaks, hydraulic fracturing, landfill leachate.

Categories of pollution sources

Surface water and groundwater have often been studied and managed as separate resources even though they are interrelated.[21] Surface water seeps through the soil and becomes groundwater. Conversely, groundwater can also feed surface water sources. Sources of surface water pollution are generally grouped into two categories based on their origin.

Point sources

Point source water pollution refers to contaminants that enter a waterway from a single, identifiable source, such as a pipe or ditch. Examples of sources in this category include discharges from a sewage treatment plant, a factory, or a city storm drain.

The U.S. Clean Water Act (CWA) defines point source for regulatory enforcement purposes.[22] The CWA definition of point source was amended in 1987 to include municipal storm sewer systems, as well as industrial storm water, such as from construction sites.[23]

Non-point sources

Nonpoint source pollution refers to diffuse contamination that does not originate from a single discrete source. This type of pollution is often the cumulative effect of small amounts of contaminants gathered from a large area. A common example is the leaching out of nitrogen compounds from fertilized agricultural lands.[3] Nutrient runoff in storm water from "sheet flow" over an agricultural field or a forest are also cited as examples of non-point source pollution.

Contaminated storm water washed off of parking lots, roads and highways, called urban runoff, is sometimes included under the category of non-point sources. This runoff becomes a point source because it is typically channeled into storm drain systems and discharged through pipes to local surface waters.

Contaminants and their sources

Further information: Wastewater, Sewage, and Industrial wastewater

The specific contaminants leading to pollution in water include a wide spectrum of chemicals, pathogens, and physical changes such as elevated temperature and discoloration. While many of the chemicals and substances that are regulated may be naturally occurring (calcium, sodium, iron, manganese, etc.) the concentration usually determines what is a natural component of water and what is a contaminant. High concentrations of naturally occurring substances can have negative impacts on aquatic flora and fauna.

Oxygen-depleting substances may be natural materials such as plant matter (e.g. leaves and grass) as well as man-made chemicals. Other natural and anthropogenic substances may cause turbidity (cloudiness) which blocks light and disrupts plant growth, and clogs the gills of some fish species.[24]

Alteration of water's physical chemistry includes acidity (change in pH), electrical conductivity, temperature, and eutrophication. Eutrophication is an increase in the concentration of chemical nutrients in an ecosystem to an extent that increases the primary productivity of the ecosystem. Depending on the degree of eutrophication, subsequent negative environmental effects such as anoxia (oxygen depletion) and severe reductions in water quality may occur, affecting fish and other animal populations.

Pathogens

Disease-causing microorganisms are referred to as pathogens. Pathogens can produce waterborne diseases in either human or animal hosts.[25] Coliform bacteria, which are not an actual cause of disease, are commonly used as a bacterial indicator of water pollution. Other microorganisms sometimes found in contaminated surface waters that have caused human health problems include:

- *Burkholderia pseudomallei*
- *Cryptosporidium parvum*
- *Giardia lamblia*
- *Salmonella*
- *Norovirus* and other viruses
- *Parasitic worms including the Schistosoma type* [26][27]

High levels of pathogens may result from on-site sanitation systems (septic tanks, pit latrines) or inadequately treated sewage discharges.[28] Older cities with ageing infrastructure may have leaky sewage collection systems (pipes, pumps, valves), which can cause sanitary sewer overflows. Some cities also

have combined sewers, which may discharge untreated sewage during rain storms.[29] Silt (sediment) from sewage discharges also pollutes water bodies.

Organic, inorganic and macroscopic contaminants

Contaminants may include organic and inorganic substances. Many of the chemical substances are toxic. Detergents

- Disinfection by-products found in chemically disinfected drinking water, such as chloroform
- Food processing waste, which can include oxygen-demanding substances, fats and grease
- Insecticides and herbicides, a huge range of organohalides and other chemical compounds
- Petroleum hydrocarbons, including fuels (gasoline, diesel fuel, jet fuels, and fuel oil) and lubricants (motor oil), and fuel combustion byproducts, from storm water runoff[30]
- Volatile organic compounds, such as industrial solvents, from improper storage.
- Chlorinated solvents, which are dense non-aqueous phase liquids, may fall to the bottom of reservoirs, since they don't mix well with water and are denser.
  - Polychlorinated biphenyl (PCBs)
  - Trichloroethylene
- Perchlorate
- Various chemical compounds found in personal hygiene and cosmetic products
- Drug pollution involving pharmaceutical drugs and their metabolites, this can include antidepressant drugs or hormonal medicines such as contraceptive pills. These molecules can be small and difficult for treatment plants to remove without expensive upgrades. Inorganic water pollutants include:

- Acidity caused by industrial discharges (especially sulfur dioxide from power plants)
- Ammonia from food processing waste
- Chemical waste as industrial by-products
- Fertilizers containing nutrients--nitrates and phosphates—which are found in storm water runoff from agriculture, as well as commercial and residential use[30] (see nutrient pollution)
- Heavy metals from motor vehicles (via urban storm water runoff)[30][32] and acid mine drainage
- Secretion of creosote preservative into the aquatic ecosystem
- Silt (sediment) in runoff from construction sites, logging, slash and burn practices or land clearing sites.

Macroscopic pollution – large visible items polluting the water – may be termed "floatables" in an urban storm water context, or marine debris when found on the open seas, and can include such items as:

- Trash or garbage (e.g. paper, plastic, or food waste) discarded by people on the ground, along with accidental or intentional dumping of rubbish, that are washed by rainfall into storm drains and eventually discharged into surface waters.
- Nurdles, small ubiquitous waterborne plastic pellets. *See* plastic pollution and microplastic pollution.
- Shipwrecks, large derelict ships.

Change in temperature

Main article: Thermal pollution

Thermal pollution is the rise or fall in the temperature of a natural body of water caused by human influence. Thermal pollution, unlike chemical pollution, results in a change in the physical properties of water. A common cause of thermal pollution is the use of water as a coolant by power plants and industrial manufacturers. Elevated water temperatures decrease oxygen levels, which can kill fish and alter food chain composition, reduce species biodiversity, and foster invasion by new thermophilic species. Urban runoff may also elevate temperature in surface waters.

Thermal pollution can also be caused by the release of very cold water from the base of reservoirs into warmer rivers.

Measurement

Water pollution may be analyzed through several broad categories of methods: physical, chemical and biological. Most involve collection of samples, followed by specialized analytical tests. Some methods may be conducted *in situ*, without sampling, such as temperature. Government agencies and research organizations have published standardized, validated analytical test methods to facilitate the comparability of results from disparate testing events.[35]

Sampling

Sampling of water for physical or chemical testing can be done by several methods, depending on the accuracy needed and the characteristics of the contaminant. Many contamination events are sharply restricted in time, most commonly in association with rain events. For this reason "grab" samples are often inadequate for fully quantifying contaminant levels. Scientists gathering this type of data often employ auto-sampler devices that pump increments of water at either time or discharge intervals.

Sampling for biological testing involves collection of plants and animals from the surface water body. Depending on the type of assessment, the organisms may be identified for biosurveys (population counts) and returned to the water body, or they may be dissected for bioassays to determine toxicity.

Physical testing

Common physical tests of water include temperature, solids concentrations (e.g., total suspended solids (TSS)) and turbidity.

Chemical testing

See also: water chemistry analysis and environmental chemistry

Water samples may be examined using the principles of analytical chemistry. Many published test methods are available for both organic and inorganic compounds. Frequently used methods include pH, biochemical oxygen demand (BOD),[36]:102 chemical oxygen demand (COD),[36]:104 nutrients (nitrate and phosphorus compounds), metals (including copper, zinc, cadmium, lead and mercury), oil and grease, total petroleum hydrocarbons (TPH), and pesticides.

Biological testing

Main article: Bioindicator

Biological testing involves the use of plant, animal or microbial indicators to monitor the health of an aquatic ecosystem. They are any biological species or group of species whose function, population, or status can reveal what degree of ecosystem or environmental integrity is present.[37] One example of a group of bio-indicators are the copepods and other small water crustaceans that are present in many water bodies. Such organisms can be monitored for changes (biochemical, physiological, or behavioral) that may indicate a problem within their ecosystem.

For microbial testing of drinking water, see Bacteriological water analysis.

Control of pollution

Municipal wastewater treatment

In urban areas of developed countries, municipal wastewater (or sewage) is typically treated by centralized sewage treatment plants. Well-designed and operated systems (i.e., with secondary treatment steps or more advanced treatment) can remove 90 percent or more of the pollutant load in sewage.[38] Some plants have additional systems to remove nutrients and pathogens, but these more advanced treatment steps get progressively more expensive.

Nature-based solutions are also being used instead of (or in combination with) centralized treatment plants.

Cities with sanitary sewer overflows or combined sewer overflows employ one or more engineering approaches to reduce discharges of untreated sewage, including:

- utilizing a green infrastructure approach to improve storm water management capacity throughout the system, and reduce the hydraulic overloading of the treatment plant
- repair and replacement of leaking and malfunctioning equipment
- increasing overall hydraulic capacity of the sewage collection system (often a very expensive option).

On-site sanitation and safely managed sanitation

Further information: Sanitation

Households or businesses not served by a municipal treatment plant may have an individual septic tank, which pre-treats the wastewater on site and infiltrates it into the soil. This can lead to groundwater pollution if not properly done.

Globally, about 4.5 billion people currently (in 2017) do not have safely managed sanitation, according to an estimate by the Joint Monitoring Programme for Water Supply and Sanitation.[40] Lack of access to sanitation often leads to water pollution, e.g. via the practice of open defecation: during rain events or floods, the human feces are moved from the ground where they were deposited into surface waters. Simple pit latrines may also get flooded during rain events. The use of safely managed sanitation services would prevent this type of water pollution.[40]

Industrial wastewater treatment

Some industrial facilities generate wastewater that is similar to domestic sewage and can be treated by sewage treatment plants. Industries that generate wastewater with high concentrations of organic matter (e.g. oil and grease), toxic pollutants (e.g. heavy metals, volatile organic compounds) or nutrients such as ammonia, need specialized treatment systems.[41]:Ch. 16 Some industries install a pre-treatment system to remove some pollutants (e.g., toxic compounds), and then discharge the partially treated wastewater to the municipal sewer system.[42][43]:Ch. 1 Industries generating large volumes of wastewater typically operate their own treatment systems. Some industries have been successful at redesigning their manufacturing processes to reduce or eliminate pollutants, through a process called pollution prevention.

To remove heat from wastewater generated by power plants or manufacturing plants the following technologies are used:

- cooling ponds, man-made bodies of water designed for cooling by evaporation, convection, and radiation
- cooling towers, which transfer waste heat to the atmosphere through evaporation or heat transfer
- cogeneration, a process where waste heat is recycled for domestic or industrial heating purposes.[44]

Non point source controls
Sediment (loose soil) washed off fields is the largest source of agricultural pollution in the United States.[24] Farmers may utilize erosion controls to reduce runoff flows and retain soil on their fields. Common techniques include contour plowing, crop mulching, crop rotation, planting perennial crops and installing riparian buffers.

Nutrients (nitrogen and phosphorus) are typically applied to farmland as commercial fertilizer, animal manure, or spraying of municipal or industrial wastewater (effluent) or sludge. Nutrients may also enter runoff from crop residues, irrigation water, wildlife, and atmospheric deposition. Farmers can develop and implement nutrient management plans to reduce excess application of nutrientsand reduce the potential for nutrient pollution.

To minimize pesticide impacts, farmers may use Integrated Pest Management (IPM) techniques (which can include biological pest control) to maintain control over pests, reduce reliance on chemical pesticides, and protect water quality.

Point source wastewater treatment
Farms with large livestock and poultry operations, such as factory farms, are called *concentrated animal feeding operations* or *feedlots* in the US and are being subject to increasing government regulation.[48][49] Animal slurries are usually treated by containment in anaerobic lagoons before disposal by spray or trickle application to grassland. Constructed wetlands are sometimes used to facilitate treatment of animal wastes. Some animal slurries are treated by mixing with straw and composted at high tempe\

Effective control of urban runoff involves reducing the velocity and flow of storm water, as well as reducing pollutant discharges. Local governments use a variety of storm water management techniques to reduce the effects of urban runoff. These techniques, called best management practices for water pollution (BMPs) in the U.S., may focus on water quantity control, while others focus on improving water quality, and some perform both functions.[7]

Pollution prevention practices include low-impact development techniques, installation of green roofs and improved chemical handling (e.g. management of motor fuels & oil, fertilizers and pesticides).[52] Runoff mitigation systems include infiltration basins, bioretention systems, constructed wetlands, retention basins and similar devices.

Thermal pollution from runoff can be controlled by storm water management facilities that absorb the runoff or direct it into groundwater, such as bioretention systems and infiltration basins. Retention basins tend to be less effective at reducing temperature, as the water may be heated by the sun before being discharged to a receiving stream