DOWNLOAD PDF GROUND WATER CONTAMINATION

Chapter 1 : Ground Water Awareness Week | Features | CDC

Groundwater contamination occurs when man-made products such as gasoline, oil, road salts and chemicals get into the groundwater and cause it to become unsafe and unfit for human use.

History[edit] Woburn was first settled in near Horn Pond, a primary source of the Mystic River , and was officially incorporated in At that time the area included present day towns of Woburn, Winchester, Burlington, and parts of Stoneham and Wilmington. In Wilmington separated from Woburn. In Burlington separated from Woburn; in Winchester did so, too. Woburn got its name from Woburn, Bedfordshire. Woburn played host to the first religious ordination in the Americas on Nov. Edward Johnson co-founder of the church and town of Woburn. Johnson is regarded as "the father of Woburn. Lyth engraver The first organizational Town Meeting was held on April 13, and the first town officers were chosen. William Learned was also selected as Constable. He was one of its first selectmen, and built the first house and first mill in Woburn. He was very active in town affairs and was a large landowner, miller and surveyor. The public library opened in The telephone was introduced in Woburn in ; Electric lights in Woburn was incorporated as a City on June 12, Route opened in Route 93 was built through town in Rail depot closed in Cummings Properties, the major holder of commercial properties in the region, was founded in Cummings Foundation was established in Cummings Foundation purchased the former Choate Memorial Hospital site and turned it into the New Horizons of Choate senior living community in Cummings and began publishing Woburn Advocate in Maguire was killed in the line of duty while responding to an armed robbery on December 26, During the mid to late s, the local community became concerned over the high incidence of childhood leukemia and other illnesses, particularly in the Pine Street area of east Woburn. In May , a number of citizens whose children had developed or died from leukemia filed a civil lawsuit against two corporations, W. Grace and Company and Beatrice Foods. The film was largely filmed in nearby Bedford and Lexington, with only a few shots on location in Woburn. According to the United States Census Bureau , the city has a total area of Climate[edit] Woburn features a humid continental climate , similar to those of many of the other Boston suburban areas. Spring generally starts out cool, around degrees, often with snow still on the ground. However, it quickly begins to rapidly warm to around 75 degrees by the time Summer begins. Temperatures often top in the 80s, but when an Atlantic low comes, temperatures may fail to rise out of the 60s. High pressure from The Gulf of Mexico, occasionally brings much hotter conditions with temperatures sometimes topping near , though this is fairly rare and only happens so often. Like most of the region, temperatures can vary widely in the span of a day.

Chapter 2 : Groundwater contamination - blog.quintoapp.com

Câ€¢1â€¢ round water contamination is nearly always the result of human activity. In areas where population density is high and human use of the land is intensive, ground water is espe-.

These man-made organic compounds are of most concern. The organic compounds occur in nature and may come from natural sources as well as from human activities. In many locations groundwater has been contaminated by chemicals for many decades, though this form of pollution was not recognized as serious environmental problem until the s. A brief description of the contamination sources follows. The types and concentrations of natural impurities depend on the nature of the geological material through which the groundwater moves and the quality of the recharge water. Groundwater moving through sedimentary rocks and soils may pick up a wide range of compounds such as magnesium , calcium , and chlorides. Some aquifers have high natural concentration of dissolved constituents such as arsenic , boron , and selenium. The effect of these natural sources of contamination on groundwater quality depends on the type of contaminant and its concentrations. Pesticides, fertilizers, herbicides and animal waste are agricultural sources of groundwater contamination. The agricultural contamination sources are varied and numerous: Agricultural land that lacks sufficient drainage is considered by many farmers to be lost income land. So they may install drain tiles or drainage wells to make the land more productive. The drainage well then serves as a direct conduit to groundwater for agricultural wastes which are washed down with the runoff. Storage of agricultural chemicals near conduits to groundwater, such as open and abandoned wells, sink holes, or surface depressions where ponded water is likely to accumulate. Contamination may also occur when chemicals are stored in uncovered areas, unprotected from wind and rain, or are stored in locations where the groundwater flows from the direction of the chemical storage to the well. Manufacturing and service industries have high demands for cooling water, processing water and water for cleaning purposes. Groundwater pollution occurs when used water is returned to the hydrological cycle. Modern economic activity requires transportation and storage of material used in manufacturing, processing, and construction. Along the way, some of this material can be lost through spillage, leakage, or improper handling. The disposal of wastes associated with the above activities contributes to another source of groundwater contamination. Some businesses, usually without access to sewer systems, rely on shallow underground disposal. They use cesspools or dry holes, or send the wastewater into septic tanks. Any of these forms of disposal can lead to contamination of underground sources of drinking water. Dry holes and cesspools introduce wastes directly into the ground. Septic systems cannot treat industrial wastes. Wastewater disposal practices of certain types of businesses, such as automobile service stations, dry cleaners, electrical component or machine manufacturers, photo processors, and metal platters or fabricators are of particular concern because the waste they generate is likely to contain toxic chemicals. Other industrial sources of contamination include cleaning off holding tanks or spraying equipment on the open ground, disposing of waste in septic systems or dry wells, and storing hazardous materials in uncovered areas or in areas that do not have pads with drains or catchment basins. Underground and above ground storage tanks holding petroleum products, acids, solvents and chemicals can develop leaks from corrosion, defects, improper installation, or mechanical failure of the pipes and fittings. Mining of fuel and non-fuel minerals can create many opportunities for groundwater contamination. The problems stem from the mining process itself, disposal of wastes, and processing of the ores and the wastes it creates. Residential wastewater systems can be a source of many categories of contaminants, including bacteria, viruses, nitrates from human waste, and organic compounds. Injection wells used for domestic wastewater disposal septic systems, cesspools, drainage wells for storm water runoff, groundwater recharge wells are of particular concern to groundwater quality if located close to drinking water wells. Improperly storing or disposing of household chemicals such as paints, synthetic detergents, solvents, oils, medicines, disinfectants, pool chemicals, pesticides, batteries, gasoline and diesel fuel can lead to groundwater contamination. When stored in garages or basements with floor drains, spills and flooding may introduce such contaminants into the groundwater. When thrown in the household trash, the products will eventually be carried into the groundwater because community landfills are not

equipped to handle hazardous materials. Similarly, wastes dumped or buried in the ground can contaminate the soil and leach into the groundwater. Click here for definitions concerning groundwater, or to learn more about its properties , its origin and quantities , its sources in Europe.

Chapter 3 : Groundwater pollution - Wikipedia

Groundwater pollution (also called groundwater contamination) occurs when pollutants are released to the ground and make their way down into groundwater. This type of water pollution can also occur naturally due to the presence of a minor and unwanted constituent, contaminant or impurity in the groundwater, in which case it is more likely.

Page Share Cite Suggested Citation: The National Academies Press. From to the liquid wastes were discharged into unlined ponds, which resulted in contamination of part of the underlying alluvial aquifer. Since , disposal has been accomplished by discharge into an asphalt-lined reservoir, which significantly reduced the volume of contaminants entering the aquifer. In the mids toxic organic chemicals were detected outside of the Arsenal in the alluvial aquifer. The Colorado Department of Health issued three orders, which called for 1 a halt to unauthorized discharges, 2 cleanup, and 3 groundwater monitoring. Subsequently, a management commitment was made to mitigate the problem. A pilot groundwater containment and treatment system was constructed in ; it consists of 1 a bentonite barrier and several withdrawal wells to intercept contaminated groundwater along a ft length of the northern Arsenal boundary, 2 treating the water with an activated carbon process, and 3 injecting the treated water on the downgradient side of the barrier through several recharge wells. Because of the success of the pilot operation, it is being expanded at present to intercept most of the contaminated underflow crossing the entire north boundary. However, boundary interception alone cannot achieve aquifer restoration at the Arsenal. It is anticipated that the overall final program will also have to include elements of source containment and isolation, source elimination, process modification to reduce the volume of wastes generated, and development of alternative waste-disposal procedures that are nonpolluting. A variety of alternatives have been proposed and are currently being evaluated to determine the most feasible for implementation. The research, planning, and design studies that are necessary to achieve the reclamation goal at the Arsenal illustrate that an effective aquifer restoration program is difficult to design and expensive to implement. The contamination of a groundwater resource is a serious prob- lem that can have long-term economic and physical conse- quences because in most cases the problem is neither easily nor quickly remedied. Wood concluded, "The most sat- isfactory cure for groundwater pollution is prevention. But even then, contaminants already in the aquifer will continue to migrate and spread unless some action is taken to immobilize, neu- tralize, or remove them. Hence, there is often a need to clean up or restore contaminated aquifers. Restoration of a contaminated aquifer is neither technically nor economically feasible in many cases. Factors frequently hindering restoration include 1 the slow diffusive nature of groundwater flow, 2 the difficulty of defining sec- ondary permeability effects, 3 the generally low oxygen con- tent and lack of biologic reactivity in groundwater, 4 the re- tention of some chemicals in the aquifer because they tend to be sorbed by minerals in the rocks making up the aquifer, 5 the lack of transferability of some restoration techniques from one site to another, and 6 the lack of knowledge about the source of the contamination. Effective aquifer restoration programs, if technically feasible, are both difficult to design and expensive to implement. Never- theless, in response to public or governmental demands for positive action in clearly documented cases where groundwater contamination threatens public health, aquifer cleanup pro- grams are being required and instituted more frequently. Some programs are being financed and operated by the federal gov- ernment. Examples include the Rocky Mountain Arsenal, Col- orado, where irrigation and domestic water-supply wells in adjacent areas have been contaminated from industrial wastes stored at the Arsenal, and also Wurtsmith Air Force Base, Michigan, where toxic organic solvents used in aircraft main- tenance have entered and spread through the underlying aqui- fer. Other programs may be implemented because of violations of federal regulations. General management options for restoring water quality in aquifers currently available include the following: The selection of the best approach for a particular situation requires the ability to predict changes in flow and chemical concentration in the aquifer for each possible management alternative. This in turn requires both adequate field data to describe the aquifer systems and the development of accurate simulation models to define the groundwater flow system, pollutant-transport mechanisms, and nature and rate of chemical or biological reactions. This area is well

suited for serving as a case study to illustrate data requirements, inves- tigative approaches, and management options related to the reclamation of contaminated aquifers because 1 the yr his- tory of groundwater contamination is relatively well docu- mented in the scientific and engineering literature; 2 the geology and hydrology of the area are fairly well known; 3 adequate, though limited, water-quality data are available to calibrate numerical simulation models; 4 the locations and strengths of contaminant sources can be approximately recon- structed; 5 a management commitment has been made to aquifer reclamation; and 6 construction, operation, and eval- uation of a pilot reclamation system at the Arsenal have been completed. The liquid wastes were discharged to several unlined ponds Figure 6. On the basis of available records, it is assumed that contamination first occurred at the beginning of From to the primary disposal was into pond A. Alternate and overflow discharges were collected in ponds B. Much of the area north of the Arsenal is irrigated, both with surface water diverted from one of the irrigation canals, which are also unlined, and with groundwater pumped from irrigation wells. Some damage to crops irrigated with shallow ground- water was observed in , , and Walton, Several investigations have been conducted since to determine both the cause of the problem and how to prevent further damage. Petri and Smith showed that an area of contaminated groundwater of several square miles existed north and northwest of the disposal ponds. To prevent additional contaminants from entering the aquifer, a acre 0. Although the liner eventually failed, even if the lining were to have remained totally impervious, this new disposal pond in itself would not eliminate the contamination problem because large amounts of contaminants were already present in and slowly migrating through the aquifer. From about or through about , pond C was maintained full most of the time by diverting water from the freshwater reservoirs to the south. This artificial recharge had the effect of diluting and flushing the contaminated groundwater away from pond C faster than would have occurred otherwise. By the areal extent and magnitude of contamination, as indicated by chlo- ride concentration, had significantly diminished. In and there were new claims of crop and livestock damages allegedly caused by groundwater that was contami- nated at the Arsenal. Data collected by the Colorado Depart- ment of Health Shukle, show that diisopropylmethyl- phosphonate DIMP , a nerve-gas by-product, has been detected at a concentration of 0. A DIMP concentration of 48 parts per million ppm , which is nearly , times higher, was measured in a groundwater sample collected near the dis- posal ponds. The detection of these chemicals, which were manufactured or used at the Arsenal, in areas off the Arsenal property led the Colorado Department of Health to issue cease and desist, cleanup, and monitoring orders in April to the Rocky Mountain Arsenal and Shell Chemical Company, which was leasing industrial facilities on the site. The Cease and Desist i Order called for a halt to unauthorized discharges of contam- i inants into surface water and groundwater just north of the Arsenal. The third order called for a groundwater monitoring program, the results of which would be reported to the State Health Department on a regular basis. Consequently, a program that included groundwater monitor- ing and studies to determine a means to intercept contaminants flowing across the north boundary of the Arsenal was estab- lished by the U. As a result of continued monitoring, additional contaminants have been identified in the groundwater at the Arsenal. The most widespread of those found are Nemagon dibromochlo- ropropane and various industrial solvents. Nemagon contam- 96 ination has been identified as probably resulting from Arsenal- related activities, whereas the industrial solvents identified are not unique to Arsenal activities. Other organic con- taminants associated with pesticide manufacturing have been found in wells located in a centrally located manufacturing plant area known as the South Plants area. These contaminants prob- ably entered the aquifer from accidental spills and leaks and appear to be migrating from this area very slowly. Hydrogeology The records of several hundred observation wells, test holes, irrigation wells, and domestic wells were compiled and anal- yzed to describe the hydrogeologic characteristics of the alluvial aquifer in and adjacent to the Rocky Mountain Arsenal. Kon- ikow presented four maps that show the configuration of bedrock surface, generalized water-table configuration, sat- urated thickness of alluvium, and transmissivity of the aquifer. These maps show that the alluvium forms a complex, sloping, discontinuous, and heterogeneous aquifer system. A map showing the general water-table configuration for is presented in Figure 6. The assumptions and limitations of Figure 6. The areas in which the alluvium either is absent or is unsaturated most of the time form internal barriers that significantly affect groundwater flow patterns within

the aquifer and, hence, significantly influence solute transport. The general direction of groundwater movement is from regions of higher water-table altitudes to those of lower water- table altitudes and is approximately perpendicular to the water-table contours. Deviations from the general flow pattern inferred from water-table contours may occur in some areas because of local variations in aquifer properties, recharge, or discharge. The nonorthogonality at places between water-table contours and aquifer boundaries indicates that the approximate limit of the saturated alluvium does not consistently represent a no-flow boundary but that, at some places, there may be significant flow across this line. Such a condition can readily occur in areas where the bedrock possesses significant porosity and hydraulic conductivity or where recharge from irrigation, unlined canals, or other sources is concentrated. Because the hydraulic conductivity of the bedrock underlying the alluvium is generally much lower than that of the alluvium, groundwater flow and contaminant transport through the bedrock are as- sumed to be secondary considerations compared with flow and transport in the alluvial aquifer. Groundwater withdrawals in the area are predominantly from wells tapping the alluvial r aquifer. Contamination Pattern Since several hundred observation wells and test holes have been constructed to monitor changes in water quality and water levels in the alluvial aquifer. Contour interval 10 feet 3 meters. Chloride data col- lected during indicate that one main plume of con- taminated water extended beyond the northwestern boundary of the Arsenal-and that a small secondary plume extended beyond the northern boundary see Figure 6. The contam- ination pattern shown in Figure 6. Because chloride generally behaves as a conservative that is, nonreactive solute in groundwater, it is often assumed that chlorides can be used to indicate the maximum extent of con- tamination from a source that contains chloride. But this as- sumption is not always reasonable because chloride is also a common natural constituent in groundwater. At the Rocky Mountain Arsenal the extent of contamination as indicated by chloride concentration reflects a dilution ratio of about Other organic contaminants exhibit a much smaller plume, or migra- tion distance, than does the chloride because of reactions that cause them to decay or to be adsorbed. Other differences among shapes and locations of plumes of different contaminants arise because they entered the aquifer at significantly different times and or locations within the Arsenal. For example, the Nem- agon plume occurs west of the chloride plume because the source of the Nemagon was not from the disposal ponds but apparently from a spill that occurred west of the ponds. Contaminants have also been detected in several shallow bedrock wells in or near the Arsenal. However, at present there are inadequate data to define the areal extent, depth of pen- etration, or rate of spreading of contaminants in the bedrock. Reliable and quantitative predictions of contam- inant movement can only be made if the processes controlling 97 convective transport; hydrodynamic dispersion; and chemical, physical, and biological reactions that affect solute concentra- tions in the ground are understood. These processes, in turn, must be expressed in precise mathematical equations having defined parameters. The theory and development of the equa- tions describing groundwater flow and solute transport have been well documented in the literature. Perhaps the most important technical advancement in the analysis of ground- water contamination problems during the past 10 yr has been the development of deterministic numerical simulation models that efficiently solve the governing flow and transport equations for the properties and boundaries of a specific field situation. Although many of the processes that affect waste movement are individually well understood, their complex interactions in a heterogeneous environment may not be understood well enough for the net outcome to be reliably predicted. Thus, the analysis of groundwater contamination problems can be greatly aided by the application of deterministic numerical simulation models that solve the equations describing groundwater flow and solute transport. The model included an area of approximately 34 mi2 88 Imp. The stringent data requirements for applying the solute- transport model pointed out deficiencies in the data base avail- able at the start of the study. Specifically, it was found that the velocity distribution determined from the water-table config- uration mapped in see Petri and Smith, was in part inconsistent with the observed pattern of contaminant spread- ing. The subsequent quantitative analysis and reinterpretation of available hydrogeologic data, based partly on feedback from the numerical simulation model, led to a revised conceptual model of the aquifer properties and boundaries that incorpo- rated the strong influence of the internal barriers within the alluvial aquifer. The solute-transport model of Konikow was calibrated mainly on the basis of the chloride concentration pattern that was observed in Figure 6.

Computed chloride patterns agreed closely with observed patterns, which during the yr history were available only for , , , and The calibrated model was then used to analyze the effects of future and past changes in stresses and boundary conditions. For example, comparative analyses illustrated that it would probably take at least many decades for this contaminated aqui- fer to recover naturally its original water-quality characteristics. But it was also inferred that appropriate water-management policies for aquifer reclamation can help to reduce this resto- ration time to the order of years, rather than decades, for the relatively mobile contaminants. Konikow ; also noted that the simulation results showed that a reclamation scheme using a network of interceptor wells would aid in containing and removing the contaminated groundwater. The model included an area of about 90 mi- km- and assumed that DIMP is conservative. Using the calibrated model, Robson was able to reconstruct the historical movement of DIMP in the aquifer between and , to estimate DIMP concentrations in the South Platte River resulting from discharge of contaminated groundwater, and to predict future DIMP concentrations under a variety of assumed management alternatives. To evaluate more fully the range of engineering approaches or alternatives that would be feasible for construction along the north boundary of the Arsenal, Warner modeled a smaller part of the aquifer 2. He predicted the impact on DIMP concentration of implementing a variety of interception schemes that incor- porated variants of a basic plan that included elements of groundwater withdrawal, a barrier, and reinfection of treated water. Among other findings, Warner showed that a properly operated hydraulic barrier, consisting of a line of pumping wells, would be just as effective as a bentonite barrier in stopping the movement of DIMP-contaminated groundwater across the northern boundary of the Arsenal. It is recognized that other organic contaminants of concern may be sorbed or altered by chemical and biological reactions as they move through the aquifer.

Chapter 4 : Water Contamination| Other Uses of Water | Healthy Water | CDC

Contaminants Found in Groundwater Contaminants can be natural or human-induced. Groundwater will nomally look clear and clean because the ground naturally filters out particulate matter.

Eight years ago, people in Pavillion, Wyo. EPA launched an inquiry, helmed by DiGiulio, and preliminary testing suggested that the groundwater contained toxic chemicals. Then, in , the agency suddenly transferred the investigation to state regulators without publishing a final report. Now, DiGiulio has done it for them. The study also suggests that the entire groundwater resource in the Wind River Basin is contaminated with chemicals linked to hydraulic fracturing, or fracking. This production technique, which involves cracking shale rock deep underground to extract oil and gas, is popular in the United States. There are thousands of wells across the American West and in California that are vulnerable to the kind of threat documented in the study, DiGiulio said. He is now a research scholar at Stanford University. That reliance on natural gas has sometimes blinded agencies to local pollution and health impacts associated with the resource, said Rob Jackson, an earth scientist at Stanford and co-author of the study. It behooves us to make it as safe and environmentally friendly as possible. They are great at detecting chemicals found at Superfund sites but not as good at detecting chemicals used in fracking, DiGiulio said. One such chemical was methanol. The simplest alcohol, it can trigger permanent nerve damage and blindness in humans when consumed in sufficient quantities. It was used in fracking in Pavillion as workers pumped thousands of gallons of water and chemicals at high pressure into the wells they were drilling. About 10 percent of the mixture contained methanol, DiGiulio said. So the presence of methanol in the Pavillion aquifer would indicate that fracking fluid may have contaminated it. But methanol degrades rapidly and is reduced within days to trace amounts. Commercial labs did not have the protocol to detect such small traces, so DiGiulio and his colleagues devised new procedures, using high-performance liquid chromatography, to detect it. They devised techniques for detecting other chemicals, as well. By then, Pavillion was roiling in controversy as EPA and residents collided with industry. EPA had drilled two monitoring wells, MW01 and MW02, in , and its testing had found benzene, diesel and other toxic chemicals. They pointed to a technical disagreement between EPA and the U. EPA realized it needed a consensus on its water testing methodology. They retested the monitoring wells in April This time, they also tested for methanol. But EPA never released those results to the public. Methanol, diesel and salt Industry representatives repeatedly pointed out that EPA had not published a peer-reviewed study on its findings. The report said the groundwater is generally suitable for people to use. He felt he had to finish his work. It is important that the work be seen by other scientists and enter the peer review realm so that other scientists will have access to virtually everything. All of it was publicly available, waiting for the right person to spend a year crunching the information. More research is needed. The sampling wells contained methanol. They also contained high levels of diesel compounds, suggesting they may have been contaminated by open pits where operators had stored chemicals, DiGiulio said. The deep groundwater in the region contained high levels of salt and anomalous ions that are found in fracking fluid, DiGiulio said. The chemical composition suggests that fracking fluids may have migrated directly into the aquifer through fractures, he said. Encana had drilled shallow wells at Pavillion, at depths of less than 2, feet and within reach of the aquifer zone, said Jackson of Stanford University. The study also shows that there is a strong upward flow of groundwater in the basin, which means contamination that is deep underground could migrate closer to the surface over time. But regulators had concluded that only two chemicals exceeded safe limits and the water could be used for domestic purposes. Nearly half the 19 chemicals are unstudied, and scientists do not know the safe level of exposure, EPA stated. The state is finalizing its findings and has its eyes set on the future, he said. At present, no state has restrictions on how shallowly a company can frack, he said.

Chapter 5 : Groundwater Contamination | Texas Groundwater Protection Committee

Contamination of Groundwater. The Committee considers groundwater contamination to be the detrimental alteration of the naturally occurring physical, thermal, chemical, or biological quality of groundwater.

Overworking the land for example, plowing too often Poorly managed and ineffective application of pesticides, irrigation water, and fertilizer Top of Page Effects Agricultural water can become contaminated through a variety of ways and can potentially spread bacteria, viruses, and parasites to crops and animals. Crop Production Fresh fruits and vegetables come in contact with water during various stages of the production process. Contaminated water that is used during crop production, harvesting, and processing can lead to health issues. Below is a list of the potential food production points where contaminated water sources can affect crop production: Chemical Application Crops with contaminated water used for pesticide or herbicide application. Water used for mixing chemicals should be of appropriate quality. Irrigation Irrigating crops with contaminated water. Water used for irrigation should be of appropriate quality. Worker Hygiene Lack of potable water for hand hygiene. There should be an established handwashing and hygiene policy for farm workers. Food Processing Wash crops in the final wash process with quality water. Water should be of drinking water quality and should not be recycled 3. People who consume fruit or vegetables that were exposed to contaminated water are at risk of developing a foodborne illness. Some of the bacteria that are spread through water within the United States include E. Irrigation of foods imported from international locations can spread these and other microbes for example, Cyclospora not usually found in developed countries. Small amounts of any of these organisms can cause foodborne illness. In order to keep microbes out of water sources, growers should use practices that are appropriate for their operation and make sure that they are using the best quality water 4. Water quality is also important in ensuring post harvest quality by decreasing decay 5. Animal Health It is important that livestock are provided with adequate amounts of quality water, free of contamination. Contaminated water can contain disease-causing organisms which can rapidly spread if animals are drinking from the same trough. If there is reason to question the quality of the water that is provided to livestock, it is important to test the water to ensure its safety. There are many chemicals and microorganisms that can be potentially dangerous to livestock. Some chemicals include nitrates, sulfates, and chemicals found in pesticides like DDT, Chlordane, and Endrin. Certain microorganisms such as blue-green algae, Cryptosporidium , or Staphylococcus, can be toxic to animals and cause symptoms like diarrhea, lack of coordination, labored breathing, or death 6. Ill animals can then release millions of infectious microbes into the soil that can further contaminate other water sources. Protecting Water Quality from Agricultural Runoff. National Water Quality Inventory: Report to Congress, Reporting Cycle: University of Wisconsin Extension, Food Safety Begins on the Farm: Cornell Good Agricultural Practices Program, Ohio State University Extension.

Chapter 6 : Fracking Can Contaminate Drinking Water - Scientific American

Soil and groundwater contamination /pollution occurs due to different human activities and also arises from manufacturing processes. It is a matter of great complexity and concern. It is a matter of great complexity and concern.

Chemicals used at wood preservation facilities Mill tailings in mining areas Fly ash from coal-fired power plants Sludge disposal areas at petroleum refineries Land spreading of sewage or sewage sludge Graveyards Wells for disposal of liquid wastes Runoff of salt and other chemicals from roads and highways Spills related to highway or railway accidents Coal tar at old coal gasification sites Asphalt production and equipment cleaning sites Non-point distributed sources Pesticides on agricultural land and forests Contaminants in rain, snow, and dry atmospheric fallout Source: Wallace, Canadian Aquatic Resources, eds. Department of Fisheries and Oceans: These systems were originally designed for houses that were widely separated from their nearest neighbour, such as farmhouses and the occasional rural residence. Yet, today, in many parts of the country, individual private wells are being installed in subdivisions at suburban densities. The primary danger here is that too many wells may pump too much water for the aquifer to sustain itself. Septic treatment systems associated with these developments can stress the environment in a number of other ways. They are often allowed in less than satisfactory soil conditions and are seldom maintained properly. They are also unable to treat many household cleaners and chemicals which, when flushed down the drain or toilet, often impair or kill the bacterium needed to make the system work The same applies in urban systems. See also Wastewater section Saltwater intrusion Saltwater intrusion can be a problem in coastal areas where rates of groundwater pumping are high enough to cause sea water to invade freshwater aquifers. The problem can be avoided by appropriate well field design and by drilling relief wells to keep the salt water away from the fresh groundwater source. Some wells pumping saltwater in Prince Edward Island, are used as convenient water supplies for shellfish farms. Leaking underground storage tanks and piping Leaks of petroleum products have been increasing over the last two decades because underground steel tanks installed in large numbers in the s and s have become corroded. Before , most underground tanks were made of steel. Groundwater dissolves many different compounds, and most of these substances have the potential to contaminate large quantities of water. This problem is particularly severe in the Atlantic provinces where there is a high usage of groundwater. In many cases, the problem is noticed long after the aquifer is contaminated, for example, when consumers start tasting or smelling gasoline. These include chemicals used in dry cleaning, wood preservation, asphalt operations, machining, and in the production and repair of automobiles, aviation equipment, munitions, and electrical equipment. They can also be generated and released in accidents, e. As with petroleum products, the problems are caused by groundwater dissolving some of the compounds in these volatile substances. These compounds can then move with the groundwater flow. Except in large cities, drinking water is rarely tested for these contaminants. It exists everywhere under the Canadian landscape and is vitally connected to our rich surface water resources. Contamination of groundwater is a serious problem in Canada. Industrial and agricultural activities are major sources of contaminants, but Canadian households are equally important sources. Groundwater moves so slowly that problems take a long time to appear. Because of this, and because it is so expensive to clean up a contaminated aquifer if it can be done at all , it is preferable by far to prevent contamination from happening in the first place. For example, leaking underground storage tanks can be replaced by tanks that will not corrode; landfills can be sited in locations where leachates will not contaminate underlying groundwater; and the impacts of spills of hazardous materials reduced by restricting access to recharge areas. Once these contaminants are in the groundwater, they eventually reach rivers and lakes. In other words, once we have a pollution problem, we may be only a step away from a water supply problem. All levels of government in Canada are starting to take some of the actions necessary to protect our groundwater supplies, but there is a long way to go before these measures are fully effective. At the same time, universities and government research institutes are investigating what happens to water underground and what can be done to preserve it and even improve its availability to us. Report a problem or mistake on this page Please select all that apply: A link, button or video is not working It has a spelling mistake Information is

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Chapter 7 : Woburn, Massachusetts - Wikipedia

Includes groundwater contamination cases for the current and some previous years as per the Joint Groundwater Monitoring and Contamination Report (TCEQ publication SFR). Open the Map Viewer User Guide - This downloadable PDF document explains how to use the tools available in the Viewer.

The natural arsenic pollution occurs because aquifer sediments contain organic matter that generates anaerobic conditions in the aquifer. These conditions result in the microbial dissolution of iron oxides in the sediment and, thus, the release of the arsenic , normally strongly bound to iron oxides, into the water. As a consequence, arsenic-rich groundwater is often iron-rich, although secondary processes often obscure the association of dissolved arsenic and dissolved iron. Arsenic is found in groundwater most commonly as the reduced species arsenite and the oxidized species arsenate, being the acute toxicity of arsenite somewhat greater than that of arsenate. This tool also allows the user to produce probability risk mapping for both arsenic and fluoride. This contaminants can be important locally but they are not as widespread as arsenic and fluoride. Groundwater pollution with pathogens and nitrate can also occur from the liquids infiltrating into the ground from on-site sanitation systems such as pit latrines and septic tanks , depending on the population density and the hydrogeological conditions. Liquids leach from the pit and pass the unsaturated soil zone which is not completely filled with water. Subsequently, these liquids from the pit enter the groundwater where they may lead to groundwater pollution. This is a problem if a nearby water well is used to supply groundwater for drinking water purposes. During the passage in the soil, pathogens can die off or be adsorbed significantly, mostly depending on the travel time between the pit and the well. In any case, such recommendations about the safe distance are mostly ignored by those building pit latrines. In addition, household plots are of a limited size and therefore pit latrines are often built much closer to groundwater wells than what can be regarded as safe. This results in groundwater pollution and household members falling sick when using this groundwater as a source of drinking water. Sewage treated and untreated [edit] Groundwater pollution can be caused by untreated waste discharge leading to diseases like skin lesions, bloody diarrhea and dermatitis. This is more common in locations having limited wastewater treatment infrastructure, or where there are systematic failures of the on-site sewage disposal system. The treated effluent from sewage treatment plants may also reach the aquifer if the effluent is infiltrated or discharged to local surface water bodies. Therefore, those substances that are not removed in conventional sewage treatment plants may reach the groundwater as well. Groundwater pollution can also occur from leaking sewers which has been observed for example in Germany. This is because only a fraction of the nitrogen-based fertilizers is converted to produce and other plant matter. The remainder accumulates in the soil or lost as run-off. The nutrients, especially nitrates, in fertilizers can cause problems for natural habitats and for human health if they are washed off soil into watercourses or leached through soil into groundwater. The heavy use of nitrogenous fertilizers in cropping systems is the largest contributor to anthropogenic nitrogen in groundwater worldwide. The US Environmental Protection Agency EPA and the European Commission are seriously dealing with the nitrate problem related to agricultural development, as a major water supply problem that requires appropriate management and governance. Ore mining and metal processing facilities are the primary responsible of the presence of metals in groundwater of anthropogenic origin, including arsenic. The low pH associated with acid mine drainage AMD contributes to the solubility of potential toxic metals that can eventually enter the groundwater system. Oil spills associated with underground pipelines and tanks can release benzene and other soluble petroleum hydrocarbons that rapidly percolate down into the aquifer. There is an increasing concern over the groundwater pollution by gasoline leaked from petroleum underground storage tanks USTs of gas stations. It has also been used for metal-degreasing operations. Because it is highly volatile, it is more frequently found in groundwater than in surface water. Although non-miscible, both LNAPLs and DNAPLs still have the potential to slowly dissolve into the aqueous miscible phase to create a plume and thus become a long-term source of contamination. Hydraulic fracturing The recent growth of Hydraulic Fracturing "Fracking" wells in the United States has raised concerns regarding its potential risks of contaminating groundwater resources. The Environmental

Protection Agency EPA , along with many other researchers, has been delegated to study the relationship between hydraulic fracturing and drinking water resources. While it is possible to perform hydraulic fracturing without having a relevant impact on groundwater resources if stringent controls and quality management measures are in place, there are a number of cases where groundwater pollution due to improper handling or technical failures was observed. Within one kilometer of these specific sites, a subset of shallow drinking water consistently showed higher concentration levels of methane , ethane , and propane concentrations than normal. An evaluation of higher Helium and other noble gas concentration along with the rise of hydrocarbon levels supports the distinction between hydraulic fracturing fugitive gas and naturally occurring "background" hydrocarbon content. This contamination is speculated to be the result of leaky, failing, or improperly installed gas well casings. So far, a significant majority of groundwater contamination events are derived from surface-level anthropogenic routes rather than the subsurface flow from underlying shale formations. In many of these events, the data acquired from the leakage or spillage is often very vague, and thus would lead researchers to lacking conclusions. They concluded that the probability is small that the rise of fracking fluids through the geological underground to the surface will impact shallow groundwater. Love Canal was one of the most widely known examples of groundwater pollution. In , residents of the Love Canal neighborhood in upstate New York noticed high rates of cancer and an alarming number of birth defects. This was eventually traced to organic solvents and dioxins from an industrial landfill that the neighborhood had been built over and around, which had then infiltrated into the water supply and evaporated in basements to further contaminate the air. Eight hundred families were reimbursed for their homes and moved, after extensive legal battles and media coverage. Other[edit] Further causes of groundwater pollution are chemical spills from commercial or industrial operations, chemical spills occurring during transport e. An area can have layers of sandy soil, fractured bedrock, clay, or hardpan. Areas of karst topography on limestone bedrock are sometimes vulnerable to surface pollution from groundwater. Earthquake faults can also be entry routes for downward contaminant entry. Water table conditions are of great importance for drinking water supplies, agricultural irrigation, waste disposal including nuclear waste , wildlife habitat, and other ecological issues. A noteworthy class of such chemicals is the chlorinated hydrocarbons such as trichloroethylene used in industrial metal degreasing and electronics manufacturing and tetrachloroethylene used in the dry cleaning industry. Both of these chemicals, which are carcinogens themselves, undergo partial decomposition reactions, leading to new hazardous chemicals including dichloroethylene and vinyl chloride. Conversely, groundwater can also feed surface water sources. Sources of surface water pollution are generally grouped into two categories based on their origin. Interactions between groundwater and surface water are complex. Consequently, groundwater pollution, sometimes referred to as groundwater contamination, is not as easily classified as surface water pollution. A spill or ongoing release of chemical or radionuclide contaminants into soil located away from a surface water body may not create point or non-point source pollution but can contaminate the aquifer below, creating a toxic plume. The movement of the plume, may be analyzed through a hydrological transport model or groundwater model. Prevention[edit] Schematic showing that there is a lower risk of groundwater pollution with greater depth of the water well [6] Further information: Precautionary principle The precautionary principle , evolved from Principle 15 of the Rio Declaration on Environment and Development , is important in protecting groundwater resources from pollution. They are important components to understand the hydrogeological system, and for the development of conceptual models and aquifer vulnerability maps. Effective groundwater monitoring should be driven by a specific objective, for example, a specific contaminant of concern. When a problem is found, action should be taken to correct it. There are two types of zoning maps: Depth to water table, net Recharge, Aquifer media, Soil media, Topography slope , Impact on the vadose zone , and hydraulic Conductivity. Thus, potential sources of degradable pollutants, such as pathogens, can be located at distances which travel times along the flowpaths are long enough for the pollutant to be eliminated through filtration or adsorption.

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Decades ago, industrial pollution began fouling some groundwater wells throughout Los Angeles County. That prompted water officials to stop using the most polluted wells and rely more on water.