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- To View the presentation as a slideshow with effects select "View" on the menu bar and click on "Slide Show."
- To advance through the presentation, click the right-arrow key or the space bar.
- From the resources slide, click on any resource to see a presentation for that resource.
- From the Chapter menu screen click on any lesson to go directly to that lesson's presentation.
- You may exit the slide show at any time by pressing the Esc key.

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Objectives

- **List** five pollutants, their sources, and their possible effects on human health.
- **Explain** how scientists use toxicology and epidemiology.
- **Explain** how pollution can come from both natural sources and human activities.
- **Describe** the relationship between waste, pollution, and human health.

Environmental Effects on Health

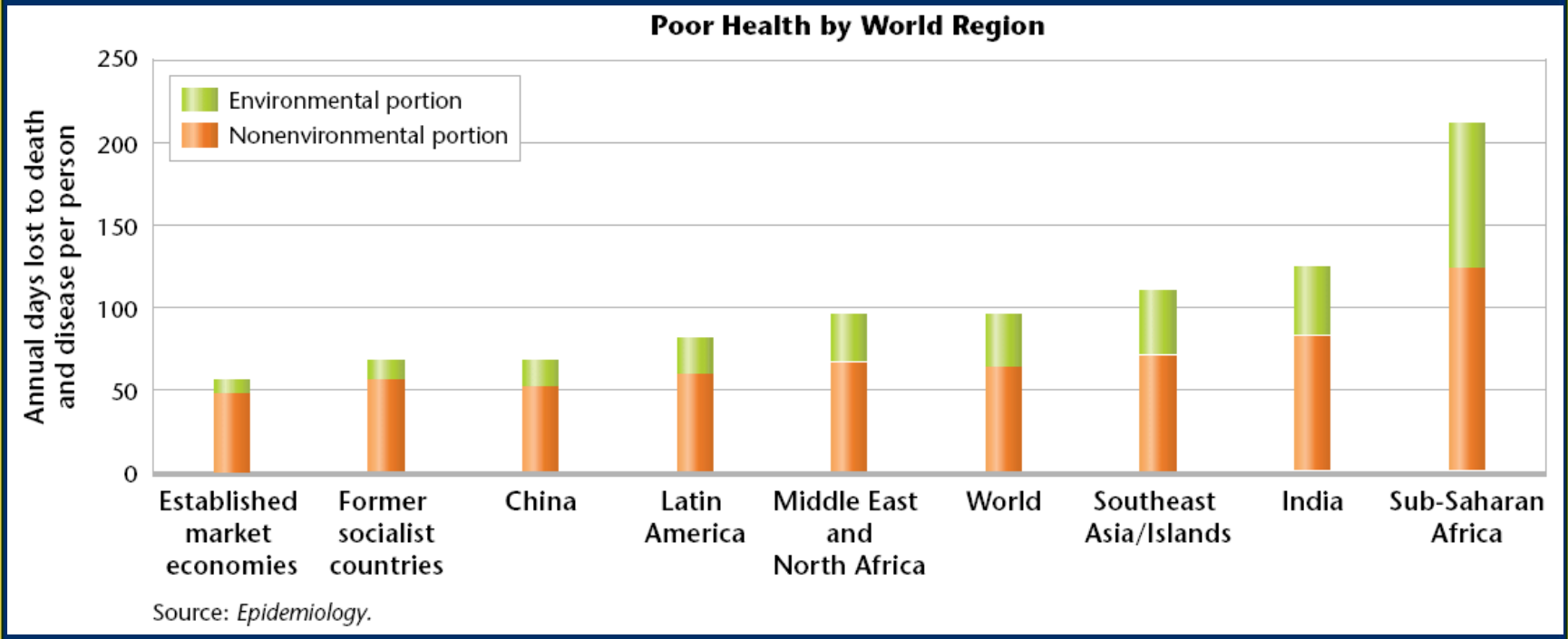
- Pollution causes illnesses directly and indirectly.
- Pollution may cause illness by poisoning us directly, as in the cases of lead poisoning and lung cancer.
- Second, because many infections diseases, such as cholera and river blindness, spread in polluted environments, illness can be caused indirectly.

Environmental Effects on Health

- The World Health Organization (WHO) has begun to collect data on how the environment affects human health.
- In one study, WHO estimates poor health by days of healthy life lost to death and disease, in different world regions.
- The study shows that, in general, people in developing countries suffer greater health impacts.
- The main factor is the enormous role of infectious diseases which are more common in crowded areas with poor sanitation.

End Of Slide

Environmental Effects on Health



Toxicity: How Dangerous Is It?

- **Toxicology** is the study of toxic substances, including their nature, effects, detection, methods of treatment, and exposure control.
- Several pollutants have toxic, poisonous, effects.

Pollutant Types and Effects

Pollutant	Source	Possible effects
Pesticides	use in agriculture and landscaping	nerve damage, birth defects, and cancer
Lead	lead paint and gasoline	brain damage and learning problems
Particulate matter	vehicle exhaust, burning waste, fires, and tobacco smoke	respiratory damage (asthma, bronchitis, cancer)
Coal dust	coal mining	black lung disease
Bacteria in food	poor sanitation and poor food handling	gastrointestinal infections

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Toxicity: How Dangerous Is It?

- Almost any chemical be harmful if taken in, or **ingested**, in large enough amounts.
- A **dose** is the amount of a harmful substance to which a person is exposed.
- The damage to health from exposure to a given dose is the **response**.
- We need to know how much of the pollutant is in the environment and in the body to determine the effect of a pollutant on health.

End Of Slide

Toxicity: How Dangerous Is It?

- The toxic effect of a chemical depends on:
  - Dose
  - Exposure
  - Body size
  - Body's ability to break down the chemicals

Toxicity: How Dangerous Is It?

- A persistent chemical is a chemical that breaks down slowly in the environment.
- This type of chemical dangerous because it is most likely to remain in the body.
- People are more likely to come into contact with persistent chemicals, like DDT.

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Dose-Response Curves

- A **dose-response curve** is a graph that shows the relative effect of various doses of a drug or chemical on an organism or organisms.
- Sometimes, there is a **threshold dose**.
- Exposure to any amount of chemicals less than the threshold dose has no adverse effect on health.
- Exposure levels above the threshold dose usually leads to worse health effects.

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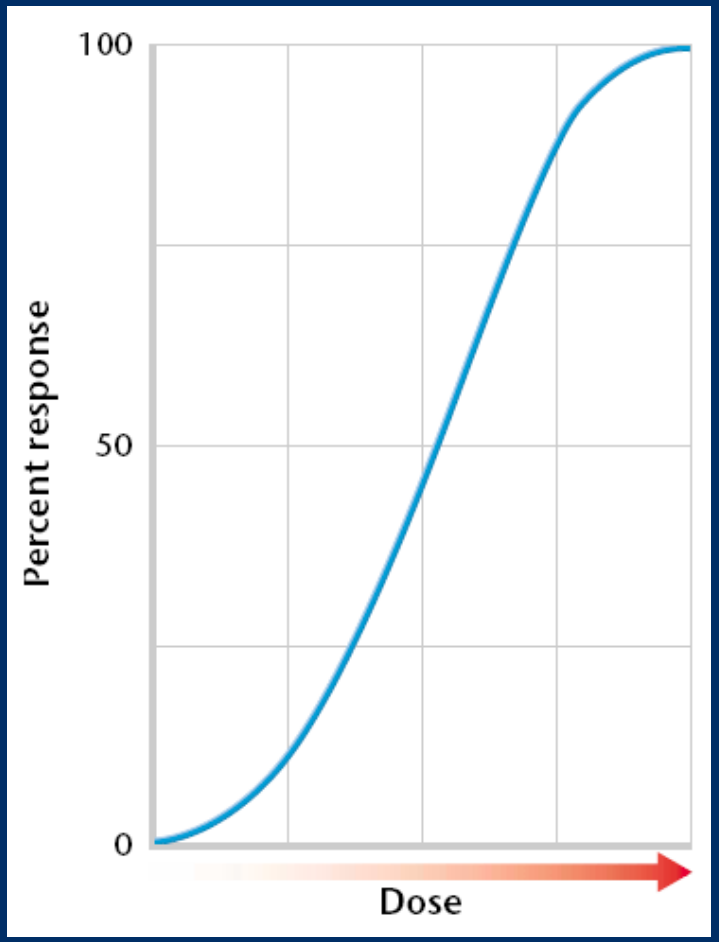
Dose-Response Curve

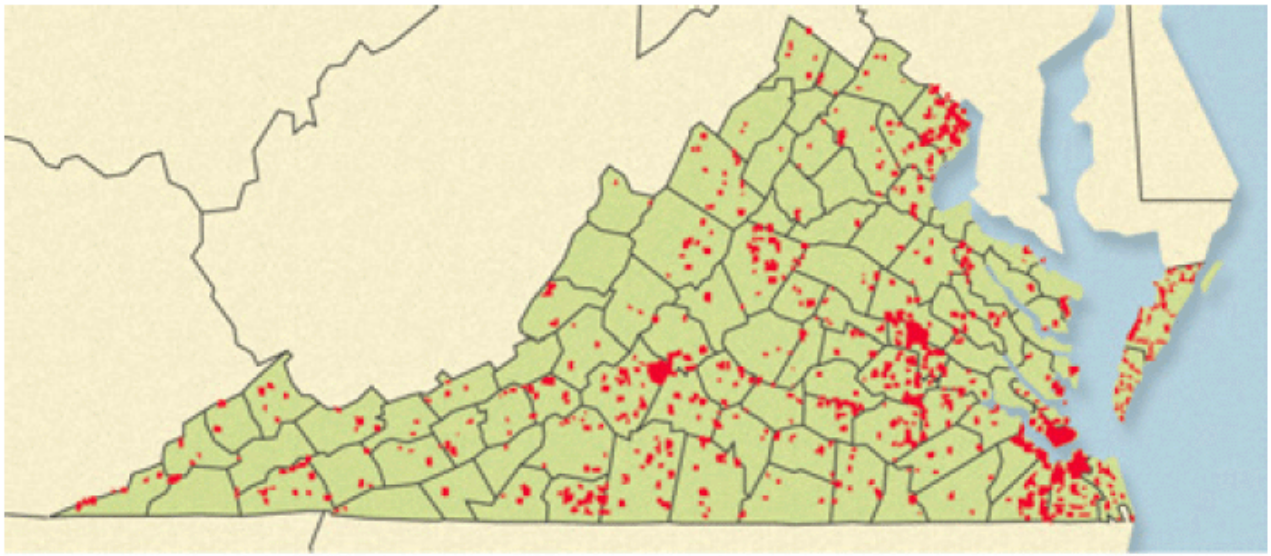


Epidemiology

- **Epidemiology** is the study of the distribution of diseases in populations and the study of factors that influence the occurrence and spread of disease.
- When an epidemic occurs, epidemiologists collect data from health workers on when and where cases of the disease have occurred.
- Scientists trace the disease to try to find its origin and how to prevent it from spreading.

Epidemiology

- The map below shows the location of cases of mercury poisoning in Virginia. Patterns point scientists toward areas of mercury poisoning.



Source: Virginia Department of Health.

End Of Slide

Risk Assessment

- **Risk assessment** is the scientific assessment, study, and management of risk. It is also the scientific estimation of the likelihood of negative effects that may result from exposure to a specific hazard.
- Scientists and health officials work together on risk assessment for pollutants.
- Risk assessment may lead to government regulation on how and where the substance can be used.

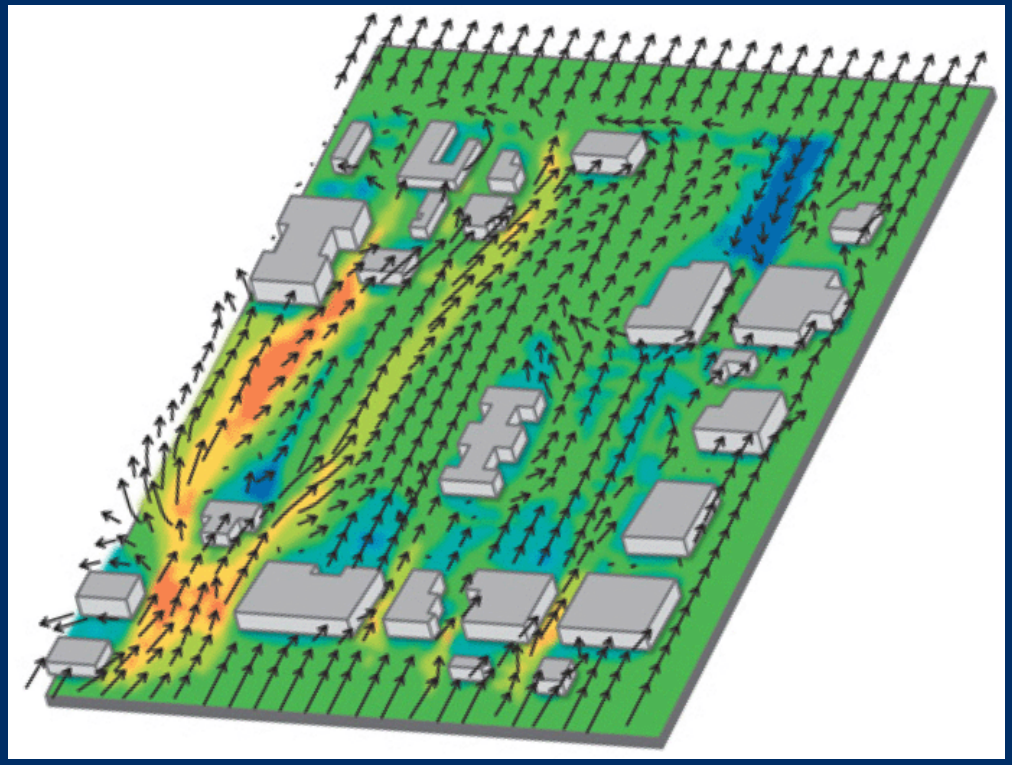
End Of Slide

Risk Assessment

- The process of risk assessment includes:
  - compiling and evaluating existing information on the substance,
  - determining how people might be exposed to it by using diagrams, air flow models, and others,
  - determining the toxicity of the substance,
  - and characterizing the risk of that substance to the public.

End Of Slide

Risk Assessment



Air flow models like this one help scientists predict the path that air pollutants may follow through a city. The bright orange areas are receiving the most pollutants.

Pollution from Natural Sources

- Some pollutants occur naturally in the environment.
- Naturally occurring pollutants usually become hazardous to health when they are concentrated above their normal levels in the environment.
- The most common pollutants from natural sources are dust, soot, and other particulates.

End Of Slide

Particulates

- **Particulates** are fine particles that are suspended in the atmosphere and that are associated with air pollution.
- Particulates may be breathed in and become trapped in the tiny air sacs in our lungs.
- This results in irritation, which can make lung conditions, such as chronic bronchitis and emphysema, worse.
- Dust storms, wildfires, volcanic eruptions all produce large amounts of particulates.

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Heavy Metals

- Another pollutant from natural sources are the so-called **heavy metals**.
- Dangerous heavy metals include the elements arsenic, cadmium, lead, and mercury.
- These elements occur naturally in rocks and soil.
- Most of these elements cause nerve damage when they are ingested beyond their threshold dose.

End Of Slide

Pollution from Human Activities

- Human activities release thousands of types of chemicals into the environment.
- We know surprisingly little about the health effects of most of these chemicals.
- Only about 10 percent of commercial chemicals have been tested for their toxicity, and about 1,000 new chemicals are introduced every year.

End Of Slide

Recent Improvements

- Regulations in the United States have helped reduce exposure to pollutants. Most vehicles and factories now have pollution-control devices.
- On average, people contain lower levels of some toxic chemicals in their bodies than in the past.
- Because we know so little about the effects of chemicals on our health, new health risks are discovered frequently.
- For example, scientists now think that chemical pollution may be part of the cause of Parkinson's and Alzheimer's diseases.

End Of Slide

Burning Fuels

- Air pollution is still a major health problem, despite the very real advances in public health resulting from pollution control.
- Burning fuels in vehicles, home furnaces, power plants, and factories introduces enormous amounts of pollutants into the air, including the gas carbon monoxide.
- These pollutants and particulates contribute to premature death each year from asthma, heart disease, and lung disorders.

End Of Slide

Pesticides

- **Pesticides** are chemicals designed to kill unwanted organisms such as insects, fungi, or weeds.
- Pesticides are beneficial in that they allow us to grow more food by reducing pest damage.
- But because pesticides are designed to kill organisms, they are often dangerous to humans in large doses.

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Pesticides

- Modern pesticides, such as **organophosphate** pesticide, break down quickly in the environment into less harmful substances.
- However, they may still pose a risk.
- In 1999, the U.S. poison centers reported more than 13,000 cases of organophosphate poisoning.
- Most cases of pesticide poisoning affect the people applying the chemicals.

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Industrial Chemicals

- We are exposed to low levels of industrial chemicals every day, particularly inside new buildings that have new furnishings.
- Older building were often painted using lead-based paint. Lead is directly linked to brain damage and learning disabilities.
- Often, industrial chemicals are not known to be toxic until they have been used for many years.

End Of Slide

Waste Disposal

- Much of the pollution in our environment is a byproduct of inadequate waste disposal.
- Although methods of disposing waste have improved, problems remain.
- Toxic chemicals continue to be carried into our waterways, while incineration plants release toxic products into the air.
- Laws regulating waste disposal are not always enforced.

End Of Slide

Objectives

- **Explain** why the environment is an important factor in the spread of cholera.
- **List** two changes to the environment that can lead to the spread of infectious diseases.
- **Explain** what scientists mean when they say that certain viruses are emerging.

The Environment's Role in Disease

- Some of the damage to human health is not caused by toxic chemicals but by organisms that carry disease.
- Infectious diseases are caused by **pathogens**, a virus, microorganism, or other substance that causes disease.
- Some of these diseases are spread from person to person through the air. Others are spread by water that contains the pathogen.

End Of Slide

The Environment's Role in Disease

- Other disease are transmitted by a secondary host, such as a mosquito.
- A **host** an organism from which a parasite takes food and shelter.
- The table on the following slide lists the most deadly infectious diseases worldwide.

End Of Slide

The Environment's Role in Disease

Deaths from Infectious Diseases in 2000, Estimated by the World Health Organization		
Disease and examples	Cause	Estimated deaths per year (in millions)
Total infectious and parasitic diseases	bacteria, viruses, and parasites	10.5
Respiratory infections (pneumonia, influenza, and whooping cough)	bacteria, viruses	4.0
AIDS	virus	2.9
Diarrheal diseases (cholera, typhus, typhoid, and dysentery)	bacteria, viruses, parasites	2.1
Tuberculosis	bacteria	1.7
Childhood diseases (measles and diphtheria)	virus	1.5
Malaria	parasitic protist	1.1
Tetanus	bacteria	0.3
Tropical diseases (trypanosomiasis, Chagas' disease, schistosomiasis, and leishmaniasis)	bacteria, viruses, and parasites	0.1

Waterborne Disease

- Pathogens can transfer diseases directly to humans through water, or organisms that carry the pathogens can transfer them to humans.
- A **vector** is an intermediate host that transfers a pathogen or a parasite to another organism.
- Widespread construction of irrigation canals and dam increase habitats for vectors, such as mosquitoes.
- These organisms are intermediate hosts that transfer the pathogen or parasite to people.

End Of Slide

Cholera

- Nearly three-fourths of infectious disease are transmitted through water.
- The deadliest waterborne diseases, such as those that cause **cholera** and **dysentery**, come from drinking water polluted by human feces.
- These diseases cause the body to lose water and become dehydrated, and they cause most of the infant mortality around the world

Malaria

- Malaria was once the world's leading cause of death.
- Malaria is caused by parasitic protists and is transmitted by a bite from female mosquitoes of many species.
- No effective vaccine for malaria exists, but preventative measures are used to control mosquitoes.

End Of Slide

Antibiotic Resistance

- By altering the environment, we make it more suitable for pathogens to live and reproduce.
- Our actions cause pathogens to evolve resistance to antibiotics that are used to kill them.
- In 1979, 6% of European strains of pneumonia bacteria were resistant to antibiotics. Ten years later, 44% of the strains were resistant.

Malaria on the March

- Malaria was common in the United States and Europe before the days of mosquito control. Now it is most common in tropical countries.
- Historically, malaria was controlled by draining marshes and rice paddies and by spraying with pesticides.
- Since the 1970s, however, mosquitoes have evolved resistance to most pesticides.
- Currently, mosquitoes are controlled by spreading growth regulators that prevent mosquito larvae from maturing into adults or that sterilize the female mosquitoes

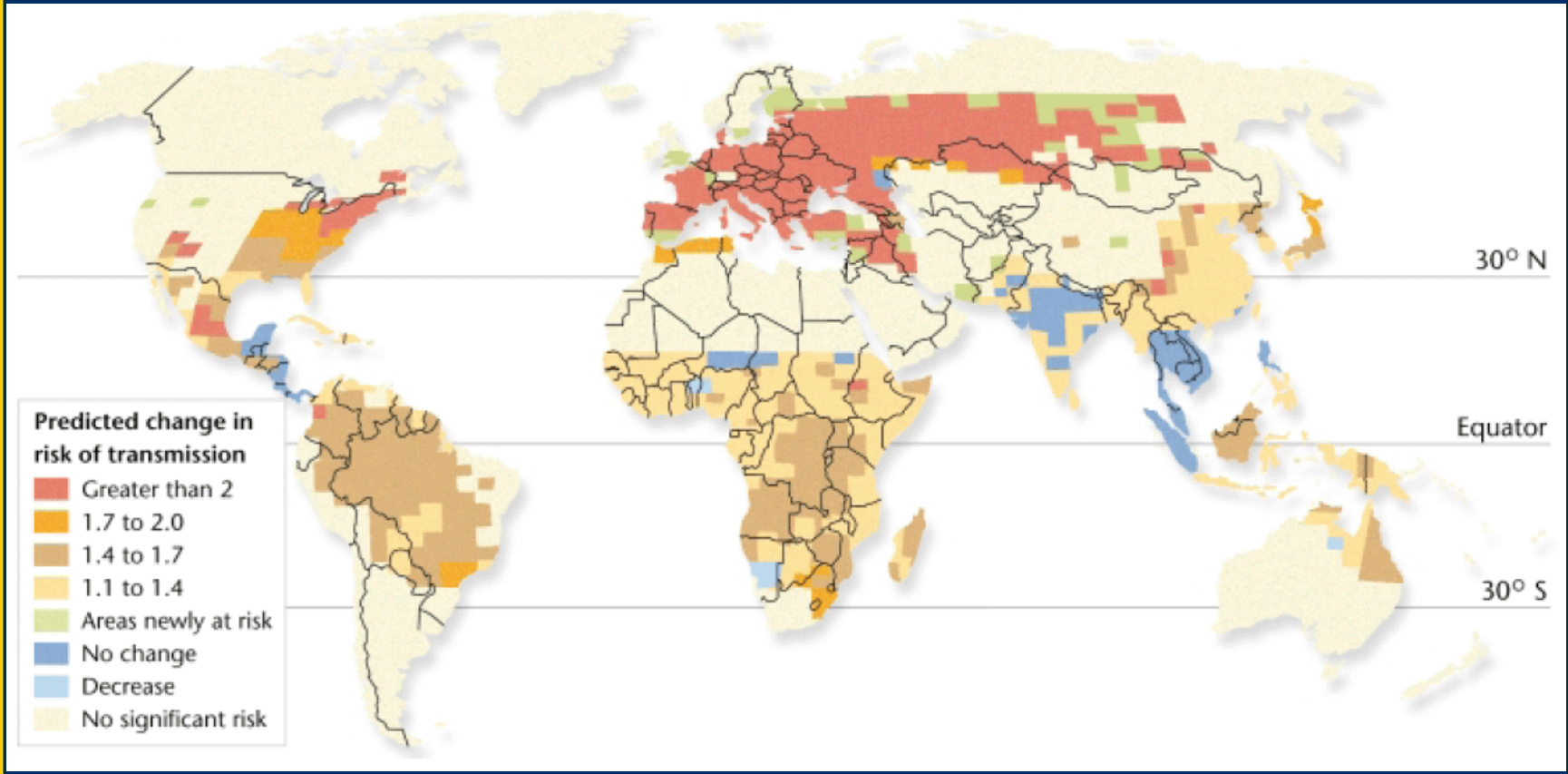
End Of Slide

Malaria on the March

- The mosquitoes that transmit malaria are found in the warmer parts of the world.
- Thus it is thought that global warming could spread malaria to different parts of the world.
- The following slide shows the areas into which malaria might spread under specific global warming conditions.

End Of Slide

Malaria on the March



Emerging Viruses

- In recent years, medical scientists have been focusing on previously unknown viruses.
- Examples of these “emerging viruses” include the hanta virus, the ebola virus, the West Nile virus, and the HIV, which causes AIDS.
- Most viral diseases spread directly from one person to another.
- Often, the virus invades the body through a cut or through mucus membranes.

End Of Slide

Emerging Viruses

- We do not have many effective drugs to treat viral diseases.
- Our main defense against viral diseases is vaccination.
- However, vaccines are virus specific and viruses evolve rapidly.
- New vaccines must be developed when a new strain of a viral pathogen evolves.

End Of Slide

Cross-Species Transfer

- Lately, there has been an increasing number of pathogens that have made a **cross-species transfer**, or have moved from one species to another.
- These pathogens have lived for centuries in some species of wild animals and have often done little damage.

Cross-Species Transfer

- When the pathogens invade humans, the pathogens cause serious diseases. For example West Nile virus and HIV fall into this category.
- Some ecologists fear that cross-species transfer of diseases will be more common with continued destruction of habitats and of the environment.

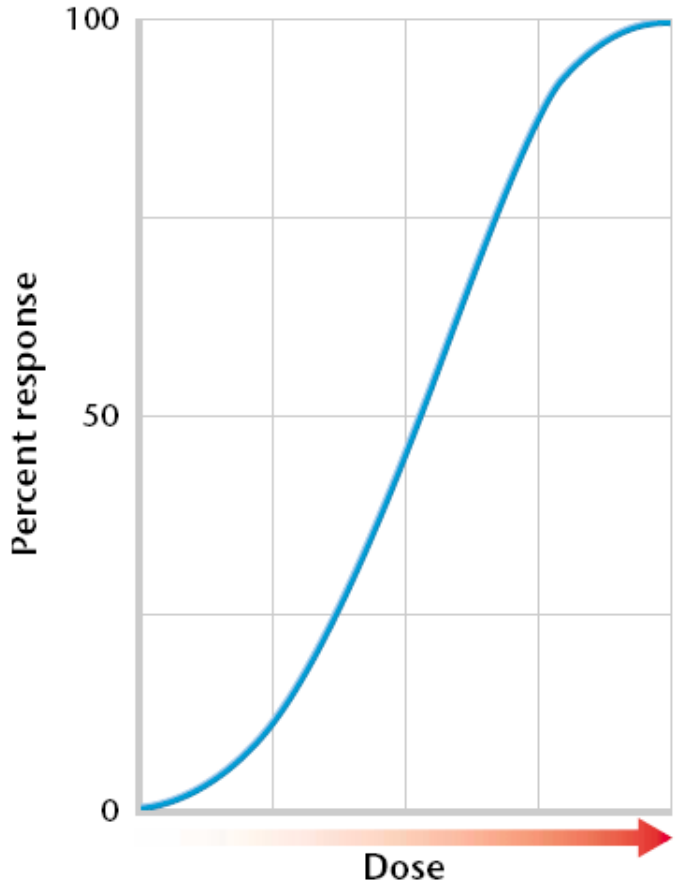
Bellringer

Section: Pollution and Human Health

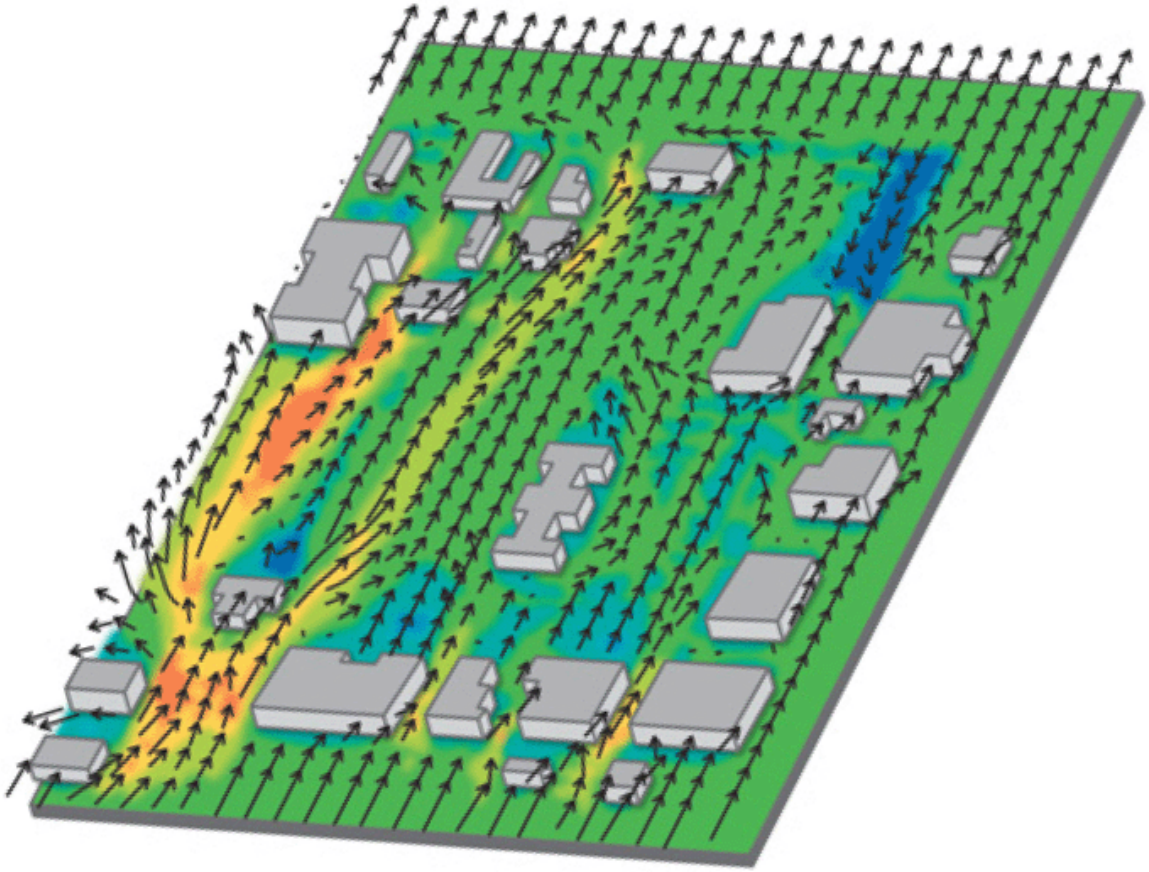
Brainstorm all of the possible pollutants, including natural pollutants, that might affect human health. List the sources of these pollutants.

Write your responses in your ***EcoLog***.

A Typical Dose-Response Curve



A Model of Air-Pollutant Movement Through a City



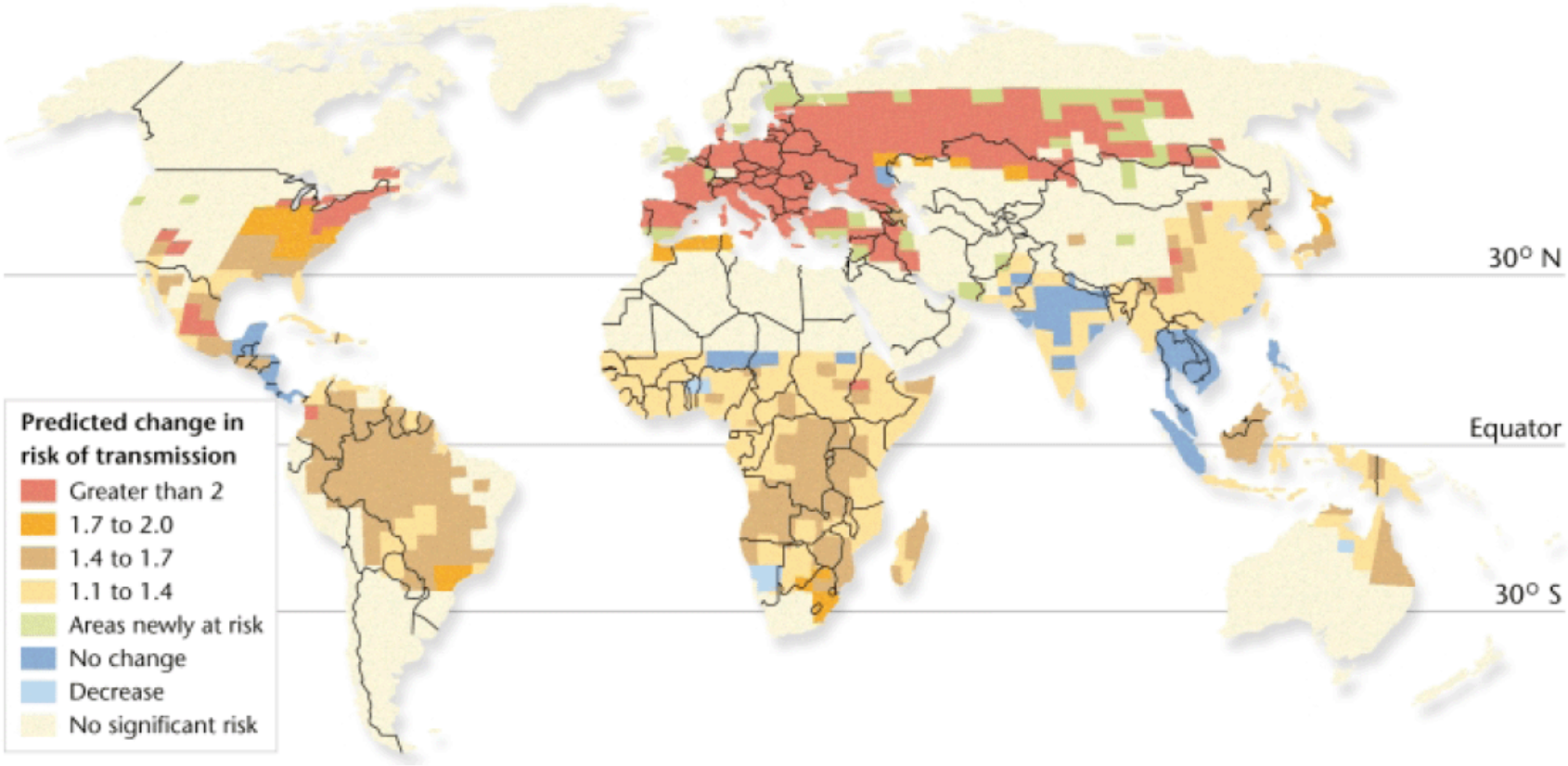
Bellringer

Section: Biological Hazards

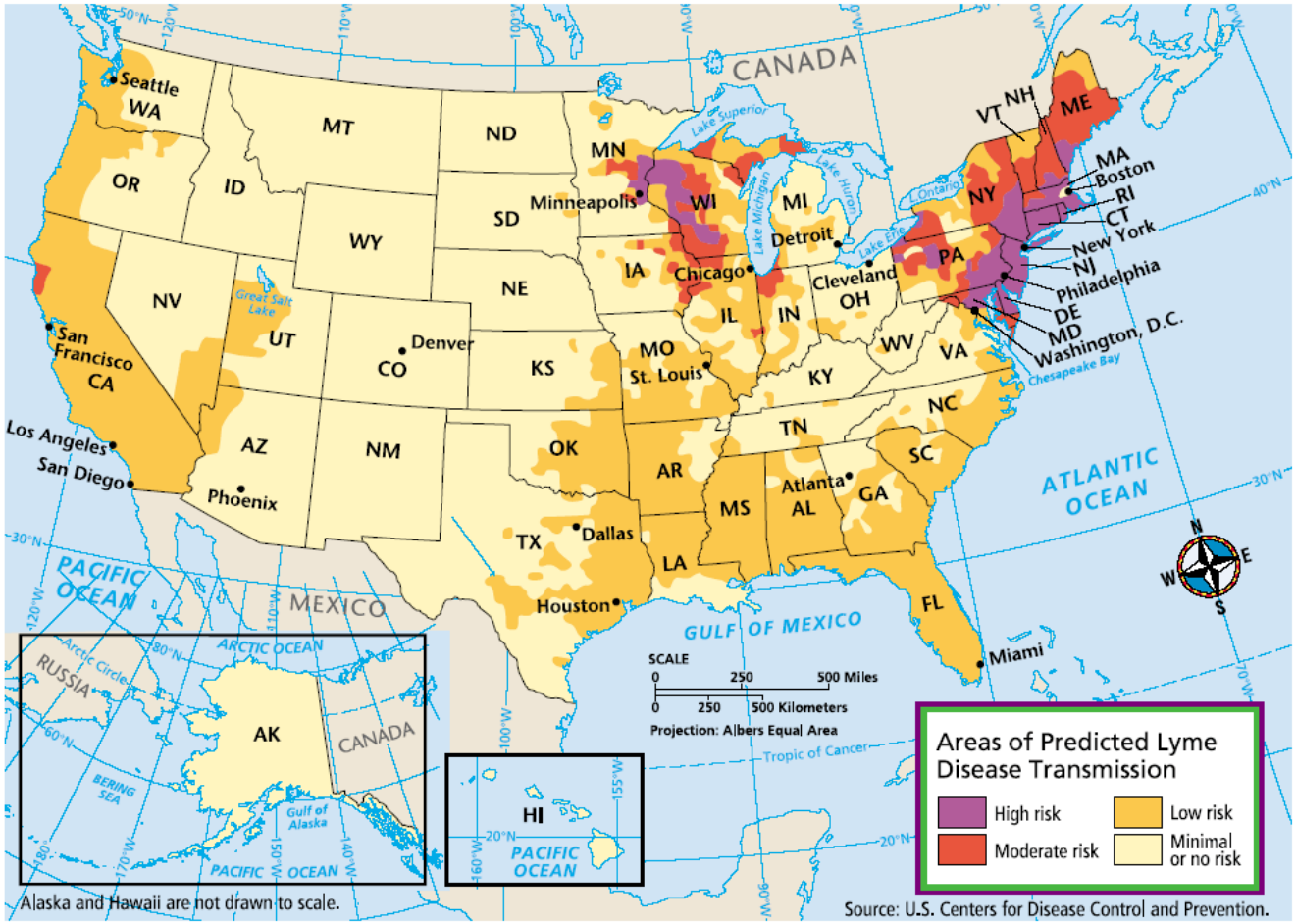
Review the "Estimated deaths per year (in millions)" column in **Table 2.** Explain why the number of deaths from respiratory diseases are greater than deaths from other diseases.

Write your responses in your ***EcoLog.***

A Model of Increase in Malaria Risk Due to Climate Change



Lyme Disease Risk



Multiple Choice

1. Which of the following is a naturally occurring pollutant?

   A. pesticides
   B. radon
   C. sewage
   D. vectors

Multiple Choice

1. Which of the following is a naturally occurring pollutant?

   A. pesticides
   B. radon
   C. sewage
   D. vectors

Multiple Choice, *continued*

2. What is the study of the spread of disease called?

F. antibiology
G. epidemiology
H. pathogenology
I. toxicology

Multiple Choice, *continued*

2. What is the study of the spread of disease called?

F. antibiology
G. epidemiology
H. pathogenology
I. toxicology

Multiple Choice, *continued*

3. What is the difference between pollution from natural sources and pollution from human activities?

   A. Naturally occurring pollutants are less toxic.
   B. Pollution from human activities has not been researched.
   C. Pollution from human activities can be predicted and controlled.
   D. Naturally occurring pollutants are only hazardous in small dosages.

Multiple Choice, *continued*

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   A. Naturally occurring pollutants are less toxic.
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Multiple Choice, *continued*

4. How has the construction of irrigation canals and dams enabled the spread of infectious disease?

   F. The construction allows viruses to evolve.

   G. Canals and dams provide sites for waste disposal.

   H. Canals and dams provide increased habitats for vectors.

   I. The construction eliminates the natural predators of pathogens.

Multiple Choice, *continued*

4. How has the construction of irrigation canals and dams enabled the spread of infectious disease?

F. The construction allows viruses to evolve.

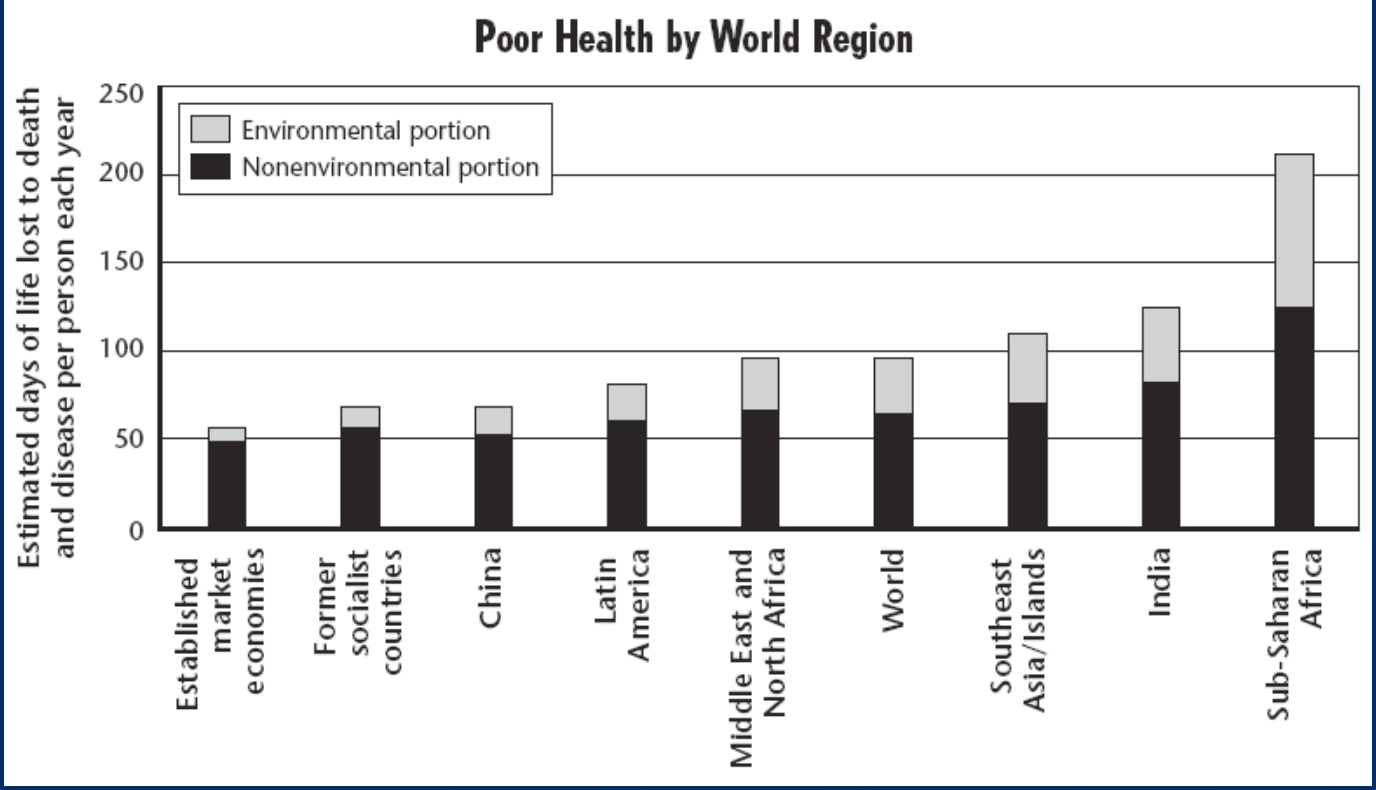
G. Canals and dams provide sites for waste disposal.

H. Canals and dams provide increased habitats for vectors.

I. The construction eliminates the natural predators of pathogens.

Multiple Choice, *continued*

Use the graph to answer questions 5 through 7.



Multiple Choice, *continued*

5. In which of these regions is nonenvironmental pollution the largest percentage of the total?

   A. China
   B. India
   C. Latin America
   D. Sub-Saharan Africa

Multiple Choice, *continued*

5. In which of these regions is nonenvironmental pollution the largest percentage of the total?

   A. China
   B. India
   C. Latin America
   D. Sub-Saharan Africa

Multiple Choice, *continued*

6. In which of these regions are nonenvironmental causes of poor health the smallest percentage of the total?

   F. China
   G. India
   H. Latin America
   I. Sub-Saharan Africa

Multiple Choice, *continued*

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   F. China
   G. India
   H. Latin America
   I. Sub-Saharan Africa

Multiple Choice, *continued*

7. What is the main factor in the poor health of undeveloped countries?

   A. too few doctors
   B. infectious disease
   C. industrial pollution
   D. more imports than exports

Multiple Choice, *continued*

7. What is the main factor in the poor health of undeveloped countries?

A. too few doctors
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Image and Activity Bank

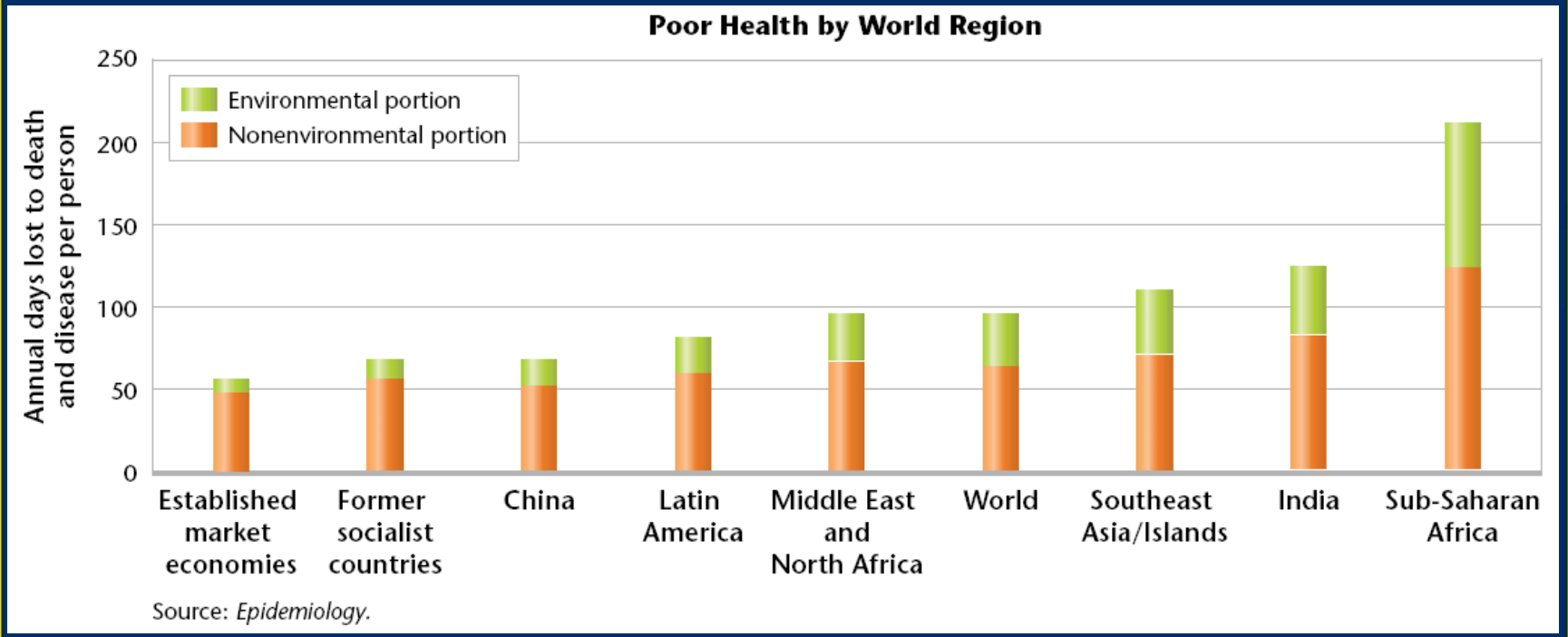

Image and Activity Bank

Pollutant Types and Effects		
Pollutant	**Source**	**Possible effects**
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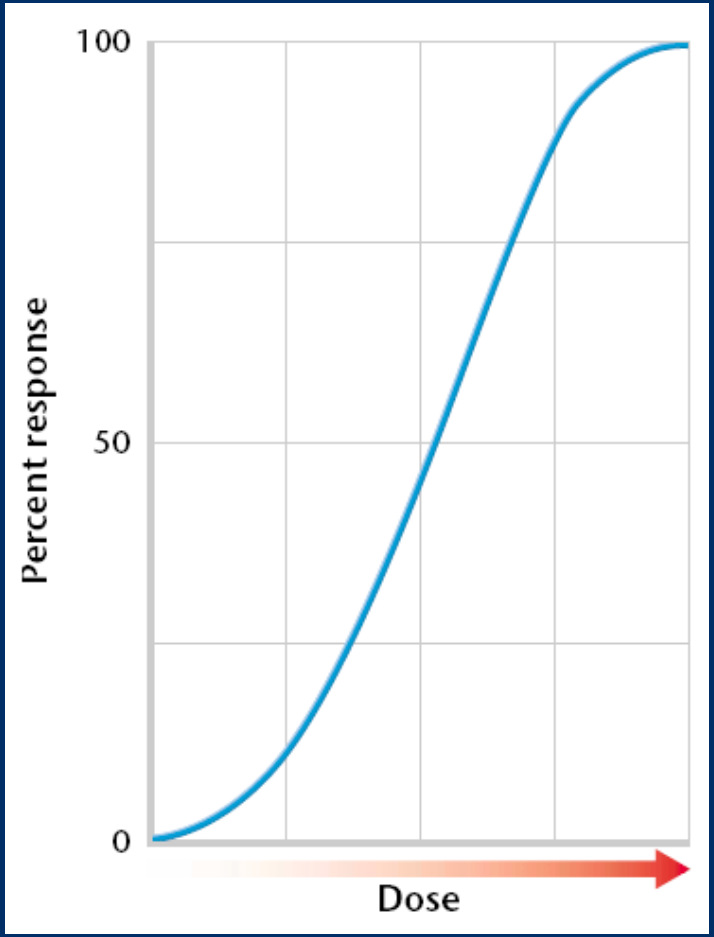
Bacteria in food	poor sanitation and poor food handling	gastrointestinal infections

Image and Activity Bank



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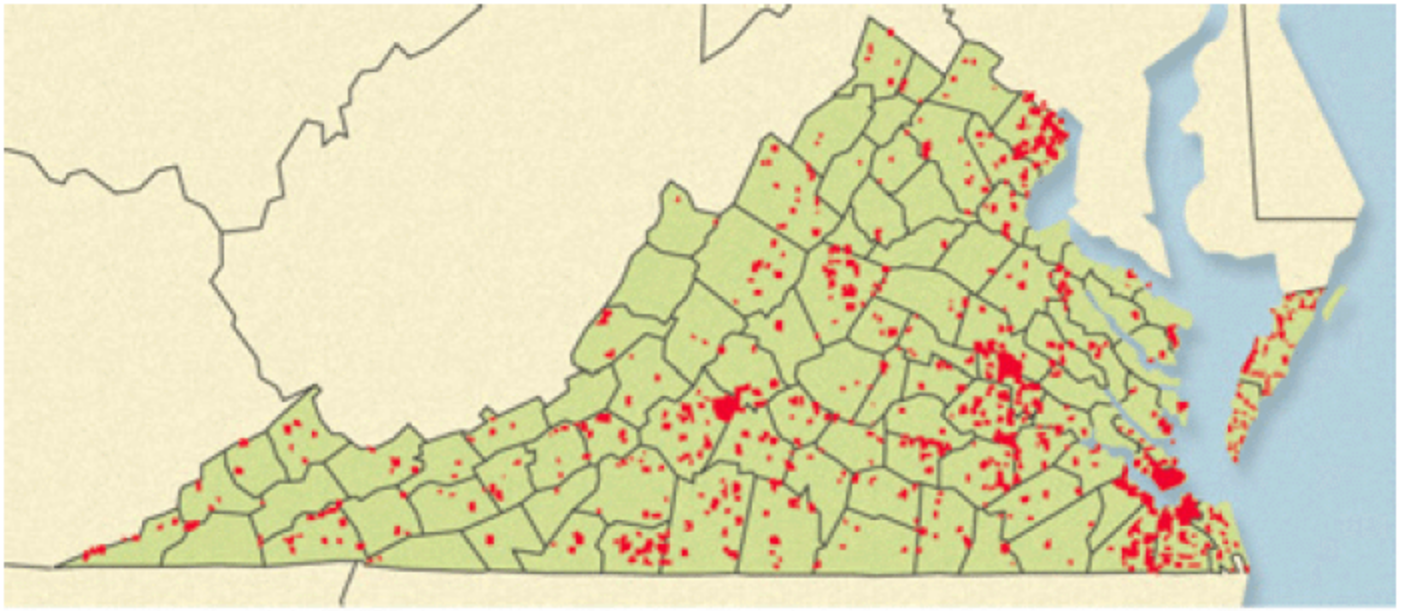
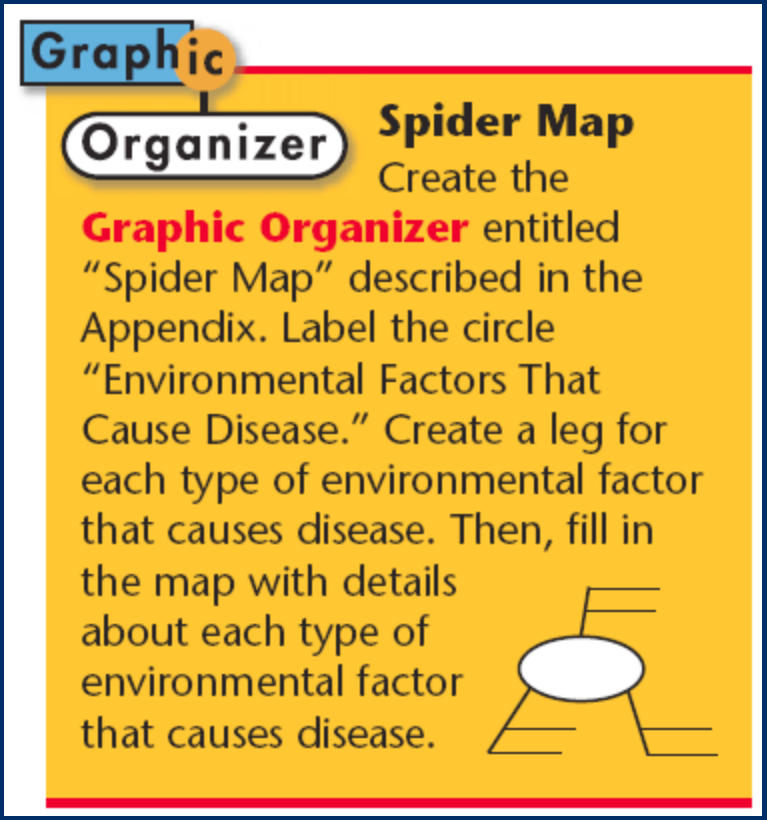


Source: Virginia Department of Health.

Image and Activity Bank



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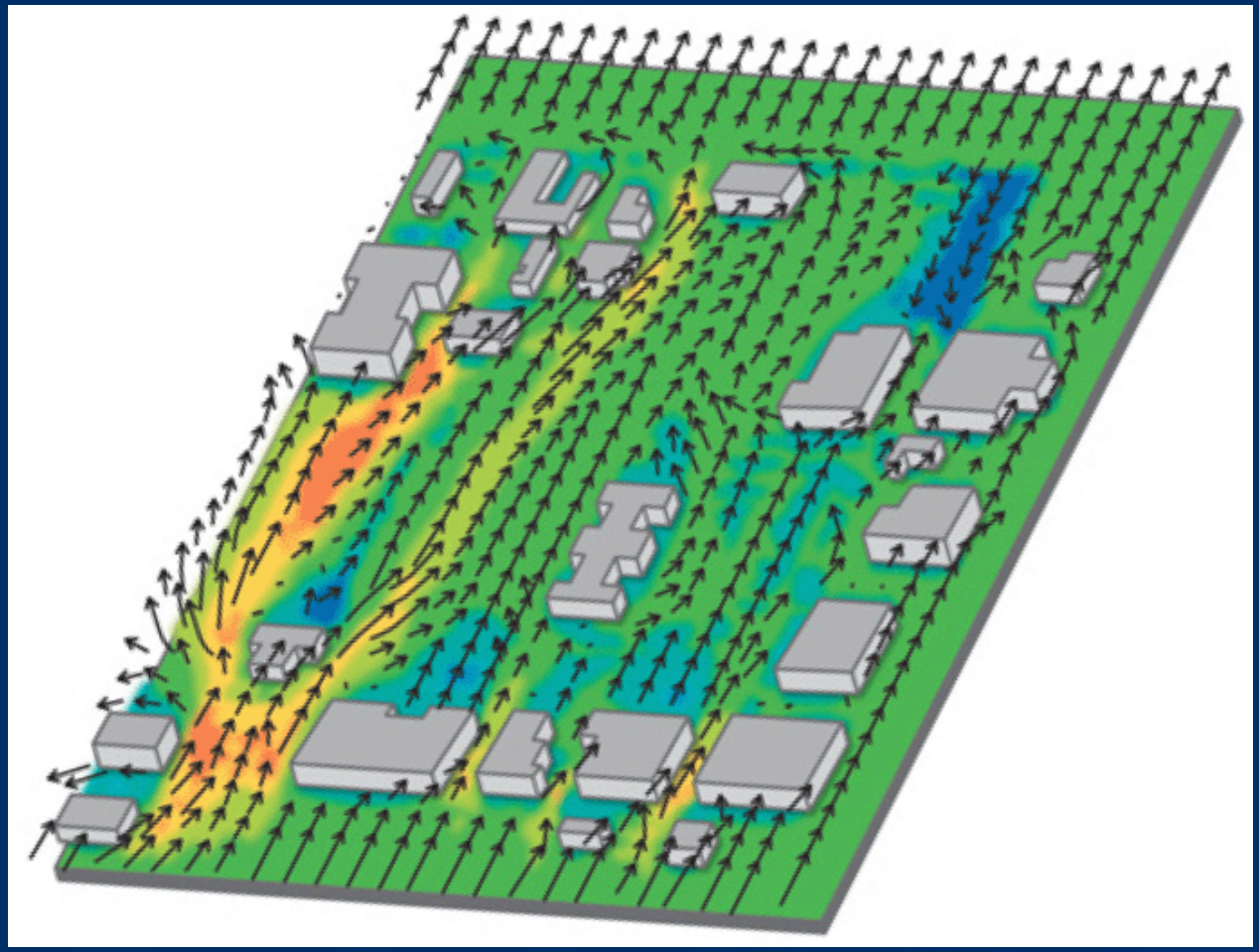

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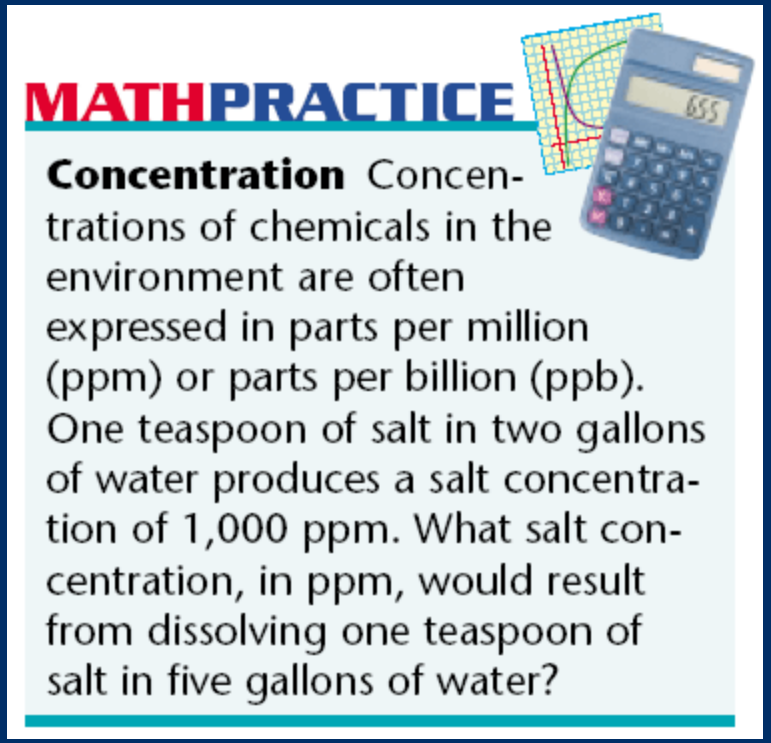

Image and Activity Bank

Deaths from Infectious Diseases in 2000, Estimated by the World Health Organization

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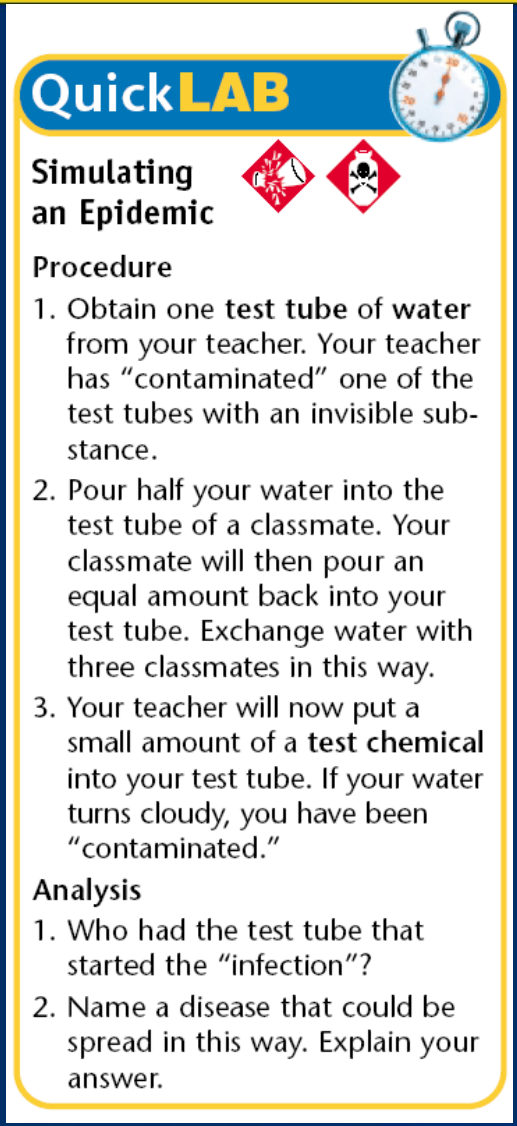
Image and Activity Bank



QuickLAB

Simulating an Epidemic

Procedure

1. Obtain one **test tube** of **water** from your teacher. Your teacher has "contaminated" one of the test tubes with an invisible substance.
2. Pour half your water into the test tube of a classmate. Your classmate will then pour an equal amount back into your test tube. Exchange water with three classmates in this way.
3. Your teacher will now put a small amount of a **test chemical** into your test tube. If your water turns cloudy, you have been "contaminated."

Analysis

1. Who had the test tube that started the "infection"?
2. Name a disease that could be spread in this way. Explain your answer.

Image and Activity Bank