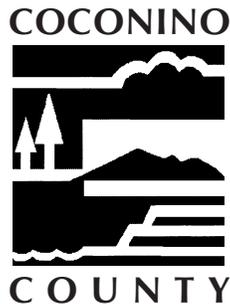


Backcountry ENVIRONMENTAL HEALTH MANUAL



COCONINO COUNTY DEPARTMENT OF HEALTH SERVICES ENVIRONMENTAL HEALTH

2002 First edition by Coconino Environmental Health.
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INTRODUCTION

Each year, millions of people visit America’s national forests, wilderness areas, parks, and public lands. They come from many different nations, cultures, and economic circumstances, but they share a common love of outdoor adventure. An entire industry has developed to supply these backcountry travelers with the tools, equipment, and products they use in their trips into the outback. Coincidentally, there has been a dramatic increase in the number of companies that provide guided trips on rivers, lakes, and trails throughout the country. Backcountry outfitters are in a unique business that combines the standard functions of the hospitality industry with the challenges posed by travel in difficult terrain.

Typically, backcountry outfitters assume the responsibilities of feeding and providing basic accommodations for their clients during wilderness outings. At minimum, this involves safely storing, transporting, and preparing food, providing toilet and sanitary facilities, and taking reasonable precautions against disease and injury. Although the specific nature and complexity of the



services that different outfitters provide may vary greatly, it is possible to generalize about the things they need to know and do to fulfill their obligations to their clients.

Simply stated, backcountry operators are required to take reasonable steps to ensure that their clients are as healthy at the end of each trip as they were when the trip began. This entails learning about the diseases to which travelers may become exposed, and techniques for minimizing the risk of illness. In addition, operators must learn how to store and prepare food safely in a primitive setting, how to purify water, and how to handle and dispose of solid waste and human excreta. The responsibilities of a backcountry operator are many, and may at times seem overwhelming. Fortunately, most of the health risks posed by wilderness travel may be easily overcome by following the simple procedures described in this manual.

While much of the information presented in this manual is focused on risks to human health, the techniques described are equally effective in protecting the health of natural ecosystems. Wild areas are especially vulnerable to contamination and damage from human presence, and when people become ill in the wilderness it often is a result of previous human visitation. Operators who learn and implement the practices recommended in this manual will be doing a great service, both to their clients and to the wild places they visit.

DISCLAIMER

This manual is designed to provide the best available demonstrated technology for water purification, food safety, human excreta and solid waste handling and disposal under field conditions. The information provided in this manual is based on the latest federal codes and guidelines. This manual does not attempt any interpretation of state or local laws concerning water treatment, food safety, human excreta and solid waste handling. Backcountry operators who are uncertain about the impact of local or state laws are urged to consult their local or state agencies.

DISEASES

FOOD & WATER BORNE DISEASES

Bacteria

1. Botulism Poisoning - *Clostridium botulinum*
2. *Clostridium perfringens*
3. Campylobacteriosis - *Campylobacter jejuni*
4. Cholera - *Vibrio cholerae*
5. *Vibrio parahaemolyticus*
6. "E. coli" - *Escherichia coli* 0157:H7
7. Shigellosis - *Shigella* sp.
8. Salmonellosis - *Salmonella* sp.
9. Staph Food Poisoning - *Staphylococcus aureus*

Viruses

1. Hepatitis A
2. Norwalk Virus

Other Larger Parasites

1. Amoebic Encephalitis - *Acanthamoeba*
2. Galloping Amoeba - *Entamoeba histolytica*
3. Giardiasis - *Giardia lamblia*
4. Cryptosporidiosis - *Cryptosporidium parvum*
5. Trichinosis - *Trichinella spiralis*
6. Taeniasis - *Taenia solium*

INSECT AND ANIMAL BORNE DISEASES

1. Colorado Tick Fever
2. Encephalitis
3. Hantavirus Pulmonary Syndrome
4. Lyme Disease
5. Plague
6. Rabies
7. Rocky Mountain Spotted Fever
8. Tick Relapsing Fever
9. Tularemia

QUIZ

DISEASES

THE LAST THING most people associate with a backcountry experience is the possibility of contracting a disease while enjoying the wilderness. However, the risk of illness is very real, and people need to be aware of diseases that may be present and how to avoid exposure to these diseases. Although there are a number of ways to contract diseases while visiting backcountry areas, experienced travelers prepare for these risks in the same way that they prepare for inclement weather or difficult terrain. People may be exposed to diseases through contact with wild animals, such as bats, skunks, fox, rodents, muskrats, beaver as well as deer and elk. Any of these animals may be carriers of diseases, so it is important to avoid direct contact with wild animals while camping, hiking, hunting, boating, or engaging in other activities.

Backcountry users need to be concerned especially with infectious diseases that can be transmitted from animals to humans or from humans to humans. Diseases that are transmitted from wild and domestic animals to humans are called zoonotic diseases. Many of these diseases are shed by animals through their digestive tracts that may end up in surface waters that are used for recreating and drinking. Other types of diseases may be transmitted to people from improperly handled food and water. It is also possible to get sick from animal bites, insect bites, or having close contact with animals or their burrows.

Diseases may be caused by a variety of microorganisms, such as bacteria, viruses, protozoa and fungi. The following sections review common diseases associated with food water and wildlife. The discussion of each disease includes the cause, stages, prevention and control measures.

FOOD BORNE & WATER BORNE DISEASES

In the United States the Centers for Disease Control and Prevention estimates that 76 million people become ill with food borne disease resulting in about 325,000 thousand hospitalizations and 5000 deaths each year⁽¹⁾. From 1997 to 1998 the Centers for Disease Control and Prevention reported 4,166 illnesses from contaminated drinking water and recreational water exposure in the United States⁽²⁾. Nevertheless, most food borne outbreaks go unreported because many food borne illnesses are self-limiting and few seek medical attention. However, groups that may be at a higher risk of becoming seriously ill from a food borne or water borne disease are the elderly, pre-school aged children, pregnant women and immunocompromised individuals. Disease-causing agents are not detectable in food. Food that is contaminated with disease-causing microorganisms and/ or their toxins may look, smell and taste fine. This is one reason that there are so many food borne outbreaks each year in the United States.

A food borne or water borne outbreak is defined by the Centers for Disease Control and Prevention (CDC) as “the occurrence of two or more cases of similar illness resulting from the ingestion of a common food”. When investigating a possible food borne disease outbreak epidemiologists collect information about each individual’s food history, incubation period, signs and symptoms and duration of illness. A food history is important since most food borne diseases take anywhere from several hours to days or even weeks before symptoms may occur. The incubation period is measured from the time contaminated food is consumed to the first signs and symptoms. All of this information assists an epidemiologist in determining what type of organism caused an outbreak. However, in order to identify the cause of a disease with certainty, samples of the incriminated food or water must be taken and analyzed along with stool or sputum samples from sick individuals.



To prevent food and water borne diseases, backcountry users need to decide what types of food to take on a trip, and how food will be stored and prepared. Also, care must be taken when selecting a water purification device. In most cases, food borne and water borne diseases may be prevented by implementing simple water purification procedures and safe food handling methods. These steps are outlined in both the Water Purification and Food Sections provided

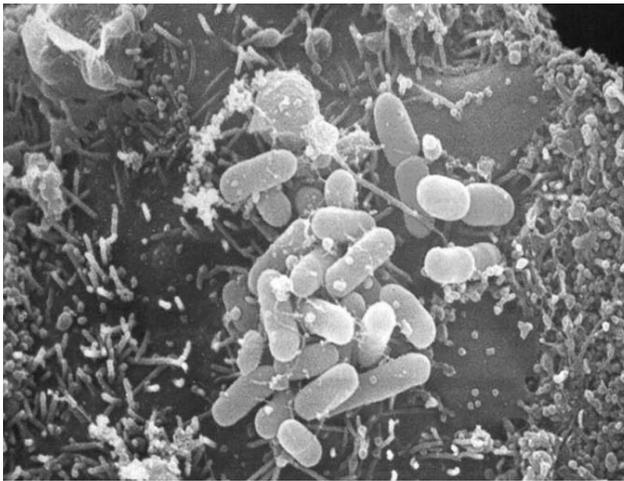
in this manual. The following sections cover the most common water and food borne diseases and provide information about the stages of each disease, how it's transmitted, common sources and steps to prevent disease.

BACTERIA

Bacteria are single celled organisms that are capable of growing and reproducing without the aid of a host. A single bacterial is invisible to a human eye. Bacteria cells may be round, rod-shaped, or spiral-shaped. Some bacteria are capable of forming spores that protect them from extreme heat and cold conditions. After a bacteria forms a spore it cannot grow or multiply, but once the environment changes and there are food, moisture and ideal temperatures bacteria will come out of their spores and reproduce. More detailed information about bacteria may be found in Appendix A.

Rod-Shaped Bacteria

Bacteria need moisture, temperature, pH (acidic and basic environment) and food to grow and multiply. All of these conditions are present in potentially



hazardous food. Potentially hazardous food is defined by the Food and Drug Administration as food that can support the growth of disease-causing bacteria. Foods that are potentially hazardous include raw and cooked meat (fish, beef, pork, poultry, sheep, etc.), cooked vegetables, raw sprouts (bean, clover and alfalfa), any type of cut melons, cooked legumes, cooked grains, dairy products, chopped garlic in oil and whole fresh eggs.

Given that all of these foods can support the growth of disease-causing bacteria, they must be held at and cooked to proper temperatures to prevent disease (Proper preparation, cooking and holding procedures are discussed in detail in the Food Section of this manual).

Botulism Poisoning ^(3,4)

What is it?

Botulism is a food poisoning that is caused by a bacterium called *Clostridium botulinum*. This bacterium produces a toxin in packaged and canned food, such as canned vegetables and packaged meat products. *Clostridium botulinum* produces that may be destroyed by heat (boiling temperatures).

Where is it found?

Clostridium botulinum is worldwide and may be found in soil, sediment of lakes and ponds, and in the digestive tract of fish and other animals.

How is the disease spread?

Botulism toxin is produced in low acid food if canned food, such as vegetables, meat and fish are improperly packaged and prepared. Hermetically sealed packages and canned food may become contaminated with botulism bacteria if a can is damaged especially on a seam.

Poisoning occurs from eating contaminated food. Only a small amount of contaminated food may result in illness. The disease is not spread from person to person.

Foods that have been associated with food borne botulism outbreaks in the United States are home canned vegetables and low acid fruits, dried whole fish (with intestines), sautéed onions, chopped garlic in oil and baked potatoes.

Stages of Disease

The incubation period ranges from 12 to 36 hours. The shorter the incubation period the more severe the disease and the higher the fatality rate.

Once eaten the toxin causes muscle paralysis that progresses throughout the body, starting from the eyes downward. The first signs and symptoms exhibited are blurred or double vision, vomiting and constipation or diarrhea, followed by a dry mouth, difficulty speaking and swallowing, and failure to breathe.

The fatality rate in the United States for botulism poisoning is 5% to 10%. However, for those who survive, recovery is a slow process and may take months.

Treatment

Treatment for botulism poisoning is the use of an antitoxin, and respiratory support to prevent hypoxia (oxygen deficiency). Seek care from an emergency room, urgent care center or primary doctor.

Prevention

The disease can be avoided by not consuming food from damaged or bulged hermetically sealed cans or packages. Backcountry operators cannot serve “home” canned or hermetically packaged food to guests because home processing is inconsistent and may fail to destroy all botulism spores, therefore increasing the risk of botulism poisoning. Hermetically processed food for

guests must be from an approved commercial source, and in good physical condition. Canned or packaged low acid food, such as vegetables and meats, should be boiled prior to consumption as an extra precaution in case a container has physical damage that is invisible.

Other actions that may be taken include immediate chilling (do not allow the food to sit at “room” temperature) of baked potatoes and other cooked vegetables to 45°F within 4 hours to prevent bacteria like botulism from growing and producing their toxins. Also, opened packages and containers of low acid food must be immediately placed in an ice chest at 45°F or less to prevent bacterial growth.

***Clostridium perfringens*^(3,4)**

What is it?

The bacterium grows without oxygen in potentially hazardous food and once consumed infects the digestive tract and releases a toxin that results in illness.

Where is it found?

Clostridium perfringens is found in soil, sediment and in the digestive tracts of healthy humans and other animals.

How is the disease spread?

Food borne illness occurs from improper cooking practices. This bacterium rapidly grows in potentially hazardous food, such as meat, meat products and gravies.

Stages of Disease

Signs and symptoms usually begin 6 to 24 hours after the food is consumed and lasts for about one to two days. Typical signs and symptoms are abdominal cramps, diarrhea and nausea; vomiting and fever are usually absent. Death is rare in healthy people.

Treatment

In most cases treatment is not required, but when it is, fluids and electrolyte replacement are given.

Prevention

The best way to prevent this food borne disease is the proper cooling and reheating of potentially hazardous food, since bacterial spores survive cooking temperatures. To properly cool food, hot food needs to be placed in shallow containers in small quantities so the food is no greater than two inches deep. Hot food must be placed in a cooler immediately so it will cool to 45°F within

4 hours. However, on a backcountry trip cooling food may not be possible, and should be avoided (dispose leftover food).

Additional preventive steps in proper food practices are to rapidly reheat food to 165°F before it is served hot and do not hold food in a cooler at 45°F for longer than 4 days. The latter precaution is necessary because bacteria can grow and multiply at 45°F, and after four days bacterial numbers may be great enough to cause a food borne outbreak.

Campylobacteriosis^(3,4)

What is it?

This is an acute zoonotic disease caused by a curved-shaped rod bacterium. This disease-causing bacterium both infects and produces a toxin in the digestive tract. It is believed that this toxin causes diarrhea. This disease is the leading cause of diarrhea in the United States, resulting in 4 to 6 million cases each year.

Where is it found?

Animals that commonly carry this disease include healthy cattle, chickens, birds, puppies, kittens, swine, sheep, rodents and flies. While most of these animals carry the organism in their digestive tracts, flies carry microorganisms externally on their bodies. A fly can spread the disease by picking up microbial “hitch hikers”, on their legs and mouth-parts and deposit these organisms by landing or walking on food and water. The other animals carry this bacteria in their digestive tracts. Other sources of this disease include untreated drinking water, such as water from springs, streams, rivers and lakes, and raw dairy products.

How is the disease spread?

This disease may be spread from animal to human or from human to human. The disease may also be spread from human or animal fecal contamination of food and water, or from consuming improperly cooked poultry products.

Campylobacter jejuni occurs everywhere in the world. In fact, this bacterium is the cause of 5% to 14% diarrhea worldwide, especially in children 2 years and younger.

Stages of Disease

The incubation period for this disease is 2 to 5 days, and lasts anywhere from 2 to 10 days. Typical symptoms include watery or sticky diarrhea (which can contain blood), fever, abdominal pain, nausea, headache and muscle pain. The period of communicability (when the disease may be spread from feces)

is the entire duration of the disease, but some infections may have no symptoms. Complications and relapses of this disease are infrequent, and the fatality rate is one in a 1000.

Treatment

Antibiotic treatment is usually not necessary and most individuals are treated with fluids and replacement of lost electrolytes.

Prevention

It is thought that most of the illnesses are caused by eating undercooked poultry. Surveys indicate that 20% to 100% of commercial chickens are contaminated with *Campylobacter*. To prevent this disease, all poultry must be cooked throughout to at least 165°F for 15 seconds to kill this bacterium. It is equally important to sanitize all food contact surfaces after preparation of poultry to prevent cross-contamination to other food.

Good hygienic practices prevent the spread of diseases, such as *Campylobacter*. After handling poultry and poultry products, hands need to be lathered with soap and washed for 20 seconds in 110°F water to remove gross debris and microorganisms.

Cholera^(3,4)

What is it?

The disease Cholera is a bacterium called *Vibrio cholerae*. Cholera is caused by several different bacterial groups, some cause more severe disease than others. All groups that cause this disease produce a toxin in the digestive tract. It takes about one million bacterial cells to cause disease in an individual.

Where is it found?

Humans are the primary reservoir for this disease; however, “environmental” reservoirs have been identified in association with marine crustaceans including lobsters, shrimps, crabs and barnacles. In the United States, the Gulf of Mexico coast has been identified as an environmental reservoir for this organism.

How is the disease spread?

Transmission is through eating of food or drinking contaminated water with feces or vomitus. While the last outbreaks of Cholera occurred in the United States around 1911, there has been a steady increase of isolated cases in the nation that has been attributed to worldwide travel. Most of these cases have involved bottled water, ice, ice cream, cooked rice, produce and raw or undercooked seafood from polluted waters.

Stages of Disease

Symptoms usually appear within 2 to 3 days after eating or drinking contaminated food or water. This disease is identified by sudden onset of profuse painless, watery diarrhea (“rice water” stools), nausea and vomiting. This rapid onset of painless watery diarrhea results in rapid dehydration, which may lead to renal failure in severe, untreated cases. The fatality rate for this disease may exceed 50% if the severe disease goes untreated, and is less than 1% if individuals receive proper treatment immediately.

Individuals are contagious when they have signs and symptoms, but some individuals may remain contagious several months after they recover. Someone who appears healthy may be shedding cholera organisms from their feces, which can be transmitted to other people through food or water if this person does not practice good hygienic practices.

Treatment

The treatment of Cholera is aggressive fluid and electrolyte replacement and treatment of secondary complications from the disease. Anti-microbial treatment is also used by doctors as a supplemental treatment to reduce the numbers of bacteria in the digestive tract, and to shorten the period of communicability.

Prevention

The best prevention is to obtain water from approved sources or properly treat any surface water so the bacteria are effectively removed. Cholera is primarily associated with poor sanitation, where human sewage contaminates drinking waters and coastal waters. Seafood such as fish and shellfish is also a source, especially if the seafood is eaten raw or undercooked. All seafood served by commercial operators must be obtained from an approved sources, and the Shucker-Packer Interstate Certificate Number must be obtained and kept for at least 90 days for all shellfish. However, “High Risk” individuals may not be served undercooked seafood because of the increased risk of infection and complications. Raw or undercooked seafood cannot be served to “High Risk” customers. However, if guests are not designated as “High Risk”, then raw or undercooked seafood may be prepared and served to them as long as they have been advised of the hazards (Consumer advisory requirements are discussed in the Food Section of this workbook).

Vibrio parahaemolyticus^(3,4)

What is it?

This bacterium causes disease that is less severe than *Vibrio cholerae*. The disease is self-limiting that in that symptoms usually are mild in healthy

individuals. It produces a toxin in the digestive tract similar to Cholera. The infective dose is more than a million bacterial cells.

Where is it found?

Like Cholera, this bacterium is also found in marine coastal environments (in the water during warmer months and in the sediment during colder months).

How is the disease spread?

This organism is more widespread in the United States than Cholera, and outbreaks involve raw or undercooked seafood.

Stages of Disease

Within 12 to 24 hours after consumption of contaminated food or water, symptoms begin with watery diarrhea, abdominal cramps, and sometimes nausea, vomiting, fever and headache. Occasionally, symptoms include bloody or mucoid stools, high fever and high white blood cell count.

The disease is usually very self-limiting and recovery occurs within one to seven days, and death rarely occurs.

Unlike Cholera, this disease is not communicable (not spread from person to person).

Treatment

If treatment is required, it includes fluids and electrolyte replacement.

Prevention

Properly store and cook marine fish and shellfish. Seafood must be stored cold at 45°F or less and cooked thoroughly to 145°F or greater for 15 seconds if the seafood is whole and intact. However, if the seafood is ground it must be cooked to 155°F or greater for 15 seconds, and if the seafood is stuffed it must be cooked to 165°F or greater for 15 seconds.

Care must be taken to prevent cross-contamination when handling raw seafood. Do not store raw seafood immediately over or next to ready-to-eat food (food that is not heated after handling), wash and sanitize all surfaces after preparing raw seafood and thoroughly wash hands after preparation.

Please remember if shellfish is brought on a backcountry trip that the Shucker-Packer Interstate Certificate Number (SPICN) must be kept for at least 90 days after shellfish are purchased. This number indicates where and when shellfish were harvested, which critical information especially if there is an outbreak from shellfish.

Raw or undercooked seafood cannot be served to “High Risk” customers. However, if guests are not designated as “High Risk”, then raw or undercooked seafood may be prepared and served to them as long as they have been advised of the hazards (Consumer advisory requirements are discussed in the Food Section of this workbook).

■ **“E. coli” 0157:H7^(3,4)**

What is it?

The disease is caused by *Escherichia coli* 0157:H7. Bacteria produce toxins in the digestive tract called. Production of the toxins depends on the presence of certain phage, which are carried by the bacteria. It takes anywhere from 10 to 15 bacterial cells to cause disease in an individual.

Where is it found?

Cattle are the most likely host, but sheep and humans may carry the disease as well. In addition, there is increasing evidence that North American deer may also carry the disease.

How is the disease spread?

Disease occurs primarily from ingestion of undercooked beef patties, unpasteurized milk, unpasteurized apple cider, contaminated alfalfa sprouts and person to person transmission. Cases have been reported from contaminated drinking water sources and from swimming in a contaminated lake.

Stages of Disease

The incubation period range is from 2 to 8 days, and infected individuals are contagious for one week or less however. However, one third of children may remain communicable for up to 3 weeks. The signs and symptoms of the disease include severe abdominal cramps, diarrhea (which is initially watery but becomes grossly bloody) and occasionally vomiting. Fever is either low-grade or absent.

The disease may be mild with recovery in about 8 days. However, up to 7% of all cases can become more severe.

Treatment

Treatment is mainly fluid and electrolyte replacement.

Prevention

The primary foods of concern are ground beef, unpasteurized milk and juice and alfalfa sprouts. To prevent illness from ground meat, all ground meat such as beef must be cooked throughout to 155°F or greater for 15 seconds. Care

must also be taken to prevent cross-contamination during preparation, storage and transportation.

Only pasteurized dairy products and juice may be served to backcountry guests, and alfalfa sprouts must be thoroughly washed to remove debris and microbes.

If undercooked ground meat is prepared and served to guests, then they must be advised of the potential hazards, as outlined in the Consumer Advisory portion of the Food Section. However, if a backcountry group is a “high risk” group, then an operator may not serve them undercooked ground meat, alfalfa sprouts or unpasteurized juice or milk.

■ ***Shigellosis***^(3,4)

What is it?

There are four different species of *Shigella* that cause the disease named Shigellosis. *Shigella* bacteria infect the digestive tract of mainly humans, and in some infections produce a toxin that may damage the intestinal lining.

Where is it found?

Humans are the primary source of *Shigella*, with monkeys occasionally acting as carriers.

How is the disease spread?

Primary transmission is the fecal/oral route. Most cases are due to poor hygienic practices, especially the lack of or poor hand washing methods, and water contaminated with human feces.

This disease is responsible for about 600,000 deaths per year worldwide. Most of the deaths involve children 10 years or younger. In the United States Shigellosis accounts for up to 300,000 diarrheal cases per year, and the fatality rate is a function of the health of an individual. The fatality rate can be as high as 20% among high risk groups, such as hospitalized patients.

Stages of Disease

The signs and symptoms of the disease begin anywhere from 12 to 96 hours after consuming as few as 10 to 100 bacterial cells. The symptoms include fever, nausea, vomiting, abdominal cramps and watery or bloody diarrhea. The disease is usually self-limiting for healthy individuals and recovery occurs anywhere from 4 to 7 days.

Individuals may be contagious up to 4 weeks after symptoms end.

Treatment

For most cases, only fluid and electrolyte replacement is needed. However, for high risk individuals anti-microbial treatment may be prescribed by a physician.

Prevention

To prevent the spread of diseases such as Shigellosis, great care must be taken to wash hands. The following hand washing procedure must be used before preparing food, before purifying water, after toilet duty, or after handling waste:

- Wash exposed hands, wrists and arms for 20 seconds in
- Warm water (110°F) with
- Soap all exposed areas to a lather, then
- Rinse soap off and
- Air dry or dry with a paper towel

It is also important to treat all untreated water by following the steps outlined in the water Purification Section of this manual.

Salmonellosis^(3,4)

What is it?

These disease agents cause the disease known as Salmonellosis. There are more than 2,000 different types of *Salmonella*. There is evidence that these bacteria produce a toxin when embedded in the intestinal tract that may contribute to symptoms.

Where is it found?

Animals that are common carriers of the disease include poultry and swine, but also may include cattle, rodents, iguanas, turtles, tortoises, terrapins, dogs, cats and humans.

How is the disease spread?

The majority of the cases result from contaminated food and water, improperly cooked poultry and poultry products, improperly cooked eggs and egg products, improperly pasteurized milk and milk products, improperly sanitized kitchen surfaces and fecal/oral transmission due to improper hand washing.

Stages of Disease

Symptoms usually occur with sudden onset of headache, fever, abdominal cramps, diarrhea, nausea and sometimes vomiting. Most infections with this

organism result in inflammation of the intestines, but in some cases the infection may develop into septicemia (infection of the blood) or localize in a body tissue. Deaths with this disease are uncommon, however, death may be more frequent with high risk groups, such as young children, the elderly, or high risk individuals.

Infected individuals are communicable throughout the acute phases of the disease. However, some may develop into a “carrier” state where no signs and symptoms are exhibited, but the organism still is present for several months, but in rare cases it may last up to a year or longer.

Treatment

Most cases only require fluid and electrolyte replacement, but antibiotic treatment may be prescribed by physicians for high-risk individuals.

Prevention

To prevent disease:

- Wash hands thoroughly before handling or preparing food using the hand washing procedures found in the Food Section of this manual,
- Sanitize kitchen surfaces,
- Store raw poultry or poultry products away from other food,
- Cook eggs and egg products to 145°F for 15 seconds,
- Cook poultry and poultry products to 165°F for 15 seconds,
- Use pasteurized milk and milk products and
- Store potentially hazardous food cold at 45°F or less.

Insects such as flies may also be a source of disease by mechanically transporting disease-causing organisms from feces to food and water. Therefore, toilet facilities must be properly covered when they are not being used to keep flies from accessing waste.

Staph Food Poisoning^(3,4)

What is it?

Staph food poisoning is caused by a round-shaped bacterium known as *Staphylococcus aureus*. These bacteria produce a toxin as they eat and grow in potentially hazardous food that cannot be destroyed by cooking temperatures. It is this toxin that causes the symptoms of the illness.

Where is it found?

Twenty five percent of the population carries this bacterium in the nose and throat, on hair and on skin of the face and hands. Dairy cattle (especially with infected udders), dogs and fowl also may serve as hosts for this microbe.

How is the disease spread?

A human carrier introduces the organism to food, and if the food is held at improper temperatures, bacteria produce the heat stable toxin. The toxin cannot be detected in food by smell, taste or sight. Fortunately, this disease cannot be transmitted from human to human.

Foods that this organism commonly grows on include sandwiches, lunchmeat, salami, cooked ham, salad dressings, pastries and custards.

Stages of Disease

The incubation period ranges from 30 minutes to 8 hours. Food poisoning caused by this organism is characterized by abrupt onset with severe nausea, cramps, vomiting and diarrhea. The intoxication lasts anywhere from one to two days, and deaths are rare.

Treatment

Patients are treated with fluids and electrolyte replacement.

Prevention

Education of food handlers is a primary prevention for this disease. Food handlers must follow:

- A strict hand washing regime as described in the Food section of this manual,
- Avoid bare hand contact with ready-to-eat foods, such as lunchmeat, salad dressings, custards and cream-filled pastries,
- Hold potentially hazardous food at proper cold temperatures of 45°F or less and
- Properly chill hot food to 45°F within 4 hours (However, the use of leftovers by backcountry operators is not recommended because of the increased risk of Staph Food Poisoning).

Also, food servers with lesions on their hands, wrists, upper arms, or face need to be restricted and/or excluded from preparing food. It is very important that food handlers wear disposable gloves or use utensils when preparing ready-to-eat foods.

VIRUSES

Viruses are infectious agents that can be found inside cells (Figure A). They infect a host by attaching to a cell, dissolving a small section of the cell wall and invading the cell through this opening. The virus' single strand of genetic material then acts like a computer programmer and programs the host's cell to make more viruses. The cell eventually becomes filled with viruses and eventually the cell explodes, which allows the new viruses to invade other cells.

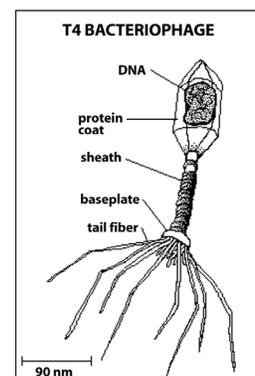


Figure A.

Because all viral diseases are intracellular infections, antibiotics cannot successfully treat viral diseases, since host cells would have to be destroyed in order to destroy the invading viruses.

Hepatitis A^(3,4)

What is it?

Hepatitis A causes the disease known as Infectious Hepatitis, which is transmitted by the fecal/oral route, that infects the liver.

Where is it found?

Humans are the primary source of Infectious Hepatitis, with chimpanzees acting as a source in rare instances.

How is the disease spread?

Transmission is through the fecal/oral route and contamination of food and water. This is why poor sanitation and over crowded conditions may lead to outbreaks of this disease. Other practices commonly associated with this disease are poor hygienic practices, improper food handling and poor diaper changing practices at day care facilities.

Hepatitis A occurs worldwide, with about 22,700 cases are reported annually in the United States.

Stages of Disease

After an incubation period ranging from 15 to 50 days, onset is usually abrupt, with fever, overall discomfort, loss of appetite, nausea, and abdominal discomfort followed by jaundice (skin turns a yellow color). Only 10 to 100 viral particles are required to cause disease in a person. Most cases resolve within 1 to 2 weeks; however, about 15% of cases can take months to recover. There are a few cases where Hepatitis A may relapse for up to a year. Rarely do people die from this disease, but for high-risk individuals it may be fatal.

People are highly contagious one to two weeks before onset of symptoms and may continue to shed the virus in their feces up to one week after jaundice.

Treatment

Contacts must receive immunization with immunoglobulin within 2 weeks by a physician. However, after symptoms begin there is no specific treatment, just support care.

Hepatitis A vaccine (2 doses) is recommended for persons at high risk for contracting hepatitis A virus, such as children who live in areas that have a high incidence, or individuals who work around human feces.

Prevention

Good sanitation practices are crucial for prevention as well as education for food handlers. It also is essential to:

- Properly treat raw water sources prior to consumption;
- Take care during toilet handling, transportation and clean up;
- Employ proper hand wash procedures as described in the Food section of this manual;
- Cook shellfish to 145°F for 15 minutes and retain the Shucker-Packer Interstate certificate number from the shellfish case for 90 days (However, if raw or undercooked shellfish is served to guests, then backcountry operators must provide a consumer advisory. If the backcountry operator is catering for an identified “high” risk group or individual, then raw or undercooked shellfish may not be served.)

Norwalk Virus^(3,4)

What is it?

Norwalk-like Virus infects digestive tracts of humans.

Where is it found?

Humans constitute the only known carrier for this disease.

How is the disease spread?

This disease has been identified as the most common cause of non-bacterial gastroenteritis outbreaks in the United States. In the United States most outbreaks are linked to the consumption of raw or undercooked shellfish. Other outbreaks have been associated with fecal contamination of food, drinking water, and recreational water. The disease is transmitted by the fecal/oral route, and it is believed that human to human transmission may occur. The period of communicability occurs during the acute stage of the disease and may last up to 48 hours after diarrhea ends.

Stages of Disease

This is considered a self-limiting, mild disease that begins after 10 to 50 hours with nausea, vomiting, diarrhea, abdominal pain, muscle aches, headache, overall discomfort and a low grade fever. The symptoms usually last 24 to 48 hours and death from this disease is rare.

Treatment

There is no specific treatment prescribed for this disease, just supportive care that includes fluid and electrolyte replacement.

Prevention

Prevention guidelines are the same as for Hepatitis A, and they include:

- Good hand wash practices during food preparation, which can be found in the Food Section of this manual;
- Proper handling of toilet waste;
- Adequate cooking of shellfish to 145°F for 15 seconds (If shellfish is served undercooked or raw then a consumer advisory must be given to guests, however, if guests are “high” risk then all shellfish must be adequately cooked);
- Proper treatment of drinking water;
- Proper sanitizing of kitchen and equipment surfaces; and
- Proper storage of raw shellfish to prevent cross-contamination to other food

OTHER LARGER PARASITES

Parasites have become a concern with public and recreational water safety. Both *Giardia* and *Cryptosporidium* are leading causes of water borne disease in the United States. Parasites can be found in all types of environments, and are capable of surviving extreme conditions like the North Pole and in hot springs. This is because parasites like *Giardia* and *Cryptosporidium* produce cysts that protect them from extreme environmental conditions. These cysts can even endure normal concentrations of disinfectants, which is why raw water must be filtered.

Parasites can invade humans. Many of these pathogens are able to escape the human immune system, thus, causing an infection that may persist for a long time.

***Amoebic Encephalitis*^(3,4)**

What is it?

There are several amoebas that can invade the brain. They reach the brain by first entering the nose and then moving up into the brain.

Where is it found?

These amoebas live in both soil and fresh water.

How is the disease spread?

These amoebas are found all over the world. They commonly are found in stagnant water, lakes, ponds, hot tubs, spas, natural hot-springs, effluent from

wastewater treatment plants and poorly maintained swimming pool water.

Disease normally occurs during warmer months and may infect healthy individuals that swim in infected waters. The likelihood of infection is increased if water is forced through the nose by diving or swimming underwater.

Stages of Disease

The incubation period for this disease can be 3 to 7 days, or much longer in some cases. Symptoms include sore throat, severe frontal headache, occasional hallucinations, nausea, vomiting, high fever followed by death within 10 days.

Treatment

Although recoveries rarely are documented, there are several prescription drugs that may be used to treat these infections.

Prevention

While visiting the backcountry, avoid swimming or diving in stagnant water, ponds, natural hot-springs, water contaminated with effluent, or lakes where these amoebas have been identified.

***Galloping Amoeba*^(3,4)**

What is it?

The disease is caused by an amoeba called *Entamoeba histolytica*. This parasite has two forms, cysts that are the infective form and a non-cyst form. Infection begins after a cyst found in contaminated water or food is swallowed. Once swallowed, the parasites may secrete toxins into the stomach lining that cause signs and symptoms.

Where is it found?

Humans are the hosts for this disease-causing agent.

How is the disease spread?

This amoeba is found everywhere in the environment, and is transmitted by the fecal/oral route. The disease may be transmitted through contaminated food and water. Amoeba cysts are very resistant to normal concentrations of chlorine that is used for water treatment.

There is a higher prevalence of Amoebiasis in areas with poor sanitation, and there is a higher incidence of this disease in young adults.

Stages of Disease

If symptoms are present, they may include abdominal discomfort, bloody or mucoid diarrhea, fever, and chills. Symptoms mainly are dependent on an individual's health. Unhealthy individuals will have less resistance to this disease than someone who is healthy. In most cases the disease is self-limiting.

Without treatment the disease and symptoms may last for years, and the infected individual will remain contagious during this time.

It only takes one cyst to become infected and the incubation period is commonly 2 to 4 weeks before symptoms appear.

Treatment

Acute Amoebiasis should be treated by a physician.

Prevention

To prevent the spread of this disease, the following guidelines must be followed:

- Provide sanitary disposal of human feces and prevent exposure to feces during toilet set up, removal and disposal.
- Provide proper hand wash set up and employ proper hand wash procedures (as found in the Food section of this manual) before and after handling of toilet facility and equipment.
- Prior to consumption, wash all produce thoroughly in treated water to remove contaminants.
- Treat all "raw" water by using one of the methods provided in the water purification section of this manual.

***Giardiasis*^(3,4,6)**

What is it?

The disease agent is a parasite that has two forms: the cyst is the infective stage that is excreted in feces, and the non-cyst form is the stage that lives and multiplies in the small intestine of humans. The disease may cause inadequate absorption of fats and fat-soluble vitamins during the infection. The infective form of *Giardia* is resistant to cold temperatures and normal concentrations of disinfectants used to treat water. Therefore, to ensure that cysts are removed from "raw" water, water must be filtered to physically remove the hardy cysts.

Where is it found?

Humans, as well as other animals such as rats, mice, dogs, cats, beavers, muskrats, gerbils, and mule deer may carry *Giardia* that may infect humans. However, beavers and muskrats are the most likely source for human infections.

Feces from humans and other animals increase the presence of Giardiasis in the environment. This disease may occur if untreated water is consumed from surface water sources like streams, lakes or rivers.

How is the disease spread?

Giardia is transmitted via the fecal/oral route through water and food and the disease is frequently spread from person to person as well. *Giardia* sometimes is referred to as “travelers” disease. Large water borne outbreaks have occurred, and illness has been associated with consumption of water from unfiltered surface water sources or shallow wells, and during water recreational activities. According to the World Health Organization, Giardiasis is the most commonly reported water borne disease worldwide.



The disease is more prevalent in young children and infants, but anyone can get the disease if they consume contaminated food or water.

Stages of Disease

Between 50% to 70% of infected individuals show no symptoms, but still can spread the disease. However, people who have symptoms may experience chronic diarrhea, abdominal cramps, bloating, excess gas, pale greasy and foul smelling stools and weight loss. In severe cases the cells of the intestinal lining may become damaged, but in most cases the disease is self-limiting unless individuals are a health risk. Fortunately, deaths due to Giardiasis are rare.

It takes one or more cysts to cause infection, with an average incubation period of 7 to 10 days. Duration of the disease varies from 3 to 4 days, or months depending on the health of the infected individual, but most recover in 1 to 4 weeks without complications. However, some cases become chronic, and are characterized with recurrent, persistent brief episodes of loose foul-smelling stools that can last for months without treatment. The *Giardia* organisms may be spread throughout the entire duration of infection, with or without symptoms. This is probably why the disease is widespread, since many infected individuals do not realize they are infected and may easily spread the disease if they do not practice good hygiene.

Treatment

Giardiasis must be treated by a physician.

Prevention

Giardia may be present in any surface water source and, therefore, it is critical that these sources be properly disinfected and filtered to remove cysts. It is equally important to properly handle, transport and dispose of human feces during a backcountry trip. All toilet units and equipment must be stored in

tightly sealed containers and properly disinfected during a trip. Also, backcountry operators must implement proper hand wash procedures (as found in the Food section of this manual) during a trip to prevent the spread of diseases like Giardiasis after using and handling portable toilets and equipment.

■ ***Cryptosporidiosis***^(3,4,7)

What is it?

Cryptosporidium parvum, a parasite, is the primary disease-causing agent for humans.

These parasites are extremely resistant to environmental conditions, especially in cold water temperatures, and to normal concentrations of water disinfectants like chlorine and iodine. Symptoms of the disease are caused by the disruption of intestinal absorption and secretion by the protozoan parasite.

Where is it found?

Humans as well as other animals including cattle, sheep, pigs, goats, deer and horses are common sources. These sources contribute to environmental contamination of watersheds, foods and recreational waters.

How is the disease spread?

Cryptosporidium is widespread in surface waters and is common worldwide. It is estimated that there are over one million cases annually throughout the world.

Transmission is person to person, or animal to person by the fecal/oral route. However, transmission may occur when human and/or animal feces contaminate food and water sources.

Stages of Disease

An infective dose ranges from 30 to a million oocysts, depending on the individual. Symptoms of the disease occur between 7 to 9 days after parasites are consumed. Signs primarily include profuse watery diarrhea that resolves itself in less than 30 days. However, other symptoms may include fever, anorexia, nausea, abdominal cramps, vomiting, or infection of the respiratory tract. Illness may persist and contribute to death in individuals that have weakened immune systems.

Treatment

Currently, there is no treatment for *Cryptosporidium* other than fluid and electrolyte replacement.

Prevention

Primary prevention includes:

- Proper handling, transportation and disposal of human feces.
- Proper disinfection and filtration of water sources.
- Good personal hygiene for backcountry operators (see hygienic practices in the Food section in this manual)

***Trichinosis*^(3,4)**

What is it?

The disease is caused by a roundworm that is invisible to a human eye. The infection occurs after consumption of undercooked or raw meat from a particular animal, when the roundworms attach to the intestinal wall and lay eggs. After the eggs hatch the larvae move from the intestine and embed in muscle tissues throughout the human body.

Where is it found?

Common sources of Trichinosis include pigs, dogs, cats, horses, rats, bear, walruses and foxes. Infection occurs when raw or undercooked meat from these animals is consumed.

How is the disease spread?

Trichinosis occurs worldwide, and transmission occurs if raw or undercooked meat from infected animals is consumed.

Stages of Disease

The average incubation period for the disease is from 8 to 15 days, and the signs vary in humans depending upon the number of roundworms ingested. The first symptoms that appear are muscle soreness, swollen upper eyelids and fever, followed by orbital pain, retinal hemorrhage, photophobia, sweats, chills, weakness and diarrhea. Death is due to myocardial failure, which is a result of roundworms invading the heart muscle.

Treatment

Infected individuals must be treated by a physician.

Prevention

Primary prevention consists of properly cooking meat from reservoirs of this disease. The proper cooking temperatures for various meats are:

- Whole pork muscle tissue must be cooked throughout to 130°F or greater for at least 15 seconds.
- Ground pork meat or other meat products must be cooked to 155°F or greater for at least 15 seconds.

- Stuffed pork meat or other stuffed meat products must be cooked to 165°F or greater for at least 15 seconds.

Other preventive measures include good hygienic practices and avoidance of cross-contamination. To prevent cross-contamination, raw meat, (such as pork) must be stored away from or below ready-to-eat foods in ice chests or other storage units, and all work surfaces thoroughly sanitized before and after each use.

INSECT AND ANIMAL BORNE DISEASES

A zoonotic disease is defined as a disease that is transmitted from animals to humans.

Eleven zoonotic diseases are discussed in this section, although many more are known to exist. These eleven diseases were selected because they are the ones to which readers are most likely to become exposed during a backcountry outing.



Zoonotic diseases are transmitted from animals to humans in a variety of ways. Diseases may be transmitted via animal bites, from urine or feces, from direct contact with an infected animal, or from an insect bite if the insect has bitten an infected animal. There are many different insects that may transmit diseases from infected animals to humans. These insects are called vectors. A vector serves as an intermediate host that enables a disease to find its way to

other animals. Insects that “carry” a disease may not be affected by the disease-causing agent. Insects that are common vectors for zoonotic diseases include ticks, fleas, mosquitoes and deer flies.

The following paragraphs provide information about the most commonly encountered zoonotic diseases and their vectors. By learning about the ways these diseases are transmitted, backcountry travelers can minimize their risk of exposure.

■ **Colorado Tick Fever**^(4,8,9)

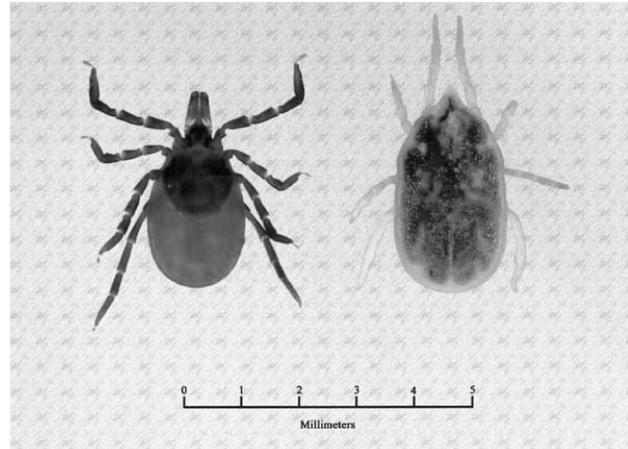
What is it?

The disease-causing agent is a virus. These viruses are known as arboviruses, which means that the viruses reside in an insect and are transmitted when the

infected insect bites an animal. This is a tick-borne arbovirus and is the only viral disease that is known to be transmitted by ticks.

Insect Vector

The vector for this disease is a tick called *Dermacentor andersoni*. The common name for this tick is the Rocky Mountain wood tick, and it is generally found throughout the western part of the United States and in Canada. This tick inhabits areas with thick brush and an abundance of low-lying vegetation.



An immature tick picks up the virus from an infected animal and carries the virus throughout its life; thus, passing the infective virus to any animal it feeds on.

Where is it found?

The primary sources for Colorado Tick Fever are Golden-Mantle squirrels, chipmunks, pine squirrels, deer mice, porcupines and the Rocky Mountain wood tick.

How is the disease spread?

Colorado Tick Fever is common in mountainous areas above 5,000 feet in elevation in all of the Rocky Mountain States and parts of Canada. Transmission is by the bite of a tick carrying this virus. There is no evidence that this disease is spread from person to person.

Stages of Disease

In three to six days following a tick bite there is sudden onset of fever, headache, pain behind the eyes, severe muscle aches and a rash may occur in a small percentage of cases. The symptoms of this disease occur in two phases. The first phase is the initial onset, which goes away for a brief time, followed by the second phase of fever that lasts 2 to 3 days.

This is considered a moderately severe disease with some cases resulting in encephalitis and myocarditis. However, deaths from this disease are rare.

Treatment

There is no treatment.

Prevention

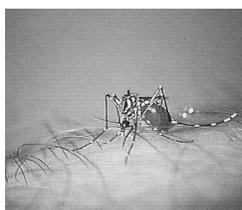
The best prevent to avoid tick bites includes the following:

- Avoid thick, brushy areas during the summer months.
- Wear long sleeves and pants that hang over boots and shoes.
- Check pets for ticks frequently.
- Examine yourself frequently for ticks.
- If ticks are found, remove them immediately and properly. To remove a tick properly, use tweezers to grasp the tick by the mouthparts as close to the skin as possible. Pull the tick straight out with gentle steady pressure. Take care not to squeeze or crush the body of the tick during removal. Wash the bite site with soap and water. Do not use hot matches, cigarettes, fingernail polish, or petroleum jelly to remove ticks as these methods are not effective. It is important to save the tick (preserved in alcohol) for later identification by health officials as it helps assess the risk of disease.

■ *Eastern Equine Encephalitis, St. Louis Encephalitis, Western Equine Encephalitis and West Nile Virus*^(16,20,21)

What is it?

This disease is caused by an arbovirus, which means that the virus multiplies in a blood-sucking insect like a mosquito and is transmitted by a bite. In nature, arboviruses alternate residence in insect hosts to animal reservoirs.



Insect Vector

The vectors for Eastern Equine Encephalitis (EEE), Western Equine Encephalitis (WEE), St Louis Encephalitis (SLE) and West Nile Virus (WNV) are mosquitoes. The disease-causing viruses are transmitted by the bite from an infected mosquito.

Where are they found?

Animal and insect sources for EEE, WEE, SLE and WNV may include birds, rodents, bats, reptiles, amphibians, or mosquitoes.

How are these diseases spread?

Transmission to humans is from a bite from an infected mosquito. This disease is not spread from person to person.

Stages of Disease

Eastern Equine Encephalitis (EEE) often causes more severe symptoms than Western Equine Encephalitis (WEE) or St. Louis Encephalitis (SLE). Most people exposed to these viruses have either no symptoms or mild flu-like illness. A small percentage (usually less than 1%) may develop encephalitis, which is characterized by a sudden onset of high fever, headache, meningeal

signs, stupor, disorientation, coma, tremors, occasional convulsions and spastic paralysis. Symptoms usually occur between 5 to 15 days after a mosquito bite. The fatality rate for EEE may be from 0.3% to 60% depending on the health and age of the person; whereas, death is uncommon for WEE.

Treatment

There is no specific treatment for either disease, only supportive treatment.

Prevention

The best prevention includes:

- Wearing repellents to prevent mosquito bites.
- Sleeping in a protected area, such as a tent that is properly screened.

***Hantavirus Pulmonary Syndrome*^(4,10)**

What is it?

The disease-causing agent is a virus called Hantavirus. Hantavirus Pulmonary Syndrome was first recognized in 1993 in the Four Corners area of the southwestern part of the United States. The strain of Hantavirus found in the United States is called Sin Nombre Virus, which means virus with no name.

Where is it found?

The primary source for Hantavirus Pulmonary Syndrome (HPS) is the deer mouse, also known the Black-footed deer mouse. However, other species of mice (*Peromyscus maniculatis*), such as the cactus, pinyon and brush mice have been identified as sources for HPS as well. This disease has no known insect vectors.

How is the disease spread?

The disease is transmitted through aerosolization and inhalation of urine, droppings, or saliva from infected mice. Transmission most commonly occurs when cleaning mouse droppings or nests in enclosed areas. The risk is considered to be much lower in open air situations. Avoid sleeping on the ground where there is considerable rodent activity. This disease is not spread from person to person.

Stages of Disease

The first symptoms may appear in a few days to 6 weeks (usually 2 weeks) after inhalation of aerosolized infected mouse urine, droppings, or saliva. The symptoms are flu-like and include



fever, muscle aches, dry-nonproductive coughing, vomiting and abdominal pain (It is interesting to note that the symptoms do not include nasal stuffiness or sore throat). These first symptoms may last 2 to 15 days and are followed by respiratory arrest, which is caused by fluid filling the lungs making it impossible to breath. Death is due to respiratory failure and cardiac shock. The fatality rate is 40% to 50%.

Treatment

There is no specific treatment for HPS, only supportive care.

Prevention

Precautions taken to reduce exposure to this disease during a backcountry trip include:

1. Do not camp next to rodent burrows or nests.
2. Protect food from rodents during a camping trip by storing food in rodent-proof containers.
3. Store garbage in rodent-proof containers during a backcountry trip.
4. Avoid sleeping on the ground to prevent exposure to rodents and their body fluids. If possible, sleep in an enclosure, such as a tent or car, or on a cot off the ground.
5. Avoid camping in a cabin that has evidence of a rodent infestation (presence of droppings and/or nests) unless the cabin is properly cleaned.
6. Proper cleaning of enclosed areas such as a cabin, may include the following:
 - First open all doors and windows to ventilate the enclosed area.
 - Use a disinfectant that destroys viruses, such as household bleach (one part bleach per 9 parts water) on all affected areas.
 - Allow a disinfectant to soak and treat the area for at least 30 minutes.
 - Use gloves and paper towels to “wet” clean the affected areas – NEVER DRY CLEAN! By dry cleaning a rodent infested area, viruses may become aerosolized and inhaled.
 - Dispose contaminated cleaning materials in a garbage bag, tie bag and properly dispose.

■ **Lyme Disease^(4,8)**

What is it?

The disease-causing agent is a bacterium called a *spirochete* because of its spiral-shape.



Insect Vector

Lyme disease is transmitted by a bite from a tick. This tick is commonly known as a blacklegged deer tick.

Where is it found?

The primary sources are the blacklegged deer tick and white-footed mice.

How is the disease spread?

This disease is common in the United States along the Atlantic coast between Maryland and Massachusetts, and including Wisconsin and Minnesota as well as some areas of California and Oregon.

The disease is transmitted by a bite from an infected tick, and there is evidence indicating that a tick must be attached for 24 hours or longer to transmit the bacterial infection to the animal host.

Stages of Disease

Early symptoms occur after an incubation period of 3 to 32 days and include overall discomfort, fatigue, fever, headache, stiff neck, muscle pain and migratory joint pains. However, the most characteristic symptom is a distinctive skin lesion around the tick bite called “erythema migrans”, which has a red spot or patch with a center clearing. After the initial symptoms, other symptoms manifest in several weeks or months that include neurological symptoms, cardiac abnormalities, intermittent episodes of swelling and joint pains.

Treatment

Diagnosis and appropriate treatment must be determined by a physician.

Prevention

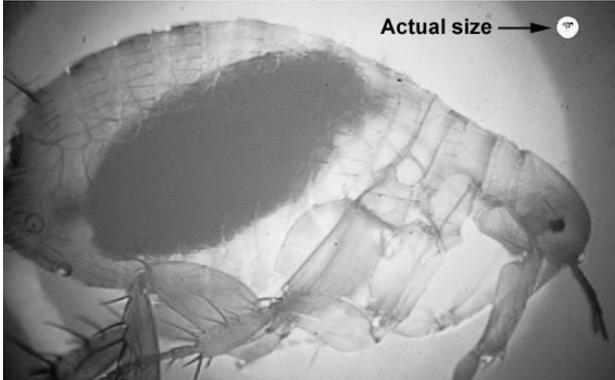
The best prevention to avoid tick bites includes the following:

- Avoid thick, brushy areas during the summer months
- Wear long sleeves and pants that hang over boots and shoes
- Check pets for ticks frequently
- Examine yourself frequently for ticks
- If ticks are found, remove them immediately and properly. To remove a tick properly, use tweezers to grasp the tick by the mouthparts as close to the skin as possible. Pull the tick straight out with gentle steady pressure. Take care not to squeeze or crush the body of the tick during removal. Wash the bite site with soap and water. Do not use hot matches, cigarettes, fingernail polish, or petroleum jelly to remove ticks as these methods are not effective. It is important to save the tick (preserved in alcohol) for later identification by health officials as it helps assess the risk of disease.

Plague^(4,8)

What is it?

Plague is caused by a rod-shaped bacterium *Yersinia pestis*. Known since ancient times, plague has had a great influence on history, characterized by epidemics and pandemics that have decimated human populations all over the world.



Insect Vector

Plague is transmitted to humans and other animals by bites from infected fleas. Fleas become infected by ingesting the bacteria while feeding on an infected animal.

Where is it found?

Plague is referred to as “sylvatic” plague, which means the disease has invaded “wild” rodent populations. There are approximately 220 different species of rodents that can harbor plague, but the most common sources for plague include ground squirrels and prairie dogs.

How is the disease spread?

Plague occurs worldwide, and is transmitted by bites from infected fleas. In the United States, it occurs in the western states. Plague may be transmitted by flea bites or through contact with blood and tissues of infected animals, or through “pneumonic” transmission from sick humans or pets. Pneumonic plague is transmitted from human to human, or from sick animal to human by inhaling droplets from animals or humans that have pneumonic plague.

Stages of Disease

There are three primary forms of plague, and they include bubonic plague, septicemic plague and pneumonic plague. The most common form of plague is “bubonic” plague. Bubonic plague occurs from 1 to 7 days after a bite of an infected flea. The disease is characterized by a characteristic skin lesion (which occurs around the site of the flea bite), a “bubo” that is a swollen, tender lymph node. Bubos usually affect the lymph nodes located in the inner thigh, groin and under arm regions. Symptoms also include sudden high fever (103°F or 104°F), headache, exhaustion, nausea, vomiting and delirium.

Secondary septicemic and pneumonic plague may occur when the bacterium invades the blood stream and lungs. However, primary pneumonic plague occurs when droplets are inhaled from infected humans or other animals. The onset of pneumonic plague is rapid, and symptoms occur anywhere from 1 to 4 days after exposure. Symptoms of pneumonic plague may include high

fever, headache, difficult breathing and coughing-up blood.

The fatality rate for untreated bubonic plague is 50% to 60%, and the fatality rate for pneumonic plague is greater than 90%. Rapid diagnosis and treatment can reduce these figures noticeably.

Treatment

Diagnosis and treatment must be done by a physician.

Prevention

The best prevention for plague includes the following:

- De-flea pets routinely – consult a veterinarian for advice on flea control
- Use insect repellents especially around pant cuffs, socks and shoes
- Do not camp next to rodent burrows and nests
- Avoid sleeping directly on the ground
- Do not pick up dead or sick rodents
- Wear gloves when field dressing game

Rabies^(4,9)

What is it?

Rabies is caused by a “bullet-shaped” virus. The rabies virus can infect any warm-blooded animal. Once introduced to a human host by an animal host, the virus travels through the nervous system to the brain.

Where is it found?

Common reservoirs include bats, skunks, foxes, coyotes, raccoons and unvaccinated dogs.

How is the disease spread?

Rabies occurs all over the world. The virus is transmitted through a bite of an infected animal. A rabid animal secretes the virus in its saliva.

Stages of Disease

The early stages of the disease include discomfort, anxiety and extreme sensitivity around the bite wound. These symptoms are followed by muscle spasms around the salivary glands that result in hydrophobia (a fear of water), delirium, coma and paralysis that invariably leads to death.



Treatment

Human rabies immune globulin is injected by a physician at the wound site as soon as possible, followed by 2 to 3 doses of the rabies vaccine.

Prevention

The best prevention after exposure includes the following:

- Immediately wash the bite wound with soap and water
- If possible, capture the animal for testing – be careful not to re-expose yourself or others (keep the dead animal chilled to prevent decomposition)
- Contact the local health department as soon as possible
- Seek medical attention immediately

Ways to prevent the spread of rabies from wild animals to pets is to have pets, such as dogs and cats vaccinated for rabies routinely.

***Rocky Mountain Spotted Fever*^(4,8)**

What is it?

The disease-causing agent is a microorganism that occupies a position between viruses and bacteria.

Insect Vector

The vector for Rocky Mountain Spotted Fever is a certain tick species. The vector for this disease in the eastern part of the United States is the American dog, and the western tick is the Rocky Mountain wood tick known.

Where is it found?

Sources for Rocky Mountain Spotted Fever include all stages of the American dog tick and the wood tick, dogs, rodents and other animals.

How is the disease spread?

Rocky Mountain Spotted Fever is common in the United States, parts of Canada, Mexico and parts of South America.

Transmission occurs 4 to 6 hours after a tick has attached itself to a human host, or if the tick is crushed or the feces rubbed into the bite wound.

Stages of Disease

The characteristic symptom for this disease is a rash that appears within 2 to 5 days, usually on wrists, ankles at first, and later spreading all over the body. Other symptoms commonly occur within 2 to 14 days and include moderate to high fever, headache on the front and back of head, intense lower back pain and discomfort. If the infection goes untreated the case fatality rate is 13% to

25%, however, if the disease is properly treated the case fatality rate is reduced to 3% to 5%.

Treatment

Diagnosis and treatment must be done by a physician.

Prevention

The best prevention to avoid tick bites includes the following:

- Avoid thick, brushy areas during the summer months
- Wear long sleeves and pants that hang over boots and shoes
- Check pets for ticks frequently
- Examine yourself frequently for ticks
- If ticks are found, immediately remove them (be careful not to crush them or rub their excrement into the bite wound)

Tick Relapsing Fever^(4,8)

What is it?

The disease causing-agent for Tick Relapsing Fever is a bacterial spirochete.

Insect Vector

The vector for this disease is an argasid tick that is also known as a soft tick. These ticks are nocturnal feeders and hide in rodent nests during the day. They do not attach to a host as do “hard” bodied ticks.



Where is it found?

The primary sources are soft ticks and wild rodents.

How is the disease spread?

Tick Relapsing Fever is common in both North and South America, parts of Africa, Spain, Saudi Arabia, Iran and India. The disease is transmitted through a bite from an infected soft tick, or by crushing a tick into a bite wound. Soft ticks come out at night to feed on an animal host and then hide during the day, typically in a rodent nest.

Stages of Disease

The incubation period is 5 to 15 days. The onset of disease begins with a fever that may last 2 to 9 days, subside for 2 to 4 days and reoccur again. This relapsing fever cycle may occur 1 to 10 times. When the bacteria are present in the blood a person will experience fever, then when bacteria leave the blood there is no fever. The symptoms are most severe during the end of the fever period, and 2% to 10% of all untreated cases will lead to death.

Treatment

Diagnosis and treatment must be done by a physician.

Prevention

To prevent Tick Relapsing Fever:

- Rodent proof cabins and treat areas with pesticides where rodent nests are present
- If ticks are found, remove them immediately and properly. To remove a tick properly, use tweezers to grasp the tick by the mouthparts as close to the skin as possible. Pull the tick straight out with gentle steady pressure. Take care not to squeeze or crush the body of the tick during removal. Wash the bite site with soap and water. Do not use hot matches, cigarettes, fingernail polish, or petroleum jelly to remove ticks as these methods are not effective. It is important to save the tick (preserved in alcohol) for later identification by health officials as it helps assess the risk of disease.

***Tularemia*^(4,8)**

What is it?

The primary agent is a disease of rabbits and rodents caused by a bacteria This disease is also known as “rabbit fever” or “deer fly fever”.

Where is it found?

The primary sources for this disease are rabbits, hares, voles, muskrats, beavers and various hard ticks.

How is the disease spread?

Tularemia is found throughout the world and the United States. This disease may be transmitted to humans by a variety of modes. Tularemia may be transmitted from:

- Direct contact with infected blood and tissues from rabbits (cottontails, jacks and snowshoes) and from wild rodents.
- Deer fly and tick bites that are infected with the bacteria.
- Consumption of raw or undercooked infected rabbit or rodent meat.
- Drinking raw water that has not been properly treated.

Stages of Disease

After an incubation period of 1 to 14 days the signs may include fever, headache, chills, weakness and swollen lymph nodes in the armpit, elbow, groin, or neck regions. Also, an open sore or ulcer usually appears on the skin around the site of infection. When treated, Tularemia is rarely fatal.

Treatment

Diagnosis and treatment must be done by a physician.

Prevention

Prevention includes:

- Wearing gloves when skinning or field dressing rabbits or wild rodents.
- Wearing insect repellents in the backcountry, and avoiding brushy areas where ticks may reside.
- Thoroughly cooking rabbit and wild rodent meat.
- Properly treating all drinking water, as described in the Water Purification section of this manual.

QUIZ : DISEASES

1. What is a zoonotic disease?
2. Is food borne illness life threatening?
3. What groups of people are considered high risk?
4. What type of food does pathogenic bacteria grow and multiply in?
5. Is cooked rice a potentially hazardous food?
6. How can botulism poisoning be prevented?
7. What types of foods are *Campylobacter* and *Salmonella* associated with, and how can these disease-causing organisms be destroyed?
8. What is the primary prevention of Cholera?
9. What is the primary source of *E. coli* 0157:H7, and how can this disease-causing organism be destroyed?
10. How can the spread of the disease Shigellosis be prevented during food preparation?
11. What is the primary source of *Staphylococcal* food poisoning, and how can this disease be prevented?
12. How can viral food borne diseases be prevented?
13. How is Hepatitis A transmitted?
14. How can the spread of Norwalk-like Virus be prevented?
15. What are the two primary organisms of concern for water borne disease?
16. What disease may be contracted by swimming in stagnant ponds?
17. How can *Giardia* and *Cryptosporidium* cysts and oocysts be effectively removed from water?
18. What is the main preventive measure for Colorado Tick Fever?
19. What is the best prevention for Western Equine Encephalitis, Eastern Equine Encephalitis and West Nile Virus?
20. What is the primary source for Hantavirus in the United States, and how can this disease be prevented?
21. What is the most characteristic symptom of Lyme Disease?
22. What is the insect vector for Plague, and how can this disease be prevented?
23. How is the disease Rabies transmitted, and what steps must be taken after exposure?
24. How are Rocky Mountain Spotted Fever and Tick Relapsing Fever transmitted, and how can these diseases be prevented?
25. What is another name for the disease Tularemia, and how can this disease be prevented?

WATER PURIFICATION

WHY PURIFY WATER?

Collection

Pretreatment

Point-of-Use Treatment Requirements

1. What is required?
2. Water Treatment

Odors/Tastes Causes and Controls

Cleaning and Storage of Water Equipment

1. Washing and Sanitizing Procedures
2. Proper Storage

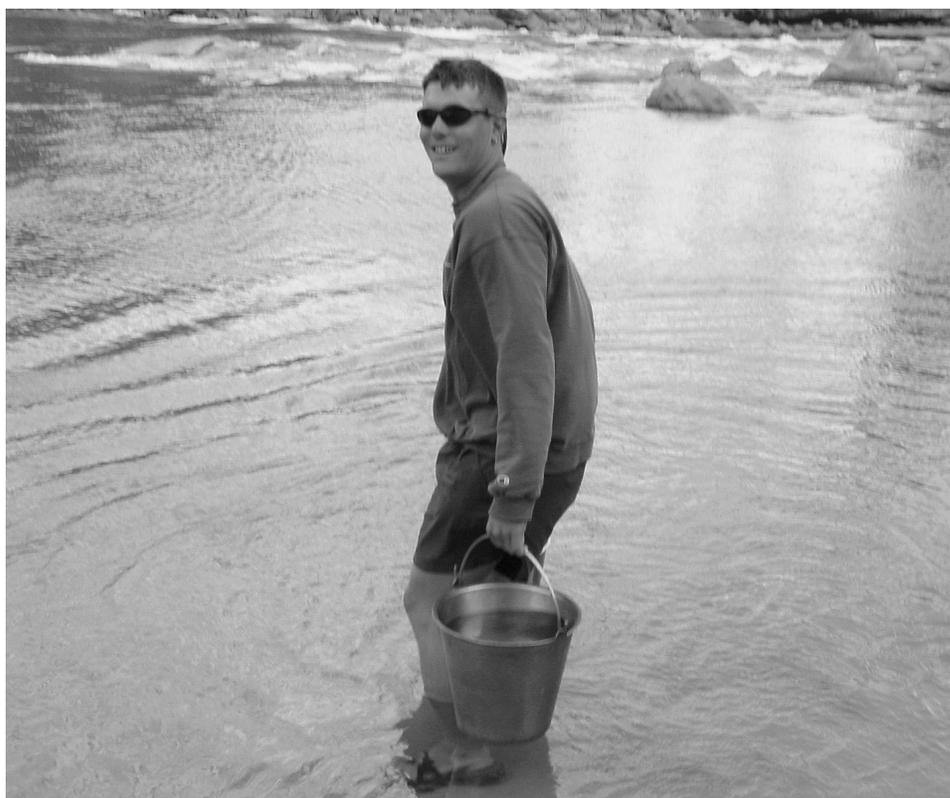
QUIZ

WATER PURIFICATION

WHY PURIFY WATER?

AN ADEQUATE SUPPLY of safe drinking water is essential to any backcountry experience, but it is not always possible to take along enough water to last throughout an extended trip. A person needs about 2 liters of water each day, but during a backcountry trip in hot weather, about 1 liter of water per hour may be needed to sustain a body. As a consequence, wilderness travelers often must drink water from natural sources. However, if such water is not properly treated, pathogenic microbes may be present, resulting in serious illness.

This fact is borne out each year as many people become ill, and some people die, from drinking unsafe water. People entering the backcountry risk infection if they drink untreated water from a spring, stream, river or lake, no matter how clean the water looks. Microorganisms that cause diseases are invisible to the human eye and cannot be detected.



Water borne outbreaks occur in backcountry as well as in city and rural environments. The most common reason for outbreaks is improperly treated water. Appendix B contains information on water borne outbreaks in the United States.

Water from backcountry sources is surface water. While it is true that most people who become sick from surface water do not die, water borne diseases produce painful symptoms. It will be an unforgettable experience for guests and/ or operators if they suddenly become ill with vomiting and/or diarrhea during a backcountry trip. Water borne pathogens come from many sources besides human fecal contamination. Deer, elk, sheep, beaver, muskrats and cattle may carry many of the waterborne disease causing agents. Water borne pathogens may also come from sources, such as discharges from wastewater treatment plants, septic systems, chemical toilets, or runoff after storms from ranch lands and town sites.

Without question, untreated surface water constitutes a health risk, and backcountry operators might incur liability if their clients become ill on a trip. Consequently, a backcountry operator must properly treat water for drinking, cooking, or other uses where it may be consumed. The following sections describe proper water purification methods.

COLLECTION

Before water can be pretreated it must be collected, and care must be taken in selecting a water collection point. Microorganisms are concentrated in stagnant water, such as eddies along river or stream banks, and along lake shores where the water may be shallow and warm. These areas should not be used as collection points. It is equally important to avoid any body of water that has an algae bloom or has a strong “organic” odor as these types of areas may also contain higher concentrations of microorganisms.

The best places to collect water are from a “flowing” portion of a stream or lake, and as far away from a shoreline as possible. When collecting water it is important to be careful not to stir up sediment because microbes tend to be concentrated in sediments (11).

PRETREATMENT

It is important to pre-treat water if it is cloudy because sediment in the water will decrease the efficiency of a disinfectant. Sediment usually consists of small, suspended solids that may remain suspended without pre-treatment.



The best way to remove these suspended particles is to use a coagulant. A coagulant is an agent that, when added to water, attaches to suspended solids and forms small dense clumps called flocs so the sediment may collect at the bottom of a container.

A common coagulant used for water pretreatment is aluminum sulfate, which is also called “alum”. The coagulant dosage is dependent on the sediment concentration, but usually is 5 to 90 milligrams per liter (mg/l), which is approximately 2 teaspoons of alum per 5 gallons of water⁽¹²⁾. After adding alum to water, the water must be allowed to settle for at least 30 minutes. A longer settling time may be required if there is excessive sediment in the water.

After the suspended solids have settled to the bottom, then the clear water must be gently poured into a clean, sanitized water container while taking care to keep the settled sediment in the bottom of the original container. If the container is bumped or the water is decanted from the container too quickly, the sediment may become re-suspended and the pretreatment process would have to be repeated.

POINT-OF-USE TREATMENT REQUIREMENTS

■ What is Required?

A backcountry operator is expected to provide safe water for guests. Frequently, it is necessary to utilize surface water during backcountry trips. Therefore, every effort must be taken by operators to properly treat water before it is consumed to prevent waterborne disease. If an operator allows guests to drink raw, untreated water, the result could be illness or even death especially for high risk individuals.

The federal government requires all surface water to be both filtered and disinfected to ensure removal of viruses, bacteria and parasites⁽¹³⁾. Boiling water is also an acceptable treatment method for backcountry operations. Currently, the federal government does not approve the use of UV disinfection. Research has not proven this method of disinfection to be effective.

Water Treatment

The primary organisms of concern in water are viruses, bacteria and parasites. All microorganisms invisible to the naked human eye. The average sizes of the microbes of concern are shown in Appendix C.

The federal government requires that these organisms be adequately removed or inactivated from potable water. Adequate removal or inactivation is shown in Appendix D.



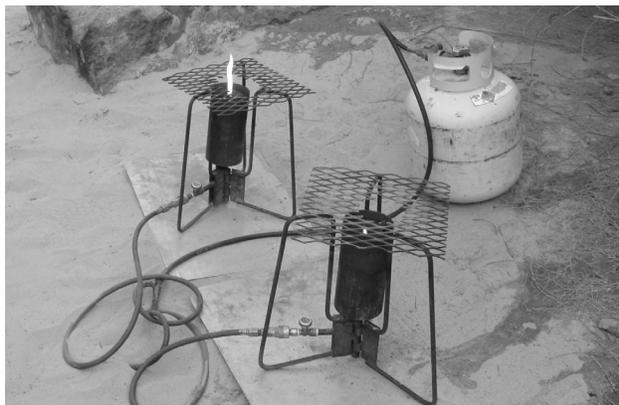
In order to achieve removal or inactivation of the microbes listed in Appendix D, the federal rule requires surface water be properly boiled, or filtered and disinfected, or provide water from an approved public drinking water system on a backcountry trip.

Water Purification by Boiling

Water boils at 212°F at sea level. However, as elevation increases both the atmospheric pressure and the boiling temperature decrease. To effectively kill pathogens in water, water must first be pre-treated, followed by boiling for at least one minute at sea level. For each thousand feet above sea level, an additional minute of boiling must be added, as shown in Table 2.

TABLE 2

Elevation in Feet	Boiling Time
Sea level	1 minute
1,000	2 minutes
2,000	3 minutes
3,000	4 minutes



Although boiling is the simplest method of water treatment, this method consumes a large amount of fuel. If there is not enough fuel to purify water for a trip, then water must be filtered and disinfected.

Water Purification by Filtration and Disinfection

Filtration

Both *Giardia* cysts and *Cryptosporidium* oocysts, which are two of the most commonly encountered parasites, are very resistant to normal concentrations of chemical disinfectants used to treat drinking water. Consequently, the most reliable method to remove these cysts and oocysts is filtration. Filtration is a process that removes contaminants by a physical process through pores. The cysts and oocysts cannot pass through the pores in the filter and are retained

within the filter. During filtration, pretreated raw water is pumped from a reservoir through a porous material that separates contaminants from the water. Filters may be constructed of special media, fabric, or ceramic.



In order to achieve acceptable levels of removal of *Giardia* cysts and of *Cryptosporidium* oocysts (as shown in Appendix D) point-of-use filters must meet National Sanitation Foundation Standard (NSF) 53⁽¹³⁾. If a filter meets this standard, this should be indicated either on the label or in the manufacturer's specifications.

Disinfection

The disinfection process involves destroying pathogenic organisms including bacteria, viruses and fungi. Disinfection must occur after the filtration process. Filtration removes tough parasite cysts that are not destroyed by disinfectants, and disinfection destroys other smaller pathogens that may pass through a filter, such as bacteria and viruses.

The two most common disinfectants used to treat drinking water for backcountry operations are chlorine and iodine. Both of these disinfectants are members of the halogen family of chemicals. Halogen chemicals combine with hydrogen in water to form acids. These acids in turn are capable of destroying pathogenic microbes, and oxidizing organic debris (chemically removing impurities).

Chlorine

Chlorine is the most widely used disinfectant for water treatment. The most commonly available form of chlorine is household bleach, which contains approximately 5% to 6% available chlorine⁽¹⁶⁾.

To disinfect water, the concentration of free available chlorine in raw water must be between 0.2 to 4.0 milligrams/liter (mg/l), or parts per million (ppm)⁽¹³⁾. A water test kit must be used to measure the concentration of the free available chlorine in water. After the proper concentration is reached, then the water with the free available chlorine (FAC) must be allowed to set for at least 30 minutes, which is known as the detention time or contact time. The concentration, along with the detention time, determines the germicidal efficiency of a disinfectant. This efficiency is shown in Appendix E.



If the exact concentration of the free available chlorine is not known, then the minimum holding time is 30 minutes to ensure destruction of pathogenic bacteria and viruses.

Typically, most backcountry operators will be disinfecting smaller amounts of water. The quantity is approximately 2 to 8 drops (is equal to 0.2 to 4 ppm of free available chlorine) of household bleach per gallon of water.



However, the effectiveness of free available chlorine to destroy pathogenic microorganisms is dependent on the presence of sediment and organic matter. Sediment shields microbes from the hypochlorous acid, and organic matter reacts with the hypochlorous acid to form disinfectant byproducts such as chloroform⁽¹³⁾. Hence, it is important to pre-treat surface water to remove as much sediment and organic material from water prior to treatment.

The temperature and pH of water also affects the effectiveness of free available chlorine. The pH is a measure of the degree of acidity or alkalinity of a solution. For chlorine to be effective, the initial pH level of the raw water must be between 6.5 and 7.6⁽¹⁶⁾.

Iodine

Iodine is a halogen-compound like chlorine, and is commonly available in a liquid or tablet form at a concentration of 2%. However, unlike chlorine,

iodine is not an effective disinfectant against enteric viruses or pathogenic bacteria at pH values of 8.0 or above. Ideally, the pH of water that is to be treated must be 5.0 pH. In Table , the proper disinfection concentrations and detention time are shown⁽¹⁷⁾:

TABLE 5		
Iodine Concentration (mg/l or ppm)	Number of Drops of Iodine/gallon of water	Contact Time (minutes)
0.5 to 1.0	5 to 10	30

As with chlorine, it is important that water be pre-treated when iodine is used so that suspended solids and organic matter are largely removed prior to treatment. Otherwise, proper disinfection will not occur.

ODORS/TASTES CAUSES AND CONTROLS

Many tastes and odors that commonly occur in surface water are a result of decaying matter, such as vegetation, algae, bacteria, or wastes from industrial or municipal operations. Two commonly occurring compounds that have “earthy” odors are Geomin and 2-methylisoborneol (MIB), which are produced by certain algal growth. Unfortunately, Geomin and MIB are resistant to oxidizers like chlorine and iodine⁽¹³⁾.

However, not all of the tastes and odors are naturally occurring. Some are linked to disinfectant byproducts. Water, when mixed with chlorine, may smell or taste moldy, earthy, stale, disinfectant-like, bitter, ammonia-like, bleach-like, or muddy⁽¹³⁾.

There are numerous methods that may be used to control tastes and odors, however, many may not be convenient in a backcountry setting. A primary step to odor and taste control is to obtain water that is visibly clear, smells fresh, and avoid stagnant smelly water. Secondly, surface water needs to be



pre-treated to remove as much sediment and organic matter as possible. Lastly, after the disinfectant is added and the settling time is completed, the batch of treated water may be “aired” by removing the lid of a water container for several minutes. This will allow some of the volatile chlorine byproducts to escape from a container before the water is consumed; however, care must be taken to prevent cross-contamination of treated water when the lid is removed.

WATER EQUIPMENT STORAGE AND CLEANING

It is equally important to make sure that water containers and attachments are properly cleaned and sanitized before, during and after use to prevent contamination. If an operator has gone to the trouble to select an appropriate water source, pre-treat, filter and disinfect the water, but he/she places it in a contaminated container, the contaminated container will negate all prior treatment.



It is essential that water containers and attachments, such as nozzles, tubes and lids are properly washed by the following process:

WASH - RINSE - SANITIZE - AIR DRY

The equipment must be washed with detergent in hot, clear water; rinsed in clear, hot water; sanitized with a chemical sanitizer approved by the Food and Drug Administration (FDA), such as chlorine and air dried. The temperature and pH of water determine the proper concentration of chlorine and contact time. The federal Food Code requires the following:



Chlorine			
Chlorine Concentration (ppm)	Contact Time (seconds)	Minimum Water Temperature	
		pH 10 or less	pH 8 or less
25	10	120°F	120°F
50	10	100°F	75°F
100	10	55°F	55°F

Quaternary Ammonia			
Quaternary Ammonia	Contact Time	Water Temperature	Water Hardness
200 ppm (or what manufacturer specifies)	30 seconds	75°F	500 ppm or less

Iodine			
Iodine	Contact Time	Water Temperature	pH
12.5 to 25 ppm	30 seconds	75°F	5.0 or less

■ Storage

Water containers and attachments must be stored in a clean, dry place after they are washed and sanitized. Operators should avoid stacking water containers inside each other, unless they are thoroughly washed and sanitized before use. Other water equipment, like hoses and nozzles from water filters and lids from water containers, must be washed and sanitized before each use.

The nozzles and hoses from water filtration equipment may become contaminated during storage, transportation and use. Proper precautions need to be used to prevent this equipment from becoming contaminated while it is used, by preventing the hose or nozzle from coming into contact with dirt, untreated water, or other sources that may contaminate these surfaces.

The use of common sense, combined with a basic understanding of the scientific principals associated with water treatment, will result in a safer experience for everyone who experiences the backcountry.

QUIZ - WATER PURIFICATION

1. What are the safest places to collect water from surface water sources for treatment?
2. Explain why it is important to pre-treat water.
3. Name a commonly used coagulant.
4. How long must water set after a coagulant is added?
5. Why is it important to treat water prior to consumption?
6. What are the primary organisms of concern in untreated water?
7. How long would water have to be boiled to adequately disinfect at an elevation of 7,000 feet?
8. What two pathogenic organisms are removed by filtration?
9. How does free chlorine destroy bacteria and viruses?
10. Why is it critical to remove suspended solids in water prior to treatment?
11. At what pH level is iodine more effective?
12. What is the best procedure for removing turbidity?
13. What is the proper procedure to wash and sanitize water containers and attachments?
14. What is the proper concentration of chlorine to sanitize equipment if the water that is to be treated has a pH of 8.0 or less and a temperature of 55°F?



FOOD

Food Handler Exclusions and Restrictions

- Conditions/Activities
- Highly Susceptible Groups
- Non-Highly Susceptible Groups

Hygienic Practices

- Personal Hygiene
- Hand Washing Procedures

Hazards

- Chemical Hazards
- Physical Hazards
- Biological Hazards

Food Condition and Storage

- Approved Source and Condition
- Cold and Hot Storage
- Date Marking
- Dry Storage
- Cross-Contamination

Food Preparation

- Food Assemblage
- Cooking Temperatures
- Consumer Advisory
- Highly Susceptible Groups
- Cooling and Reheating
- Cross-Contamination

Food Service

- Time/Temperature Control Requirements
- Food Protection During Service

Wash and Sanitize

- Dishwashing Procedures
- Sanitizing Agents

Food Equipment

- Approved Construction
- Condition

QUIZ

FOOD

THE FOOD AND DRUG ADMINISTRATION’S definition of food means: “A raw, cooked, or processed edible substance, ice, beverage, or ingredient used or intended for use or for sale in whole or in part for human consumption, or chewing gum.”

Therefore, any substance that is consumed is considered food. It is the backcountry operator’s responsibility to ensure that food served to guests is safe for human consumption. To ensure that food is safe, backcountry operators must know how to:



- Properly store, prepare and serve food
- Properly cook food
- Advise guests of the hazards if raw or undercooked potentially hazardous food is consumed
- Effectively wash hands
- Properly sanitize equipment
- Prevent cross-contamination

FOOD HANDLER RESTRICTION AND EXCLUSION REQUIREMENTS⁽¹⁴⁾

To prevent food borne diseases all food employees and applicants must provide information to the backcountry operator about their health and activities as they relate to food borne diseases. Whenever a food employee is ill they must tell their food operator so steps may be taken to protect public health. The following provides a list of conditions and activities that must be reported to a backcountry operator:

■ Conditions/Activities

A food employee is diagnosed, exposed to, or had a past illness with any of the following diseases:

- *Salmonella typhi*
- *Shigella spp.*
- *Escherichia coli 0157:H7*
- Hepatitis A

A food employee must also let a food operator know if he/she prepared food during an outbreak with any of the four diseases listed above, or lives with a person(s) that has been diagnosed or was exposed to an outbreak with any of these four diseases.

A food employee has symptoms of an acute gastrointestinal illness, which may or may not involve fever and/or sore throat that includes:

- Diarrhea
- Vomiting
- Jaundice

A food employee has a wound or sore containing pus, such as Folliculitis, Furuncles, or Carbuncles located on:

- Hands or wrist
- Exposed portions of arms
- Other parts of the body where pus from a sore or wound can drain and contaminate food or food equipment

Food operations that serve at-risk groups, such as elderly, pre-school children, pregnant women, or immune-deficient individuals must take even greater precautions. A backcountry operator must immediately enforce the following exclusion/restriction requirements after a food employee has reported any of the conditions or activities listed above.

At-Risk Groups

Exclusions

A food employee must be excluded from a food operation if any of the following applies:

1. A food employee is diagnosed, had a past illness, implicated in an outbreak, exposed to, lives with a person that has been diagnosed or was exposed to an outbreak with any of the following diseases:

- *Salmonella typhi*
- *Shigella spp.*
- *Escherichia coli* 0157:H7
- Hepatitis A

2. Experiencing acute gastrointestinal symptoms, which may or may not involve fever and/or sore throat that include:

- Diarrhea
- Vomiting
- Jaundice

3. Not experiencing any symptoms of acute gastroenteritis, but a stool analysis is positive for *Salmonella typhi*, *Shigella spp.*, or *Escherichia coli* 0157:H7.
4. Had a past infection of *Salmonella typhi* within the last 3 months.
5. Had a past infection from *Shigella spp.* or *Escherichia coli* 0157:H7 during the last month.
6. Experiencing jaundice.

Restrictions

A food employee must adhere to the following restriction when serving a highly susceptible group:

1. A food employee that has a wound or sore containing pus, such as Folliculitis, Furuncles, or Carbuncles located on hands, wrists, exposed portions of arms, or other exposed parts of the body must cover the sore or wound by the following methods:
 - Wear an impermeable cover such as a finger cot or stall that protects the lesion followed by a single-use glove, or
 - Wear an impermeable cover or a dry, durable, tight-fitting bandage on arms or on other exposed body parts.

Non-At-Risk Groups

Exclusions

A food employee must be excluded from a food operation if any of the following applies:

1. Diagnosed with any of the following diseases:
 - *Salmonella typhi*
 - *Shigella spp.*
 - *Escherichia coli* 0157:H7
 - Hepatitis A
2. Jaundice occurred within the last 7 days.

Restrictions

A food employee who has any of the following conditions must be restricted from working with exposed food, cleaning food equipment, utensils, linens and unwrapping single-service articles:

1. Experiencing acute gastrointestinal symptoms, which may or may not involve fever and/or sore throat that include:
 - Diarrhea
 - Vomiting
 - Jaundice
2. Not experiencing any symptoms of acute gastroenteritis, but a stool analysis is positive for *Salmonella typhi*, *Shigella spp.*, or *Escherichia coli* 0157:H7.
3. Onset of jaundice occurred more than 7 days.

Removal of Exclusions and Restrictions

A food operator must follow these requirements before allowing a food employee to resume her/his normal duties at a food operation:

Excluded – If a food employee was excluded, he/she must provide written medical documentation by a physician or, if allowed by law, a nurse practitioner or physician assistant, that specifies that the person is free of the infectious agent.

Restricted – A restriction may be removed by a food operator if a restricted food employee no longer is experiencing acute gastroenteritis symptoms, or written medical documentation is provided from a physician or, if allowed by law, a nurse practitioner or physician assistant, that specifies that the person is free of the infectious agent.

HYGIENIC PRACTICES⁽¹⁴⁾

One of the single most important practices in a food establishment is good hygiene. Implementing good hand washing may prevent the spread of most food borne diseases. It is especially important to use good hand washing methods as well as other hygienic practices in a backcountry setting.

Personal Hygiene

Clean Outer Clothing

Backcountry food handlers must wear clean outer garments when preparing food. This may be difficult if a food handler has spent all day on a horse, in a boat, or hiking. A food handler may slip on a clean shirt or jacket over his or her clothes that have been worn all day.



Hair Restraints

Food employees must also wear effective hair restraints prior to handling food. Hair restraints are required for all types of facial hair. Acceptable hair restraints include hairnets, caps, hats, bandanas, beard-nets, or any other device that keeps hair out of food.

Jewelry

Food employees may wear a plain wedding band when preparing food. However, nothing else may be worn on hands or wrists during food preparation.

Fingernails

Food employee's fingernails must be trimmed and clean with smooth edges. If fingernail polish or artificial nails are worn, then single-use gloves must be worn during food preparation.

Eating, Drinking and Tobacco Use

Employees may not eat as they prepare food. Food employees must thoroughly wash their hands before they resume work to prevent cross-contamination.

Food employees may have covered drink cups in food preparation areas as long as the covered drink cups are located in a place where they cannot contaminate food if spilled. Acceptable covered drink cups include plastic insulated drink cups with lids, paper cups with lids, or water bottles with tight-fitting lids or nozzles. Unacceptable beverage containers include pop cans, open cups, or glasses.

Food employees may not smoke or use any type of tobacco product in food preparation or dish wash areas.

Hand Washing

Proper hand washing is essential in preventing the spread of diseases. Food employees must wash their hands after:

- Eating
- Smoking
- Handling raw meat
- Touching any part of their body
- Using the rest room

- Toilet duty
- Handling untreated water
- Handling animals
- Handling anything else that may contaminate their hands

Backcountry operations must provide hand wash facilities near toilet and kitchen areas. Hand wash facilities for backcountry operations must have:

- A pump operated system, like a manually operated foot pump (see Figure 1), or it can be a gravity fed system where treated water is transferred from a reservoir with treated water to a container that catches the dirty hand wash water.
- Dispensed hand soap
- Dispensed paper towels



Figure 1

Food employees must wash their hands, wrists and exposed arms with soap by vigorously rubbing together the surfaces of their lathered hands and arms for at least 20 seconds and thoroughly rinsing with treated water.

Hand Sanitizers

Hand sanitizer solutions that are approved by the federal government may be used after hands are thoroughly washed, but not instead of hand washing.

HAZARDS⁽¹⁴⁾

The three primary hazards that may contaminate food and cause food borne disease are chemical, physical, and biological. Ultimately, it is a food operator's primary responsibility to prevent contamination of food, control the growth of natural contaminants in food and destroy natural contaminants in food, when possible, through cooking.

Chemical Hazards

Common chemical hazards associated with food include antimony, cadmium, lead, copper and zinc. Antimony and cadmium are heavy metals that can attach onto food if enamelware is used for food equipment. Enamelware food equipment usually comes in the forms of cups, plates, kettles and pots. Enamelware is not approved for commercial food operations because of the hazards associated with the consumption of these metal cations. If antimony or cadmium is consumed it may cause vomiting and diarrhea.

Lead may be found in ceramic, china, crystal and other types of food equipment if lead was used to make these wares. According to the Food and Drug Administration, food equipment must be lead free or contain levels of lead not exceeding those listed in Chart 1:

CHART 1		
Equipment	Description	Max Lead Concentration (mg/l) or %
Hot Beverage	Coffee Mugs	0.5 mg/l
Large Hollowware	Bowel size > 1.16 quart (1.1 liter)	1.0 mg/l
Small Hollowware	Bowel size < 1.16 quart (1.1.liter)	2.0 mg/l
Flat Utensils	Plates and Saucers	3.0mg/l
Pewter Alloys	Used for any type of food equipment	0.05 %
Solder and Flux	Used for any type of food equipment	0.2%

Lead when consumed may cause permanent damage to a person’s nervous system.

Copper and copper alloys, such as brass equipment may not be used with food that has a pH less than 6.0. Acid food will cause the copper to attach onto food, which may result in food borne disease. The signs and symptoms include diarrhea and “green” colored vomit.

Zinc poisoning occurs if galvanized equipment is used. The galvanization process, which contains zinc, coats metal surfaces, such as metal trashcans and the insides of some hermetically sealed food containers to prevent oxidation of metal surfaces. However, after a hermetically sealed food can is opened, the food may react with the galvanized coating causing the zinc to leach into food. Zinc in food may cause food borne disease, therefore, it is important to never use any type of galvanized container and remove food from opened hermetically sealed cans immediately after opening.

Other types of chemical poisonings occur if chemicals used in a food operation are not properly labeled or stored. Chemical poisonings have happened because chemicals were not properly labeled and a chemical is accidentally used in a recipe, or chemicals are carelessly stored near food.

■ Physical Hazards

Physical hazards usually get into food accidentally. Examples of physical objects that have been found in food include band-aides, rocks, string, glass, nuts and bolts. These objects may get into food if food equipment is not

properly maintained, or if food handlers are careless and do not cover a band-aid on a finger with a disposable glove, or if food, such as beans and produce, is not properly washed.

Biological Hazards

Biological hazards consist mainly of three groups of microorganisms: bacteria, viruses and protozoa. They get into food through cross-contamination, fecal/oral transmission, and use of untreated water. Viruses and protozoa do not grow or multiply in food; they only grow and multiple in a living host. Bacteria, on the other hand, is capable of growing and multiplying in potentially hazardous food.

The definition of a potentially hazardous food is a food that can support the growth of disease causing bacteria. Food that can support the growth of disease causing bacteria is technically defined as a food with a pH greater than 4.6 or a water activity of greater than 0.85. A food that has a pH greater 4.6 is less acidic than a food with a pH of 4.6 or less, and a food that has a water activity greater than 0.85 has more moisture than a food that has a water activity at 0.85 or less. Both the pH and water activity of a food must be confirmed by laboratory analysis.

The best way for a food operator to determine if a food is potentially hazardous is to read the manufacturer's label on the food package. A food operator must know what foods are potentially hazardous so the proper precautions are taken to prevent food borne disease. The following is a list of common potentially hazardous food:

- Whole Fresh Eggs
- Dairy Products
- Raw and Cooked Meat (poultry, fish, beef, pork, ratite and inspected and approved wild game)
- Shellfish (mollusk and crustacean)
- All cooked vegetables
- Raw Sprouts (alfalfa, bean and clover)
- Cut melons (watermelon, honeydew and cantaloupe)
- Cooked legumes (beans)
- Cooked grains (rice)
- Chopped garlic in oil



All of the food listed above supports the rapid growth of disease-causing bacteria. However, it is important to remember that powdered food, such as milk, eggs, infant formula and pancake mix becomes a potentially hazardous food after it is mixed with water or mil. It must be refrigerated. It is also important to remember thta any food can be a vehicle for most microbes.

FOOD CONDITION AND STORAGE⁽¹⁴⁾

Approved Source and Condition

Food must be from an approved source. Unapproved sources include food prepared in a non-permitted kitchen (like a home), non-inspected meat, raw dairy products, or produce and eggs from non-commercial sources. Condition of the food must also be considered. Food may not be used:

- From damaged hermetically sealed containers or damaged packages
- If it is moldy (mold that was not part of the production process)
- If it was held at improper temperatures for over 4 hours
- If it has been contaminated from untreated water, dirt or other pollutants

Cold and Hot Storage

Potentially hazardous food must be stored at proper cold and hot temperatures. The **temperature danger zone** for potentially hazardous food is between:

45°F ←————→ 140°F

Pathogenic bacteria multiply at rapid rates if potentially hazardous food is left in the temperature danger zone. Potentially hazardous food that has been left in the temperature danger zone for over 4 hours must be discarded because it can cause disease.



Potentially hazardous food must be held cold at 45°F or less and held hot at 140°F or greater to slow down microbial growth. Even at 45°F or less microbes are growing and reproducing, but at a slower rate. Therefore, there is a time limit that potentially hazardous food (PHF) may be held in cold storage. If cold storage temperatures are maintained between 41°F and 45°F, then PHF is good for 4 days. However, if cold storage temperatures are consistently at 41°F or less then PHF is good for 7 days.

Frozen food must be held at 0°F or less so food is frozen completely to halt microbial growth. Once food is thawed, it may not be refrozen unless it is cooked after it has been thawed.

Date Marking

Opened packages or containers of PHF, and prepared PHF that are not used within 24 hours must be date marked. Each food item must be date marked with the date the PHF was opened or prepared and the date it expires.

Frozen packages of PHF must be date marked indicating the number days left before it expires once it is returned to cold storage. There is no time limit for food that is properly frozen. However, once a PHF is removed from a freezer the expiration time begins immediately, not allowing for thawing time.

Thermometers

Thermometers, which must be accurate $\pm 2^\circ\text{F}$ must be placed in all cold storage units including refrigerators, ice chests and freezers to monitor temperatures. Dial face thermometers may be used to monitor cold or frozen temperatures.

Metal probe thermometers, which must be accurate $\pm 2^\circ\text{F}$ must be used to monitor hot food temperatures. These probes are made to take internal food temperatures, and must be placed in to a certain depth in order to take accurate temperatures (read manufacturer's instructions). However, before inserting a probe into food, make sure the probe has been washed and sanitized. The proper way to take a food temperature is to insert the probe in the:

- Top portion of hot food diagonally being careful not to touch the sides of the pan
- Middle of two frozen food packages to record frozen food temperatures
- Warmest portion of cold food to make sure proper food temperatures are being maintained
- Thickest part of cooked food to make sure it reached the minimum cooking temperature

Metal probe thermometers must be calibrated on a daily or weekly basis, depending on use, to make sure they are accurate. Ice baths may be used to calibrate metal probe thermometers in a backcountry setting. This is done by placing 70% ice and 30% water in a glass and placing the probe in the ice bath (make sure cubes of ice are in the bottom of the glass). Read the temperature after allowing the thermometer to adjust. An ice bath that has a sufficient amount of ice has a temperature of 32°F. If a thermometer is off by more than 2 degrees, then it must be adjusted or replaced.

■ Dry Storage

Canned or packaged food, not requiring cold storage, must be stored in containers or boxes to prevent insects and vermin from getting into dry food. If there is evidence that rodents have gotten in to the food, then the food must be discarded. This food must also be protected from inclement weather as well as air borne contaminants. Dry food needs to be inspected periodically for insect infestations as well.



■ Cross-contamination

To prevent cross-contamination of food:

- Store pre-cooked food or ready-to-eat food, such as lettuce, grapes and other similar food over raw meat or in a separate cold box
- Store different raw meat separately and store them in the following order: fish meat on top followed by pork, then ground beef and poultry on the bottom

FOOD PREPARATION⁽¹⁴⁾

■ Food Assembly

Produce

Prior to eating, produce must be washed with treated water to remove dirt and microorganisms. Some produce, such as berries may need to be soaked in clean water to loosen dirt. To prevent food borne illness, it is important that all produce is washed thoroughly to remove dirt and debris. The Centers for Disease Control and Prevention has indicated that the number of food borne diseases associated with produce has increased during the last 5 years. Therefore, the importance of washing produce cannot be overstated.

Untreated water may not be used to wash produce. Water must be treated in accordance with the procedures listed in the water purification section of this manual.

Ready-To-Eat Food

Ready-to-eat food, such as lunch meat, cheese and lettuce that is not cooked or heated after being handled by a food operator before it is served to guests, is potentially hazardous food. If ready-to-eat food is handled with bare hands, there is a greater risk of food borne illness because large numbers of

microorganisms are transferred from bare hands to these food items.

Consequently, food operators are required to wear single-use gloves or utilize utensils to serve ready-to-eat food to avoid bare hand contact.

■ Cooking Temperatures

Potentially hazardous food (PHF) must be cooked to proper temperatures because of the various pathogens associated with different PHF. The required cooking temperatures for each type of food are as follows:

Commercially processed food • 140°F for 15 seconds

Commercially processed food is food that is pre-cooked and processed in a commercial kitchen facility, and packaged or canned. Examples of commercially processed food include hot dogs, various types of lunch meats, and canned potentially hazardous food.



Non-commercially processed food • 145°F for 15 seconds

Non-commercially processed food includes any food that is prepared outside an approved commercial canning or packaging facility. Non-commercially processed food includes fish, eggs, pork and steak except those foods listed below. Steak may be cooked to order as long as the outside surfaces are seared to a temperature of at least 145°F for 15 seconds.



Ground or Injected Meat and Ratite Meat • 155°F for 15 seconds

Injected meat is when another food substance, such as a sauce or honey is injected inside muscle tissue. When whole muscle tissue is injected with a food substance then microbial contaminants can be introduced deep into the tissue as well. Therefore, injected tissue must be cooked to 155°F for 15 seconds. Ratite is Ostrich or Emu meat. These fowl are not common carriers of Salmonella and Campylobacter and therefore may be cooked to 155°F for 15 seconds. Inject poultry must be cooked to 155°F.

Poultry and Stuffed Food • 165°F for 15 seconds

Poultry includes chickens, turkeys, ducks, pheasants and other game hens. Stuffed food comprise stuffed fish, stuffed meat, stuffed pasta and any other stuffed potentially hazardous food.

The cooking temperatures listed for the potentially hazardous food (PHF) listed above are used to “kill” the pathogenic microbes that might be present. Both a temperature and time are indicated for each PHF. The temperature is the minimum cooking temperature and the time of 15 seconds means that all portions of that particular food must be cooked to that temperature and held at that temperature for at least 15 seconds.

For example, when grilling or barbecuing chicken, the temperature of the thickest part of the food must reach at least 165°F for 15 seconds, which would be the center of the piece just away from the bone. Once chicken meat has been cooked to at least 165°F for 15 seconds, then a food operator can assume that the two primary bacterial pathogens of poultry (Salmonella and Campylobacter) have been destroyed. Again, it is of the utmost importance that a food operator sets the thermometer to be certain that proper temperatures are reached.

■ Consumer Advisory

If guests are allowed to order potentially hazardous food raw or undercooked (less than the cooking temperatures indicated above), then a backcountry operator must provide a consumer advisory to a guest in writing. A consumer advisory consists of two parts: Disclosure and Reminder.

The **disclosure** part of the consumer advisory must indicate the food item that is served raw or undercooked. For example, raw shellfish, sunny side up eggs, or hamburgers cooked to order. The **reminder** part of a consumer advisory warns a guest of the hazard(s) that may be associated with consuming the raw or undercooked food.

An example of an appropriate consumer advisory is:

“Hamburgers Cooked to Order – The consumption of raw or undercooked hamburger meat may increase your risk of food borne illness, especially if you have certain medical conditions.”

Backcountry operators must take note that consumer advisories do not remove liability of an operator, advisories are to warn guests of the hazards in an effort to prevent food borne illness. For a backcountry setting, advisories

may be printed individually and given to guests who order potentially hazardous food raw or undercooked; a verbal warning is not enough.

At-Risk Groups

At-risk groups include elderly, pre-school aged children, pregnant women and immune compromised individuals. These four groups are highly susceptible to diseases. Therefore, if a backcountry operator caters to a recognized at-risk group, then certain foods may not be served to these groups. These foods include:

- Non-pasteurized dairy products or juices
- Raw or undercooked fresh whole eggs
- Raw or undercooked ground meat, fish, shellfish, or other similar potentially hazardous food (this does not include steak from whole muscle tissue as long as the outside surfaces are seared to at least 145°F for 15 seconds)
- Raw seed sprouts
- Leftover food

All of the items listed above cannot be served to at-risk groups!

Cooling and Reheating Food

Backcountry operations are not allowed to serve potentially hazardous leftover food (PHF) because mechanical refrigeration to properly cool food is not available in the backcountry.

The only situation where leftover PHF may be served is during an emergency. An emergency is if no other food is available due to an accident that destroyed or contaminated supplies for a trip. If an emergency occurs, then a backcountry operator may use leftovers if proper steps for cooling and reheating are followed.

Cooling

Potentially hazardous food must be cooled to 45°F in 4 hours. This may be accomplished during a backcountry trip by:

1. Placing hot food in a plastic sandwich or freezer bag so that the overall thickness of the filled bag is not greater than 2 inches.
2. Seal the plastic bag, which contains the hot food, and place it in an icebox directly on top of an ice pack or block of ice.
3. After 2 hours, flip the bag of hot food so the opposite side touches the ice pack or block of ice for the remaining 2 hours.

Reheating

Rapidly reheat the chilled potentially hazardous food to at least 165°F over an open flame before reserving the food hot. However, chilled potentially hazardous food does not require reheating if the food is served cold.

Cross-Contamination



To prevent cross-contamination during food preparation, make sure:

1. Hands are properly washed after they touch contaminated items!
2. Food contact surfaces are properly sanitized before, during and after use
3. Utensils are not reused (Do not use the same utensil for cooked and raw meat during preparation)
4. Raw and ready-to-eat food is not prepared on the same surface at the same time
5. Raw meat is not stored over or next to ready-to-eat food
6. Single-use gloves are changed after they become contaminated (single-use gloves cannot be washed or re-used!)
7. Chemicals are not stored in close proximity to food or food equipment
8. Food is protected from animal contamination during a backcountry trip

FOOD SERVICE⁽¹⁴⁾

Time/Temperature Control Requirements



Potentially hazardous food must be held at proper hot or cold temperatures when the food is served to guests. Hot holding temperatures must be at least 140°F and cold holding temperatures must be 45°F or less.

The only exception to the hot and cold holding temperature requirement is if potentially hazardous food is served within 4 hours, and the food is discarded immediately after the meal.

Food Protection during Service

Care must be taken by a backcountry food operator to protect food from becoming contaminated during service. Contamination of food may occur if:

1. Food is not properly covered and guests accidentally spit, sneeze, or drop hair on the unprotected food.
2. Dispensing utensils are not provided for guests to keep them from touching the food.
3. Insects, such as flies or other animals are allowed access to the food.
4. Food is not protected from inclement weather, such as rain and wind.

WASH AND SANITIZE⁽¹⁴⁾

Equipment must be washed and sanitized before, during and after each use; whenever they become contaminated. If equipment is not properly washed and sanitized then contaminants will be present on the equipment.



Dishwashing Procedures

Steps to properly wash equipment are:

1. Pre-flush, scrape and soak to remove food debris
2. Wash equipment in hot soapy water
3. Rinse equipment in hot clean water to remove soap
4. Sanitize equipment in sanitizing solution with one of the sanitizing agents specified in the next section
5. Air dry; do not towel dry!



Figure 2 is an example of a dish wash set up in a backcountry location. The first bucket is used to pre-flush dishes, the second to wash, third to rinse and the last bucket to sanitize. Equipment is air dried in the hammock that is strapped to the legs under the table.

Figure 2.

Equipment that cannot be easily washed in a bucket system must be cleaned in place using the same steps:

- pre-flush
- wash
- rinse
- sanitize
- air dry.



Sanitizing Agents

The following chemical sanitizing agents are approved by the Food and Drug Administration for food surfaces:

1. Chlorine. Household bleach contains chlorine and may be used to sanitize food equipment by referring to the following table:

Chlorine			
Concentration (ppm or mg/l)	Temperature	Time	pH (seconds)
25	120°F	10	10 or less
50	75°F	10	8 or less
50	100°F	10	10 or less
100	55°F	10	10 or less



2. Quaternary ammonia. It must be used as shown in the following table:

Quaternary Ammonia Compound			
Concentration (ppm or mg/l)	Temperature	Time (seconds)	Water Hardness (ppm or mg/l)
200 (or specified by manufacturer)	75°F	30	500 or less

3. Iodine. It must be used as shown in the following table:

Iodine			
Concentration (ppm or mg/l)	Temperature	Time (seconds)	Water Hardness (ppm or mg/l)
12.5 to 25	75°F	30	5 or less

FOOD EQUIPMENT⁽¹⁾

Approved Construction

Food equipment must be constructed of material that does not allow the migration of deleterious substances or impart odors, tastes, or colors to food. Food equipment must be:

1. Safe
2. Durable (withstand repeated washing)
3. Non-absorbent
4. Resistant to corrosion, pitting, chipping, crazing, scratching, scoring, distortion and decomposition
5. Smooth and easily washable

Examples of approved contact surfaces include:

1. Hard wood, such as maple or High Density Polyethylene for cutting boards
2. Pyrex or Stainless Steel for cookware
3. Stainless Steel and Porcelain for dishes

Single-service articles may be used instead of reusable cups, plates and utensils.

Condition

As food equipment wears it must be replaced to prevent cross-contamination. If equipment is



not smooth, free of cuts and grooves, then it must be replaced. Equipment that commonly wears is cutting boards.



QUIZ – FOOD SECTION

1. What is considered food?
2. What steps must be taken by a person-in-charge if a food handler is diagnosed with one of the four diseases of concern (Hepatitis A, *Escherichia coli*, *Salmonella typhi*, or *Shigella spp.*)?
3. What steps must a person-in-charge take if a food handler reports that he/she has diarrhea and the operation serves at-risk people?
4. When can a food handler return to work after he/she has been diagnosed with one of the four organisms of concern?
5. What is the primary method a food handler can use to prevent the spread of food borne diseases?
6. When must a food handler wash her/his hands?
7. What type of hand wash facility design is acceptable for a backcountry setting?
8. What type of hand sanitizers may be used by food handlers?
9. List the three main hazards of food.
10. What type of microorganism can grow and reproduce in potentially hazardous food?
11. What is the temperature danger zone?
12. What type of thermometer must be used to monitor internal food temperatures?
13. What is cross-contamination?
14. Why is it important to wash produce prior to consumption?
15. What is ready-to-eat food, and why is it important to avoid bare hand contact with this type of food?
16. What is the proper cooking temperature of ground pork?
17. What is the proper cooking temperature of fish filets?
18. What is the proper cooking temperature of stuffed manicotti?
19. What is the proper cooking temperature of canned beans?
20. What two parts must be provided for a Consumer Advisory, and explain what they are?
21. List the four groups that are considered at-risk.
22. What kind of situations may a backcountry operator serve leftover potentially hazardous food?
23. What temperature must leftover food be reheated to?
24. Explain what is time/temperature control?
25. Describe proper dish washing procedures.
26. Can household bleach be used as a sanitizing agent?
27. If the pH of water is 9.0 and the water temperature is 58°F, then what is the concentration of chlorine for sanitizing dishes?
28. What type of materials may be used for cutting boards?

HUMAN EXCRETA & SOLID WASTE

Toilet System

- Toilet Design and Maintenance
- Hand Wash
- Toilet Clean Up
- Human Waste Disposal

Solid Waste

- Handling and Storage
- Solid Waste Disposal

QUIZ



HUMAN EXCRETA & SOLID WASTE

TOILET SYSTEM

Most backcountry operations are required to provide portable toilets for guests, and dispose of the human excreta at the end of a trip. Portable toilets come in a variety of designs. A common design is where an ammo container is modified into a toilet, as shown in Figure 1.



Figure 1.

The ammo container toilet design has a modified toilet seat that extends inside the container so there are no air gaps between the seat and container. The toilet seat is usually constructed of a solid plastic material, and the toilet seat “bumpers” are removed to provide a fly-tight fit.

The inside of the ammo container that holds human excreta is finished with a smooth, washable and durable material, such as commercial-type paint, so it is easy to clean when the container is emptied.

All of the toilet chemicals and equipment are stored in another ammo container, which is located nearby the toilet set up when it is in use. This extra container is used to store:

- Disinfectants for clean up
- Chemicals that are used in the toilet to assist with digestion of the waste
- Toilet paper
- Toilet brushes
- Chemical gloves
- Soap

When the toilet system is not in use, the toilet seat is removed from the base container and placed in a garbage bag to be stored in the second ammo container. The toilet brush is stored in a separate bag alongside the toilet seat in the second container. The lids for both ammo containers are placed and clamped to prevent spillage during the trip.

Hand Wash Facility

A hand wash facility must be located nearby a toilet facility to promote good hygiene and to prevent the spread of contagious diseases during a backcountry trip. This hand wash facility must be similar in design as the one described in the Food Section of this manual. A hand wash set up must be pump operated or gravity fed. There must be a reservoir for clean water as well as a container to catch the dirty hand wash water.



A toilet facility must also have dispensed soap; however, paper towels are optional at this hand wash facility (unlike the one located in a food preparation area).

Toilet Clean Up

A backcountry operator must take steps to protect themselves from exposure to human waste during the cleaning and packing of a toilet. The following is an outline of the proper steps:

1. Protective eye ware must be worn to protect an operator's eyes from exposure to human waste
2. Chemical gloves must be worn to protect hands, wrists and lower arms from exposure
3. Spilled waste on toilet seats, outside surfaces of the toilet, or on the ground must be cleaned, the area disinfected with a virucide and dispose excreta inside the toilet (Do not dispose excreta on the ground or in surface water!)
4. Disinfect the toilet seat and any other attachments with a virucide before storing
5. Place toilet lid on toilet and clamp
6. Place toilet seat and toilet brush in bags and place them in the toilet equipment container
7. Disinfect gloves and place them in the toilet equipment container and place lid on the container
8. Wash hands, wrists and arms thoroughly for at least 20 seconds with soap and water. Also, wash any other part of the body that may have been exposed to excreta

■ Human Excreta Disposal

The disposal of human excreta or waste is regulated by the federal Resource Conservation and Recovery Act (RCRA) and the Clean Water Act⁽¹⁶⁾. These regulations require human waste to be properly disposed to protect human health. It is prohibited to dump waste on the ground, in surface waters, or in a landfill. Proper disposal requires human waste to be disposed at an approved wastewater treatment plant or approved on site wastewater system.

Some backcountry operations have an approved onsite wastewater disposal system to handle waste from their backcountry operation. Other backcountry operations take their waste to an approved wastewater treatment facility, or have a permitted septic pumper dispose of the waste for them.

SOLID WASTE

Backcountry operations are required to carry waste out from a trip. It is prohibited to dump waste anywhere except at an approved solid waste facility! The following two sections cover requirements for solid waste.

■ Handling and Storage

Containers and bags must be taken on a trip for solid waste storage. If possible, solid waste should be separated by type, especially if waste is recycled after a trip. Putrescible waste must be stored in a water-resistant container, and stored where wild animals cannot access it.



Non-rotting waste may be divided into 4 groups: aluminum, paper, plastic and glass. The non-rotting wastes may be stored in garbage bags where animals cannot get to them.

Solid waste must be stored in a safe place; never in close proximity to food and food equipment!

■ Solid Waste Disposal

The federal government regulates the disposal of solid wastes. Backcountry operators must carry out all solid waste from a trip and have it properly disposed at an approved landfill, other approved site, or recycled at an approved facility⁽¹⁸⁾.

QUIZ ANSWER KEY

DISEASE SECTION QUIZ

1. A disease that is transmitted from animals to humans.
2. Yes, especially for at-risk individuals.
3. Elderly, pre-school aged children, pregnant women and immune compromised individuals.
4. Potentially hazardous food.
5. Yes.
6. It can be prevented by:
 - Not serving “home” canned food
 - Not using potentially hazardous food from dented or bulged hermetically sealed cans
 - Immediate chilling of baked potatoes or other cooked vegetables
7. These two pathogenic organisms are commonly associated with poultry, poultry products and whole fresh eggs. Cooking poultry to 165°F for 15 seconds and fresh whole eggs to 145°F for 15 seconds can destroy these organisms.
8. Proper water treatment.
9. Cattle are the primary reservoir of this pathogenic organism. Searing the outsides of steaks to 145°F for 15 seconds and cooking ground beef to 155°F for 15 seconds can destroy this organism.
10. It can be prevented by thoroughly washing hands; by not preparing food if you have diarrhea and by thoroughly washing produce with treated water prior to consumption.
11. Food handlers are the primary source of this disease, and implementing thorough hand washing may prevent the disease.
12. Proper handwashing, proper sanitizing, proper dishwashing, and proper cooking.
13. It is transmitted fecal/orally.
14. This disease may be prevented by thorough hand washing and by not preparing food if you have diarrhea and/or vomiting.
15. *Giardia lamblia* and *Cryptosporidium parvum*.
16. *Amoebic Encephalitis*.
17. They can be removed by filtration.
18. Quick and proper removal of ticks.
19. Prevent mosquito bites by wearing long-sleeve shirts, proper use of repellents, and sleep inside a tent or other mosquito-resistant enclosure.
20. The primary reservoir is a deer mouse, and the disease may be prevented if buildings are mouse “proofed”. However, if there is evidence of mice

in a building then the proper precautions must be taken to properly ventilate the building and disinfect with a virucide prior to cleaning – never dry clean a building that contains rodent feces!

21. Erythema migrans, which is a red spot or patch with a center clearing.
22. Fleas are the vector, and the disease may be prevented if steps are taken to de-flea pets and not camp next to rodent burrows.
23. A bite from an infected mammal primarily transmits rabies. If bitten, the wound must be immediately washed with soap and water, the health authority contacted so the animal may be tested for rabies.
24. They are transmitted by the bite of an infected tick. Rocky Mountain Spotted Fever (RMSF) is transmitted by a “hard” bodied tick and Tick Relapsing Fever is transmitted by a “soft” bodied tick that feeds at night and does not attach to its host. Therefore prevention for these two diseases is different. For RMSF wear proper clothing and check yourself routinely for ticks. For Tick Relapsing Fever do not sleep next to rodent burrows and have cabins checked routinely for rodent nests.
25. Rabbit Fever or Deer Fly Fever.

WATER PURIFICATION SECTION QUIZ

1. Collect water from mid-stream, if possible, as far away from edges and eddies.
2. To remove suspended solids that may hide or protect microbes from treatment.
3. Alum.
4. At least 30 minutes.
5. To prevent waterborne diseases.
6. *Giardia lamblia*, *Cryptosporidium parvum* and Norwalk Virus.
7. Eight minutes.
8. *Giardia lamblia*, *Cryptosporidium parvum*.
9. By destroying cell walls of bacteria and protein capsids of viruses.
10. Because the suspended solids can shield microbes from treatment.
11. A pH of 5.0.
12. Using a coagulant, such as alum.
13. The procedure is: wash – rinse – sanitize – air dry.
14. A 100 ppm.

FOOD SECTION QUIZ

1. Any food, beverage, or ice – essentially anything that may be consumed.
2. The person-in-charge must exclude the food handler if he/she is diagnosed with one of the 4 diseases of concern.
3. The person-in-charge must exclude the food handler.

4. A food handler may return to work after they receive written permission by a licensed physician or approved representative.
5. By properly washing hands.
6. After eating, drinking, using the bathroom, handling raw meat, touching animals, cleaning a water filter, or whenever hands become contaminated.
7. A hand wash facility that is pump operated, so dirty hands do not touch the clean water.
8. Those that are approved by the U.S. Food and Drug Administration.
9. Chemical, physical and biological.
10. Bacteria.
11. Between 45°F and 140°F.
12. A metal probe thermometer that is accurate $\pm 2^\circ\text{F}$.
13. Cross-contamination occurs if raw meat is stored over ready-to-eat food, or when food contact surfaces like cutting boards are not properly washed and sanitized after each use, or if food handlers do not properly wash hands.
14. To remove contaminants prior to consumption.
15. Ready-to-eat food is food that does not require heating prior to consumption. It is important not to handle ready-to-eat food with bare hands to prevent the spread of disease.
16. 155°F.
17. 145°F.
18. 165°F.
19. 140°F.
20. The two parts of a Consumer Advisory include the disclosure and reminder sections. The disclosure informs the guest which food is served to order and the reminder explains what the risks are.
21. Immune compromised individuals, pregnant women, elderly and pre-school aged children.
22. Backcountry operators may serve leftovers only in emergencies; otherwise, it is prohibited to serve potentially hazardous food as leftovers in a backcountry setting.
23. 165°F.
24. A time/temperature control is where potentially hazardous food is left out in the temperature danger zone, but is discarded after 4 hours.
25. Wash – rinse – sanitize – air dry.
26. Yes, because the active ingredient is chlorine.
27. 100 ppm.
28. Hard wood like maple or high density polyethylene plastic.

HUMAN EXCRETA AND SOLID WASTE SECTION QUIZ

1. To prevent vectors, such as flies from mechanically transporting disease from feces to guests.
2. So it is readily accessible for everyone to wash hands after using the toilet.
3. Use a disinfectant, gloves and disposable paper towels to clean up waste, then place the waste and towel in the toilet.
4. Remove rings and watches prior to washing, then wash all parts of hands, wrists and forearms with soap and water for 20 seconds, then air dry or use disposable towels.
5. An approved wastewater treatment facility.
6. Non-absorbent, leak-proof containers with tight fitting lids.
7. An approved site such as a licensed landfill.

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APPENDICES

APPENDIX A. Bacteria multiply by a process called binary fission. Binary fission is asexual reproduction where one bacteria cell splits into two complete organisms. Pathogenic (capable of causing disease) bacteria grow and multiply very rapidly under the ideal conditions. For example, one pathogenic bacterial cell can multiply into 66 million cells within 24 hours in potentially hazardous food. Many of the bacterial food borne diseases discussed below only require 10 to 20 cells to cause disease in a single person.

APPENDIX B. During 1997 to 1998 the Centers for Diseases Control and Prevention reported 49 waterborne outbreaks involving 4,166 individuals in the United States⁽²⁾. This number does not include the numerous unreported cases. Approximately 12% of the waterborne outbreaks were associated with surface water, and *Cryptosporidium* caused the majority of these illnesses. In fact, the largest waterborne outbreak ever documented in the United States occurred in Milwaukee, Wisconsin during April 1993 where 403,000 people became ill with Cryptosporidiosis⁽²⁾. About 4,400 sick people were hospitalized and there were 108 deaths⁽²⁾. The reason this massive outbreak occurred is that the surface water source for Milwaukee, which is Lake Michigan, was not properly filtered to remove the *Cryptosporidium* oocysts.

APPENDIX C	
Microorganism	Size
Viruses	0.01 to 0.1 micrometers
Bacteria	0.1 to 10 micrometers
Parasite - <i>Giardia lamblia</i>	7 to 15 micrometers
Parasite – <i>Cryptosporidium parvum</i>	4 to 6 micrometers

APPENDIX D		
Microorganism	Percentage Removal/Inactivation	Log Removal/Inactivation
Enteric Viruses	99.99%	4-log
Pathogenic Bacteria	99.9999%	6-log
<i>Giardia</i> cysts	99.9%	3-log
<i>Cryptosporidium</i> oocysts	99%	2-log

APPENDIX E		
Free Available Chlorine (mg/l or ppm)	Time (minutes)	CT Value Viral Inactivation 4-log 99.99%
0.2	30	6
0.3	20	6
0.4	15	6
0.5	12	6
0.6	10	6
1.0	6	6
2.0	3	6
3.0	2	6
4.0	1.5	6

HOME STUDY EXAM

Return exam to: Environmental Health • 2500 N. Fort Valley Road • Flagstaff, AZ 86001

Backcountry Homestudy Course Examination

(Revised 8/19/02)

Directions: Multiple Choice Questions – pick only one answer and fill-in the corresponding number on the answer sheet. True and false questions – pick only one answer and fill-in #1 if the statement is true, or #2 if it is false on the answer sheet.

MULTIPLE CHOICE

(Questions 1 – 25)

1. The temperature danger zone in which pathogens grow and multiply rapidly is:
 - 1) Greater than 45°F
 - 2) 0°F to 140°F
 - 3) Between 140°F and 165°F
 - 4) Between 45°F and 140°F

2. What is the best way to prevent an outbreak of Salmonellosis and Shigellosis:
 - 1) Wash hands after preparing raw meat and using the toilet
 - 2) Wash cutting boards with soap and water
 - 3) Make sure all ice chests have accurate thermometers
 - 4) Toilet facilities must be equipped with disinfectants

3. What is considered an approved food source:
 - 1) Food prepared at home
 - 2) Raw milk
 - 3) Food that is obtained from sources that comply with the law
 - 4) None of the above

3. What internal temperature must poultry and poultry products be cooked to?:
 - 1) 145°F for 15 seconds
 - 2) 140°F for 15 seconds
 - 3) 165°F for 15 seconds
 - 4) None of the above

5. The hand wash set up for food handlers in the kitchen area must include:
 - 1) Treated or potable water, dispensed soap, and sanitary towels
 - 2) Treated or potable water, dispensed soaps, and air-dry
 - 3) River water, dispensed soaps, and air-dry
 - 4) River water, dispensed soap, and sanitary towels

6. Cross-contamination is:
 - 1) The main cleaning method for all food-contact surfaces that have been contaminated
 - 2) The transfer of harmful substances or microorganisms to food from food or from a nonfood-contact surface, such as equipment, utensils, or hands
 - 3) The removal of certain bacteria from food by cooking it thoroughly
 - 4) The prevention of food borne illnesses

7. What is the best way to prevent tick borne diseases:
 - 1) Wear long sleeves and pants that hang over boots and shoes
 - 2) Use repellents
 - 3) Stay on a boat
 - 4) Wash and sanitize food surfaces

8. What is the best method to remove water borne parasites, such as *Giardia* and *Cryptosporidium*?:
 - 1) Pretreat water with alum
 - 2) Disinfect water with chlorine or iodine
 - 3) Filter water with a 1 micron “absolute” filter pore size that complies with NSF standard 53
 - 4) Allow a 30-minute settling time

9. Which material is approved for food contact surfaces:
 - 1) Enamelware that never chips
 - 2) Galvanized metal containers for storing juices, lemonade, and tea
 - 3) Hard maple wood or high density polyethylene
 - 4) Lead or lead-based pans, which do not rust

10. The most important rule of food service personal hygiene is that employees must:
 - 1) Wear gloves at all times
 - 2) Completely give up smoking
 - 3) Wash their hands often
 - 4) See a doctor twice per year

11. What is the best method for the removal of water borne viruses, such as Norwalk-like Virus?:
 - 1) Proper disinfection using chlorine or iodine
 - 2) Proper filtration
 - 3) Pretreatment with alum
 - 4) Air drying water containers

12. If food had to be chilled for emergency purposes, what is the proper procedure:
 - 1) Place the hot food in a sanitized bucket and chill in the river
 - 2) Leave the food out at an ambient air temperature then place in a cooler before bedtime
 - 3) Place hot food in a freezer bag, making sure the bag is no more than 2 inches thick, then place it directly on ice
 - 4) Cover the container of hot food and leave it out over night

13. Portable toilet facilities must be fly-tight primarily to:
 - 1) Prevent the spread of diseases
 - 2) Keep dust and dirt out
 - 3) Prevent odors from leaking out
 - 4) Keep rodents out

14. Discard any poultry that:
 - 1) Has been improperly chilled
 - 2) Has been improperly cooked
 - 3) Both 1 and 2
 - 4) None of the above

15. The fresh whole shell eggs must be held at:
 - 1) 25°F or less
 - 2) 45°F or less
 - 3) 55°F or less
 - 4) 60°F or less

16. In which case can a damaged hermetically sealed container of food be used:
 - 1) If it is dented on a top seam or side seam
 - 2) If it is rusted only on a side seam
 - 3) If it is bulged at one end and there are no dents
 - 4) If it is dented on the side where no seams are involved and the metal is not creased

17. If a supplier offers you a good deal on home-canned tomatoes:
 - 1) Take it, but wash off the cans
 - 2) Reject it, but see if the supplier has home-canned green beans
 - 3) Reject it, or any other offer for home-canned foods
 - 4) Take it, but chill the tomatoes to 41°F

18. If potentially hazardous food has to be reheated for emergency purposes, what is the proper procedure:
 - 1) Reheat to 165°F on the stove and hold at that temperature for at least 15 seconds and serve
 - 2) Reheat to 145°F on the stove and hold that temperature for at least 15 seconds and serve
 - 3) Reheat to a rolling boil and serve
 - 4) Reheat until hot to the touch and serve

19. Frozen raw fish should be stored:
 - 1) Unwrapped
 - 2) At 30°F for long-term thawing
 - 3) Wrapped in an air-tight and moisture proof wrapping
 - 4) Under raw chicken

20. Cutting boards may be constructed of which of the following materials:
 - 1) Hard oak wood or glass
 - 2) Hard maple wood or high density polyethylene
 - 3) All hard woods
 - 4) None of the above

21. Which one of the following foods is not a Potentially Hazardous Food:
 - 1) Dairy products including non-dairy liquid creamers
 - 2) Cooked and raw meat and meat products
 - 3) Cooked onions and chopped garlic in oil
 - 4) Chopped lettuce

22. What is the proper concentration of chlorine sanitize for the dish-wash buckets if the water temperature is at least 75°F and the pH is 8.0 or less:
 - 1) 400 ppm
 - 2) 200 ppm
 - 3) 50 ppm
 - 4) As much as you want

23. The proper dish-wash procedure is:
 - 1) Wash-rinse-sanitize for 60 seconds-air dry
 - 2) Wash-rinse-sanitize for 2 minutes-air dry
 - 3) Wash-sanitize for 2 minutes-rinse-air dry
 - 4) Wash-rinse-sanitize for 60 seconds-towel dry

24. What is the proper cooking temperature of ground beef:
- 1) 165°F for 15 seconds
 - 2) 145°F for 15 seconds
 - 3) 155°F for 15 seconds
 - 4) None of the above
25. The food borne parasite *Trichinella spiralis* is commonly found in:
- 1) Poultry
 - 2) Pork
 - 3) Beef
 - 4) Fish
26. Which one of the following water purification methods is recommended:
- 1) Boil for one minute and add an additional minute for each 1,000 foot above sea level
 - 2) Filter water through an “Absolute” 1-micron filter only
 - 3) Add two drops of bleach per quart of water and allow for a 30-minute detention period
 - 4) Surface water sources require no treatment
27. The most common vehicle of food borne diseases is:
- 1) Hair
 - 2) Hands
 - 3) Cutting boards
 - 4) Thermometers

TRUE OR FALSE

28. Refrigerating food at 45°F kills all microorganisms.
29. Food borne illness may occur even if bacteria are killed during the cooking process.
30. Wearing disposable gloves means you do not have to wash your hands.
31. People can carry and spread disease without showing any symptoms of the disease.
32. Sanitizing lotions or hand dips may be used after washing hands, but must be approved by the Food & Drug Administration for contact with food.
33. There are more reported illnesses associated with the consumption of food than all other environmental factors combined.
34. Human excreta may be disposed at a landfill.
35. The coldest area in an icebox is near the top.
36. Store cooked and ready-to-eat foods above the raw foods to avoid cross-contamination.
37. Thawing food at outdoor temperatures is safe.
38. Fresh whole eggs may be pooled and used the following day.

39. Ticks and mosquitoes spread the disease rabies.
 40. Hand wash facilities only need to be located near the toilet area.
 41. Fruit and vegetables never have to be washed if there is no visible dirt.
 42. A food worker who has acute gastrointestinal illness must report this to his/her supervisor and must be restricted from handling food.
 43. Suspended solids may be effectively removed from surface water prior to treatment by applying the proper amount of alum.
 44. If lettuce is contaminated with poultry blood and juices, just wash the lettuce and serve it.
 45. Both *Giardia lamblia* and *Cryptosporidium* cysts may be destroyed by a chlorine concentration between .1 and .5 ppm.
 46. Chlorine, iodine, and household ammonia may be used to sanitize food contact surfaces.
 47. The Food and Drug Administration develops and establishes guidelines for all types of food operations in the United States.
 48. Employees and guests may use their fingers to pick up food to eat if they wash and sanitize their hands just before they help themselves.
 49. If food smells, looks, and tastes good, you may be assured that is safe to eat.
 50. If human excreta is accidentally spilled on the ground, then it must be cleaned up and the area disinfected.
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COURSE EVALUATION

Please complete the following evaluation. (Your feedback is appreciated)

A. What did you like best about this homestudy course?

B. What did you like least about this course?

C. Suggestions/Comments: