



**WATER & SEWER**  
RISK MANAGEMENT POOL



# ***Wastewater Worker Safety Program***



Author Name: Len Cornwell  
Revised by: Vincent Gabrio  
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Districts: Sammamish Plateau & Coal Creek Utility District

# WASTEWATER WORKER SAFETY PROGRAM

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# WASTEWATER WORKER SAFETY PROGRAM

## PURPOSE / SCOPE

The purpose of the *Wastewater Worker Safety Program* is to ensure that all employees understand the potential hazards associated with exposure to all aspects of untreated wastewater, the risks and the equipment used. This program provides guidelines for the protection of those workers to the greatest extent possible, and to establish best management practices for working safely in such environments.

The procedures contained in this program describe basic, minimum precautions that should be adapted to each work task. Safety committee members and field staff should perform a hazard analysis of all existing facilities by identifying the potential hazards unique to each site and each task. Standard operation procedures should therefore be different in most cases.

### Policy Statement

It is the primary policy of the District to use engineering controls, additional personnel, PPE & tools wherever practical, to reduce or eliminate the need for employees to expose themselves to excessive wastewater hazards. Where employees must work in dangerous wastewater environments, it is the policy of the District that the employees will comply fully with this Safety Program.

## HAZARD ANALYSIS

### Hazard Description

Real quantitative evidence along with qualitative data relating to the biological hazards found in wastewater is contained in the studies listed in the References/Resources section located at the end of this program. They reveal serious risks that could potentially affect the health of any worker in a wastewater environment. Therefore, a hazard unique to municipal wastewater work is the wastewater itself.

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Workers can be exposed to wastewater throughout the collection and treatment processes by being splashed or immersed in wastewater, touching contaminated surfaces, by inhaling aerosols generated by wastewater flow and agitation, the sudden release of moisture when pulling, prying, scrubbing or through several other routes.

Municipal wastewater can potentially contain all the pathogenic microorganisms that are being shed, by hosts in the municipality's collection system. These microorganisms can include airborne, waterborne, food borne, blood borne, and sexually transmitted pathogens. In addition, wastewater or its treatment by-products can contain microbial cell-wall components, toxins, and allergens.

Wastewater collection system workers may be exposed to many of the pathogenic microorganisms present in wastewater. However, the opportunity for them to become infected by a pathogen depends on a number of factors which are highlighted below:

1. The pathogen must present in the wastewater.
2. The infectious dose
3. Concentration of the pathogen in wastewater
4. Route of exposure and transmission
5. Worker susceptibility to infection

## **Hazard Evaluation** (where the hazards are)

The location of areas of exposure risks include any wastewater treatment processes, whether confined or unconfined, or other areas/activities, such as:

- Sewer line jetting
- Hydro-vactor operations
  - In wastewater environments
  - Excavations for sewer line repair
- Chemical mixing
- Wastewater treatment processes
- De-ragging or repair of pumps/grinder pumps
- Atmospheres

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- Clearing/cleaning of bar screens
- Lift station maintenance & Wet-well cleaning
- Equipment/PPE Cleaning
  - The potential of infection is possible by coming into contact with contaminated clothing, tools or other equipment.

- (1) Inhalation of wastewater aerosols,
- (2) Direct contact with wastewater or sludge, by
- (3) Ingestion of food or water contaminated with wastewater or sludge (or accidental ingestion of wastewater or sludge itself) or
- (4) Cuts, punctures, etc. contaminated with wastewater or sludge.
- (5) Hazardous atmospheres –see Confined Space Entry Program

Infections from exposure to wastewater borne disease organisms may be subclinical or may appear as actual disease in wastewater workers. **New or younger workers tend to be ill more often than experienced workers.** Several years of exposure tends to produce eventual immunity for many workers to some organisms. This should not embolden workers to take risks.

Workers could potentially become infected from:

- Stool or feces
- Aerosolized droplets
- Mist produce from wastewater
- Water spray under pressure
- Hand to eye/mouth transfer
- Consumption
- Nasal/lung inhalation
- Working in the proximity of any of the above.

**Methods of Evaluation** (see studies at Reference/Resources)

## THE VECTOR-BORNE EXPOSURE

Workers exposed to untreated wastewater have the potential to be exposed to a wide variety of **Vector-Borne diseases**. These *include* micro-organisms originating form a number of sources via human and animals. These organisms are highlighted in **three basic categories** listed below:

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## Bacteria

Bacteria are single-celled microorganisms that are able to reproduce outside of a host cell and are ubiquitous in the environment. While most bacteria are not harmful to humans and animals, some bacteria are capable of causing infections and diseases and are called pathogens. Pathogenic bacteria are frequently found in raw and treated wastewater.

Wastewater personnel have a higher potential of exposure to bacterial pathogens than many other groups of workers. They are exposed daily to wastewater-contaminated environments. The most common species of bacterial pathogens found in wastewater are: *Escherichia*, *Salmonella*, *Shigella*, *Vibrio*, *Clostridium*, *Yersinia*, *Campylobacter*, and *Leptospira*.

See Table 1 at the end of this program for other bacteria found in wastewater.

## Parasites

A parasite is an organism, single celled or multi-cellular, which lives on the surface or inside of another organism of a different species. Waterborne parasites found in wastewater consist of various types of protozoa and worms. The parasites most frequently found in wastewater are listed in Tables 2, 3, and 4. These organisms and their eggs usually do not survive through the wastewater collection and treatment processes. The cysts and eggs, in which the protozoa and worms reproduce, however can resist adverse environmental conditions.

The most commonly studied protozoa are *Entamoeba histolytica*, *Giardia lamblia*, and *Cryptosporidium parvum*. *E. histolytica* is the etiologic agent of amoebic dysentery with symptoms that alternate between abdominal cramps, diarrhea, and constipation. Both *Giardia* and *Cryptosporidium* cause gastroenteritis. Most raw and treated wastewater contains the environmentally resistant, infectious forms of protozoan pathogens.

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## Viruses

Unlike bacteria and parasites, viruses are not living cells. Viruses can best be described as a packaged group of molecules containing the genetic information enabling them to infect a living cell and take over its machinery to make copies of the virus in large quantities. This process often leads to cell death. In some occasions, a virus can integrate its genetic material into the cell's chromosome and stay dormant for years. See Table 5 for viruses commonly found in wastewater.

## Exposure Determination

District field workers have the potential to become exposed to contaminated waste and/or inadvertently transfer it to other personnel, such as:

- A. **Sewer Technicians** in the Operations and Maintenance Department.
- B. **Water Technician** workers. This is most likely to occur during an on-call response or during a time when Water Technicians are assisting Sewer Technicians due to increased workloads. They could also become exposed when handling tools or wastes that were contaminated.
- C. **Inspectors**. This is most likely to occur during inspection of connections to live sewer systems.
- D. **Office staff:** a sewer technician's hands or contaminated PPE/clothing could potentially contaminate District's facilities.
- E. **Family members**. Contaminated clothes or personnel risk passing on infectious materials to their home environment.

## VECTOR-BORNE PATHS

The potential routes of entry of bacteria, parasites and viruses are:

- Oral
- Respiratory
- Wounds, such as:
  - Abrasions,

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- Contusions(blunt force trauma causing broken blood vessels below skin)
- Punctures
- Open-cuts or lacerations
- Burns
- Blisters
- Rashes
- Mucous membranes
  - Mouth
  - Nose
  - Ocular(eyes)
- Skin Contact(microbial agents)

## VECTOR-BORNE PATHS & HUMAN BEHAVIOR

Workers often make choices based on their own comfort level. Unfortunately, this often causes behavioral modifications that lead to poor choices. Inadequate PPE selection is a root cause for risk-filled exposure. Personal hygiene is another leading cause of infections. The gap between work related exposure and simple everyday tasks reveals the risks:

- Hand to eye Transfer
- Failure to protect or cover injuries or wounds
- Taking breaks
  - Cell phone use
  - Filling out reports
  - Smoking
  - Eating or chewing gum
  - Driving(touching the exterior or interior of a vehicle)
  - Lack of tool segregation & disinfection
  - The unsanitary application of lock-out tag-out devices
- Rules of operation & safety ignored on post-work call-outs

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- Workers should avoid the attitude that they are not really *at work* during evenings or weekend call outs. District vehicle's driven home for stand-by often lack needed safety equipment.
- Stand by personnel should always take extra steps to acquire additional personnel or equipment to work safely.
- Failure to clean or disinfect sewage backups or overflows into the environment or on people's personal property.
- Short-term site to site, repetitive work such as jetting sewer manholes often leads employees to assume the risk is minimal. Proper traffic or safety procedures may be ignored. Safety procedures should also be repetitive, and mandatory.

## RESPONSIBILITIES

### District

- Provide facilities and engineering controls where feasible to reduce employee exposure to hazards associated with untreated wastewater.
- Make sure employees use provided personal protective equipment correctly, if the District cannot feasibly control the hazard with engineering controls.
- Train employees about safe work practices when work tasks expose them to untreated wastewater.
- Make appropriate corrections to the District's *Wastewater Worker Safety Program* as needed.

### Designated Person or Safety Program Coordinator

- Establish and update the written *Wastewater Worker Safety Program*.
- Provide consultation/training to District staff regarding the Program.
- Assist in determining when and where a wastewater exposure hazard exists.
- Review and approve all Standard Operating Procedures with respect to safety issues.
- Maintain records of training for future reference.

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## Managers

- Identify to Safety Coordinator, locations where wastewater exposure hazards are known to exist.
- Establish and enforce the safe work practices for untreated wastewater environments.
- Implement administrative controls and enforce the use of appropriate engineering controls when applicable.
- Notify the Safety Coordinator when new facilities, equipment or procedures are being applied that may affect an employee's exposure to untreated wastewater hazards.
- Ensure that the equipment and materials required by this program are properly stocked, controlled, and maintained by assigned staff.
- Develop, in consultation with affected staff, written Standard Operating Procedures for the use and maintenance or replacement of equipment associated with the *Wastewater Worker Safety Program*.

## Employees

- Be aware and comply with all guidelines, rules and procedures outlined in this Wastewater Work Safety Program.
- Follow all safe & sanitary use of tools or other equipment
- Clean and disinfect all PPE after use
- Do not knowingly or willfully expose others to wastewater or sewage
- Utilize appropriate number of personnel when performing wastewater related work tasks
- Dispose of waste in a sanitary manner

## GUIDELINES/RULES

### Required PPE:

- Liquid-proof clothing appropriate to the wastewater environment.
- Safety glasses and/or safety goggles appropriate to the task.
- Face shield

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- Cut and puncture-resistant gloves meeting ANSI/ISEA Cut Level 5 and ANSI/ISEA Puncture Level 4.
- Liquid-proof gloves appropriate to the task
- Liquid-proof boots appropriate to the task
- Negative-pressure Air-Purifying Respirators, Disposable Particulate Respirators or other appropriate airway protective PPE for the protection from aerosolized untreated wastewater.
- Ear protection

## PPE Selection

PPE should be selected with a balanced approach to heat levels, endurance, body types, intensity of the work environment & fatigue. Primary consideration should be given toward the level of risk at each specific site.

Engineering control measures may have to be planned for and added for any work related activities where standard PPE is overcome due to the nature of the risk or hazard.

## Most Common PPE Mistakes

A worker is generally contaminated due to *operator error*. Shortcuts in avoiding basic PPE use due to time limitations, temperatures or a general feeling of inconvenience often are the root cause of exposures. Policies for mandatory use are essential in creating a safe, routine methodology for all workers in wastewater environments.

The main routes for infections are:

- Cuts or abrasions
- Ocular(eye)
- Mouth
- Nasal/lungs

**Eyewear:** Vulnerabilities for eyewear PPE choices are illustrated in diagram 1. Exposures can occur during hand to eye transfers. Proper fitting and use of glasses can be defeated, especially during perspiration. The re-adjustment of eye wear during work is one example.

The use of airway protection should be mandatory. Objectionable odors vs. potential contamination risks are two primary factors for the selection and use of airway protection. Particle masks are light weight & offer some

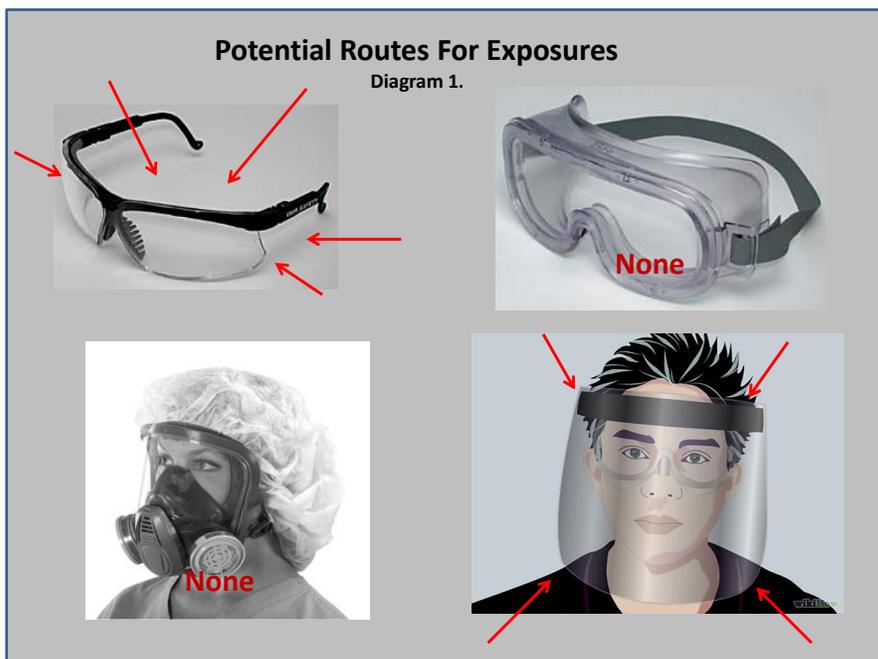
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protection while keeping body temperatures to a min. They are susceptible to moisture.

**Airway:** Half masks can often lead to the formation of moisture inside the mask, facilitating the need to remove & clean to improve airflow. A full face respirator/shield often provides the user with more air volume during vigorous work related activities. Air-supplied respirators are more bulky, often requiring belt power packs that may or may not be intrinsically safe in potentially explosive atmospheres.

**Gloves:** non-disposable gloves provide the best protection. Operators should carry extra disposable gloves & clean towels with them, if practical, into confined spaces. This will assist in personal hygiene. The procedures for removing contaminated gloves are illustrated in diagram 2.



*Note: Removing rags or other debris from pump impellers, bar screens or other spraying related activities could produce discharges of wastewater related material under sufficient enough force to defeat some forms of eye/face protection. One example of such an activity is the removal of grease from inside a sewer wet well or manhole.*

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## Selection of Gloves:

The use of disposable gloves is recommended. However, disposable gloves do not offer protection against punctures or sharp abrasions. Some common glove materials are:

- Latex
- Rubber coated chemical resistant
- Rubber/latex coated cloth

Some common industry trademarks are:

- Atlas Rubber/latex coated cloth gloves
  - Available in partially coated
  - Available in fully coated
- SAS Safety Corp., "Thicksters" disposable gloves
- Glove Plus Nitrile disposable latex gloves

## ***Misc. PPE Selection & Maintenance***

- Use PPE according to specifications for the particular item.

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- All PPE should remain at the workplace and be cleaned with anti-bacterial soap and hot water (160°F) after each use.
- Make sure that you are using all necessary PPE, when performing tasks that require contact with untreated wastewater.
- Use liquid-proof clothing to prevent skin contact with untreated wastewater.
- Were appropriate, this clothing should provide closures around the wrists and ankles.
- Use liquid-proof gloves to prevent skin contact with untreated wastewater.
- Use liquid-proof boots to prevent skin contact with untreated wastewater.
- Leather boots may serve as “liquid-proof” where incidental contact is anticipated.
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- Use liquid-proof boots to prevent skin contact with untreated wastewater.
  - Leather boots may serve as “liquid-proof” where incidental contact is anticipated.
  - Rubber boots must have steel toes.
  - Circumstances may dictate hip- or chest-wader boots. (These boots may not be available with steel toes).
- Use cut and puncture-resistant gloves when working in environments that may expose you to cuts or needle sticks.
- Wear particulate respirators when working in wet wells and when jetting.

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## Prevention Actions

Although risk of infection among wastewater workers appears to be low, the District will take precautions to ensure a safe worksite. As in the healthcare industry, wastewater workers should assume that all surfaces are contaminated with potentially infectious materials and use precautions when working in wastewater areas.

Sudden changes in odor are indications of potential hazards. Entrants may have dulled senses, especially with exposure to hydrogen sulfide. Always exercise extra care and caution. It is better to remove workers from an environment rather than rely on atmospheric or engineering controls.

## Hygiene

- Shower before changing into street cloths and going home if contact has been made with untreated wastewater.
- Wash and sanitize your hands and exposed skin areas promptly after working in contaminated areas.
  - Be certain to wash the thumb on the dominant hand when washing your hands. [This is often missed in casual hand washing].
- Use alcohol-based hand lotions for rapid cleaning/sanitizing of hands and exposed skin.
- Be aware of the potential for tracking contamination to clean areas.
  - Do not enter the lunch/break rooms with contaminated wastewater work clothes.
- Contaminated clothing and PPE should be kept away from eating and food storage areas.
- Store and consume food only in sanitary areas.

## Applicable SOP's & Hazard Assessments

Standard Operating Procedures should be site specific, evaluating the actual hazards associated with each process, location and job task. Employees cannot be properly protected without such evaluations. Each district must create SOP's with employee participation, as well as incorporating input from the safety committee.

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## Sanitized Use or Care of Clothing SOP

- Change into wastewater work clothes before exposure to untreated wastewater.
- Change soiled /contaminated wastewater work clothes during the work day as needed.
  - Shower before changing into the clean wastewater work clothes.
- Remove contaminated clothing after completion of a job.
- Laundering:
  - Wash clothing at high temperatures (160°F) to ensure that all organisms are destroyed.
  - Run washing machine, “empty” in disinfection mode afterwards, with the next user in mind, or
  - Consider designating a segregated washing system for wastewater cleaning use.
  - **Gaskets** used in front loader doors, and detergent distribution systems are **prime areas for the harboring and growth of bacterial slime**. Extra effort will be needed in cleaning & disinfecting these hidden surfaces.

## General Wastewater Work SOP Components:

*Note: Utilize all procedures as listed in the confined space safety program.*

1. Facilitate alternative communication methods where distance and noise affect a jobsite, such as:
  - A. Tug and pull on life-line when communication breaks down
  - B. Engage SRL and begin lifting the occupant.
2. Select PPE that offers the best protection for all potential exposures.
  - A. Rain gear & rubber boots for wet environments.
  - B. Face/eye & airway PPE
  - C. Appropriate hand PPE
  - D. Ear
  - E. Head
  - F. Entire body when spraying pressurized water inside a confined space.

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3. Utilize permit required confined space procedures for all active sewer environments prior to entry. Always carry spare atmospheric detectors.
4. Bypass or divert vehicle exhaust (example: Cranes or Generators), along with any potentially dangerous sewer flows.
5. Utilize wheel chocks & emergency lighting.
6. Employ traffic control as necessary.
7. Discuss and address all potential hazards, to include:
  - A. Slip or tripping hazards
  - B. Overhead risks
  - C. Flow or detention time considerations.
    - Who will run pumps: local vs. remote?
    - Verify all floats or alarms systems are un-obstructed and functional.
  - D. Electrical risks
  - E. Always prepare routes of escape.
  - F. Utilize additional personnel for all tasks not related to top side attendant duties.
  - G. Verify adequate lighting is present.
8. Entrant Supervisor: provide system of lowering and retrieving tools, debris or other items with a safety rope & appropriate bucket/container.
9. Utilize all appropriate lock-out tag-out procedures.
10. Double isolate all piping under pressure, if practical.
  - A. Verify isolation techniques utilized worked by opening petcock or other fixture to relieve pressure.
  - B. Verify proper function of check valves.
11. When jetting sewer channels, ensure upstream manhole is open to vent, is guarded or controlled by flagger/attendant so that:
  - A. Suction is prevented in piping during all phases of jetting.
  - B. Workers are kept out of manhole during active jetting operations.
12. Isolate connected force main pumps affecting manhole safety.
13. Ensure that temporary blocks or plugs are adequately employed and secure.
14. Entrants must be evacuated when:
  - A. Wet well safety can no longer be maintained.
  - B. Air supply is no longer functioning or present.
  - C. Work environment or surroundings become unstable.
15. Provide a method of preventing work under suspended or loads being lifted.
16. Ensure that refuse is stored in appropriate disposal bags or containers and segregated to ensure no cross contamination.
17. Provide air gap or RP device when flushing from a fire hydrant.

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18. Utilize all required trenching and shoring equipment for sewer related excavations.
19. Disinfect work environment prior to leaving it.
20. Disinfect & segregate work tools.

## General Health Practices

- Ensure that your vaccinations are up to date.
- Skin protection is especially important if skin is chapped, burned, cut or otherwise damaged. Use of ointments or creams in lieu of PPE is not recommended.
- Establish a system of worker relief for extended assignments.
- Report exposures & PPE failures to safety officer.
- Visit doctor if you are feeling ill and work with wastewater.

## EMERGENCY PROCEDURES

For all immediate risks to life: Call 911. For all other emergency related incidents: Utilize in-house emergency response or rescue plans. Notify public agencies for sewer related spills as legally required. Refer to the General Wastewater Work SOP Components section above for other precautionary procedures.

## First Aid Awareness and Actions

Create a barrier in the administration of first aid on injured employees who have become exposed to wastewater contaminants. The use of an airway breathing mask for CPR is also recommended for workers who have face exposures.

Eye wash, anti-septic solutions and alcohol cleaning pads are a few of the extra first aid supplies that should be on hand during wastewater work related activities. Look for signs of fatigue or despondency in all workers engaged in wastewater work.

- Clean, treat and report any cuts or punctures immediately using appropriate first aid measures.
  - Consider all wounds as potentially infected.

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- Report the injury to determine if there is a need to see a physician and to establish a record of exposure.
- Keep adequate first-aid supplies on hand, including:
  - Clean water,
  - Wipes for cleaning wounds, and
  - Sterile dressings.

## FORMS USED

Exposures from wastewater contamination should be recorded & kept on file. OSHA 301 report forms do not provide these kinds of exposure reporting for employees at risk (Blood borne pathogen exposure reporting is mandated by OSHA, but is generally not considered as part of this program). Each organization must determine the internal processes, policies & reporting procedures for your workforce. Note: please refer to the accident prevention Program.

All sewers are permit-required confined spaces (see the Confined Space & Fall Protection Safety programs).

Manhole & TV inspection forms are critical for the prevention of sewage overflows. Pump station logs are necessary to determine the pumping characteristics that give indication of a potential failure. The Prevention of sewage overflows is an aspect of safety for the protection of the general public, wildlife and the environment.

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## TRAINING

Never allow an employee to perform a wastewater related task unless accompanied by a fully trained worker familiar with the specific facility.

Some tools or methods utilized in the wastewater industry minimize exposure and shorten what could become a comprehensive task. Training should reveal tips on how to reduce those risks while placing the source of the wastewater material furthest away from the worker.



There are times when the work & contaminated material must be in close proximity to the operator. PPE may offer the only barrier against such hazards.

Prying, pulling, grabbing, lifting, pushing or spraying while working in an enclosed, wet environment is a hazard unto itself. There is no substitution for operator experience for such situations. Tips on performing these challenging tasks should be documented as part of your S.O.P.'s.

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## TABLES

Note: Bacteria & Viruses can potentially enter the body through the eyes, even though the charts below do not state this as the *primary* vector of infection.

Table 1. Microbial Agents of Public Health Importance that May be Present in Wastewater from U.S. Communities-Bacteria.

<b>Bacteria</b>			
<b>Agents</b>	<b>Source</b>	<b>Route of Entry</b>	<b>Disease</b>
Campylobacter jejuni	Humans. Domestic animals	Oral	Gastroenteritis
Clostridium perfringens	Humans, animals	Wound contact	Wound infection
Clostridium tetani	Humans, domestic animals	Wound contact	Tetanus
Escherichia coli	Humans, domestic animals, birds	Oral	Gastroenteritis
Helicobacter pylori	Humans	Oral	Gastritis
Legionella pneumophila	Water	Respiratory	Legionellosis
Leptospira spp.	Rats, dogs, wild animals	Wound contact, oral/respiratory	Leptospirosis
Mycobacterium spp.	Humans, animals	oral/respiratory	Respiratory disease
Salmonella spp.	Humans, domestic animals, birds	Oral	Gastroenteritis
Salmonella typhi	Humans	Oral	Typhoid fever
Shigella spp.	Humans	Oral	Gastroenteritis
Vibrio cholerae	Humans	Oral	Cholera
Yersinia spp.	Domestic and wild animals	Oral	Gastroenteritis

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Table 2. Microbial Agents of Public Health Importance that May be Present in Wastewater from U.S. Communities-Protozoa/Parasites.

<b>Protozoa/parasites</b>			
<b>Agents</b>	<b>Source</b>	<b>Route of Entry</b>	<b>Disease</b>
Balantidium coli	Humans, wild animals	Oral	Colitis
Cryptosporidium			
parvum	Humans, domestic animals	Oral	Gastroenteritis
Dientamoeba fragilis	Humans	Oral	Gastroenteritis
Entamoeba			
histolytica	Humans	Oral	Amoebiasis
Giardia lamblia	Humans, domestic/wild animals	Oral	Gastroenteritis
Isospora spp.	Humans	Oral	Gastroenteritis
Toxoplasma gondii	Cats	Oral	Toxoplasmosis

Table 3. Microbial Agents of Public Health Importance that May be Present in Wastewater from U.S. Communities-Helminths: Nematodes.

<b>Helminths: [Nematodes (roundworms), Parasites]</b>			
<b>Agents</b>	<b>Source</b>	<b>Route of Entry</b>	<b>Disease</b>
Ancylostoma braziliense	Cats	Skin Contact	Cutaneous larva migrans
Ancylostoma duodenale	Humans	Skin contact	Hookworm disease
Ancylostoma caninum	Dogs	Skin contact	Cutaneous larva migrans
Ascaris lumbricoides	Humans	Oral	Ascariasis
Enterobius vermicularis	Humans	Oral	Enterobiasis
Necator americanus	Humans	Skin contact	Hookworm disease

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Table 3. Microbial Agents of Public Health Importance that May be Present in Wastewater from U.S. Communities-Helminths: Nematodes.

<b>Helminths: [Nematodes (roundworms), Parasites]</b>			
Strongyloides stercoralis	Humans	Skin contact	Strongyloidiasis
Toxocara canis	Dogs	Oral	Visceral larva migrans
Toxocara cati	Cats	Oral	Visceral larva migrans
Trichuris trichiura	Humans	Oral	Trichuriasis

Table 4. Microbial Agents of Public Health Importance that May be Present in Wastewater from U.S. Communities-Helminths: Cestodes.

<b>Helminths: [Cestodes (tapeworms), Parasites]</b>			
<b>Agents</b>	<b>Source</b>	<b>Route of Entry</b>	<b>Disease</b>
Echinococcus granulosus	Dogs	Oral	Hydatid disease
Echinococcus multilocularis	Dogs, cats	Oral	Hydatid disease
Hymenolepis nana	Humans, rodents	Oral	Taeniasis
Taenia solium	Humans	Oral	Cysticercosis

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Table 5. Microbial Agents of Public Health Importance that May be Present in Wastewater from U.S. Communities-Viruses.

<b>Viruses</b>			
<b>Agents</b>	<b>Source</b>	<b>Route of Entry</b>	<b>Disease</b>
Adenoviruses	Humans	Oral, respiratory	Upper Respiratory Tract disease, conjunctivitis
Astro-viruses	Humans	Oral	Gastroenteritis
Calci-viruses	Humans	Oral	Gastroenteritis
Corona-viruses	Humans	Respiratory	URT disease
Entero-viruses	Humans	Oral, respiratory	URT disease, systemic diseases
Hantaviruses	Rats	Respiratory	None described
Hepatitis A virus	Humans	Oral	Hepatitis
Hepatitis B virus	Humans	Oral/wound	Hepatitis
Hepatitis E virus	Humans	Oral	Hepatitis
Lymphocytic choriomeningitis virus	Mice	Oral, respiratory	Influenza- like disease, meningitis
Norwalk viruses	Humans	Oral	Gastroenteritis
Parvoviruses	Humans	Oral	Gastroenteritis
Rotaviruses	Humans	Oral	Gastroenteritis

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## REFERENCES/RESOURCES

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2. *Health Hazard Manua: Wastewater Treatment Plant and Sewer Workers* by Nellie J. Brown, Cornell University 12.1.1997.
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## REVISION RECORD

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Revision No.	Revision Date	Approval Date	Change
1.0.0	10-2011		Initial design.

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## APPROVALS

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Safety Committee Chairperson	Date	General Manager	Date
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# Wastewater Worker Safety Program

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## APPENDIX A

### Description of *Most Prevalent Sewer Infection Risk*:

#### **Giardia Lamblia** (see diagram on next page)

Giardia lamblia exists in two forms, an active form called a trophozoite, and an inactive form called a cyst. The active trophozoite attaches to the lining of the small intestine with a "sucker" and is responsible for causing the signs and symptoms of giardiasis. The trophozoite cannot live long outside of the body; therefore it cannot spread the infection to others.

The inactive cyst, on the other hand, can exist for prolonged periods outside the body. When it is ingested, stomach acid *activates* the cyst, and the cyst develops into the disease-causing trophozoite. It takes ingestion of only ten cysts to cause infection. Trophozoites are important not only because they cause the symptoms of giardiasis, but also because they produce the cysts that exit the body in the feces and spread the infection to others.

Cysts of Giardia are present in the feces of infected persons. Thus, the infection is spread from person to person by contamination of food with feces, or by direct fecal-oral contamination. Cysts also survive in water, for example in fresh water lakes and streams. As a result, giardiasis is the most common cause of water-borne, parasitic illness in the U.S., domestic mammals (for example, dogs, cats, calves) and wild mammals (for example, beavers) can become infected with Giardia.

It is not clear how often domestic or wild mammals transmit giardiasis to humans. Giardiasis also has occurred as outbreaks from recreational water sources such as swimming pools, water parks, and hot tubs, most likely because of an infected user rather than a source of water that was contaminated.

Metronidazole is the most common treatment for Giardia, Respiratory tract infections, dermatological conditions, Et.

Generic Name: metronidazole (me troe NI da zole)

Brand names: *Flagyl, Flagyl 375, Flagyl ER, Flagyl I.V. RTU, Metro I.V., Protostat, Flagyl I.V., Met.*



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## Path to Infection: Giardia

