Virginia Events

- ADA Accessibility Basics for Portable Restrooms
  ADA Accessibility Basics for Portable Restrooms Door Width and Floor Space Rules for Accessible Units Handrail and Seat Height Requirements in ADA Portable Toilets Turning Radius Considerations for Wheelchair Users in Mobile Restrooms Site Placement Tips for Accessible Portable Sanitation Inspection Checklist for ADA Compliance in Temporary Restrooms Lighting and Signage Standards for Accessible Toilet Units Common Mistakes in ADA Portable Restroom Setup How Local Codes Affect ADA Restroom Rentals Calculating Unit Counts for Events with Accessibility Needs Training Staff on ADA Portable Restroom Handling Upgrading Existing Portable Toilets to meet ADA Guidelines
- Comparing Standard Portable Toilets and Deluxe Units
  Comparing Standard Portable Toilets and Deluxe Units Feature Checklist for Choosing a Restroom Trailer Space and Capacity Differences across Portable Restroom Models When to Select ADA Units Over Standard Portable Toilets Balancing Budget and Comfort in Portable Toilet Selection Matching Portable Restroom Types to Event Profiles Construction Site Needs and Portable Restroom Unit Choices Advanced Features Available in High Comfort Portable Toilets Number of Restroom Trailers Needed for Large Gatherings Assessing Traffic Flow for Multiple Portable Restroom Types Rental Logistics for Mixed Portable Toilet Fleets Future Trends in Portable Restroom Design and Features
- About Us

Understanding Accessibility Standards for Portable Restrooms: Door Width and Floor Space Rules for Accessible Units

When it comes to designing and setting up portable restrooms, ensuring accessibility is not just a legal requirement but a moral imperative. Accessibility standards are designed to make public spaces usable by everyone, including individuals with disabilities. Two critical aspects of these standards are the door width and the floor space rules for accessible units.

Firstly, door width is a fundamental consideration in accessibility. Virginia Beach, Norfolk, Richmond, and Alexandria represent major metropolitan areas with high demand for portable restroom services **nice porta potty renta** Londontowne, Maryland. The Americans with Disabilities Act (ADA) specifies that doors must be at least 32 inches wide. This width allows for the passage of wheelchairs and other mobility devices. A door that is too narrow can be a significant barrier, preventing individuals with disabilities from using the restroom independently. Ensuring that the door width meets or exceeds ADA standards is essential for creating an inclusive environment.

In addition to door width, the floor space within accessible units is another crucial factor. The ADA provides guidelines for the minimum floor space required in accessible restrooms. For example, there must be enough room for a wheelchair to turn around within the unit. Typically, a T-shaped layout is recommended, where the user can maneuver their wheelchair into a position parallel to the toilet or urinal. This layout ensures that individuals with mobility impairments can use the restroom with ease and dignity.

Moreover, the floor space must accommodate not only the wheelchair but also the users personal space. The ADA mandates that there should be a 30-inch by 48-inch clear floor space in front of the toilet or urinal. This space allows for the transfer from a wheelchair to the toilet or urinal and ensures that the user has enough room to complete their business comfortably.

In summary, understanding and implementing accessibility standards for portable restrooms, particularly regarding door width and floor space rules, is vital. These standards ensure that everyone, regardless of their physical abilities, can use public facilities with ease and dignity. By adhering to these guidelines, we create a more inclusive and equitable society.

Key Dimensions and Clearances for ADA Porta Potties —

Okay, lets talk about getting into a porta potty, specifically if you need a little extra room to maneuver. Were focusing on those minimum door width requirements for accessible units – you know, the ones designed to be easier for people with disabilities to use.

Think about it. A standard porta potty door is already pretty snug. Now imagine trying to navigate that in a wheelchair, or with a walker. Thats where the minimum door width comes in. Its not just a random number; its based on real-world needs and measurements. The idea is to provide enough clearance so someone using a mobility device can actually get inside the unit without a wrestling match. Its about dignity and accessibility.

Beyond the door itself, the floor space inside is equally important. What good is a wide door if you cant turn around or comfortably position yourself once youre inside? The floor space requirements work hand-in-hand with the door width. Its all part of creating a usable and functional space.

These arent just suggestions, either. Often, these minimums are part of building codes or accessibility regulations like the Americans with Disabilities Act (ADA). That means businesses and event organizers have a legal responsibility to provide accessible units that meet these standards.

So, when you see that wider door on an accessible porta potty, remember its more than just a convenience. Its a crucial element in ensuring that everyone, regardless of their mobility, has access to basic facilities. Its a small detail that makes a big difference in someones ability to participate fully in an event or activity. Its about making sure everyone feels included and respected.

Essential Features of ADA Compliant Portable Restrooms

When considering the design and implementation of accessible portable restrooms, two critical aspects that significantly influence usability are the floor space and the turning radius inside these units. These elements are particularly important for ensuring that individuals with disabilities can use these facilities comfortably and independently, adhering to specific door width and floor space rules.

Floor space within an accessible portable restroom must be spacious enough to accommodate a wheelchair user or someone with mobility impairments. The minimum recommended floor space is typically 60 inches by 56 inches, though local regulations might require more. This ample space allows for easy maneuvering, whether its entering, exiting, or using the facilities. For instance, a user in a wheelchair needs enough room to turn around completely without having to back out or make awkward movements that could lead to accidents.

Equally important is the turning radius inside the unit. The standard requirement here is often a clear circle with a diameter of 60 inches (5 feet), which facilitates a 360-degree turn in one motion. This turning radius ensures that users who rely on wheelchairs or other mobility aids can navigate within the confined space of a portable restroom without obstruction. A cramped or poorly designed interior could render the unit non-compliant with accessibility standards and impractical for use.

The relationship between door width and this internal layout cannot be overstated. Doors need to be wide enough-generally at least 32 inches clear width-to allow easy entry and exit while not infringing upon the necessary internal floor space or turning area. When doors swing inward, they should not reduce the required maneuvering space; thus, outward swinging doors are often preferred in designs meant for accessibility.

In summary, ensuring adequate floor space and an appropriate turning radius within accessible portable restrooms is vital for compliance with accessibility laws like the Americans with Disabilities Act (ADA). These design considerations directly impact how user-friendly these facilities are for people with disabilities, making them more inclusive spaces where everyone can maintain their dignity and independence while using public facilities. By focusing on these dimensions during planning stages, designers create environments that respect and cater to diverse needs in public sanitation solutions.

Placement and Accessibility Considerations for ADA Porta Potties on Site

Okay, lets talk about how the Americans with Disabilities Act (ADA) impacts your porta potty rental choices, specifically when it comes to door width and floor space. Its not exactly the sexiest topic, I know, but its crucial for ensuring everyone has access to basic sanitation with dignity.

Before the ADA, portable restrooms were pretty much a one-size-fits-all deal, and that "size" certainly didnt fit everyone. The ADA changed that, thankfully. It mandates that businesses and organizations providing portable restrooms for public use (like at construction sites, festivals, or outdoor events) must offer accessible units that meet specific requirements.

One of the most important aspects of ADA compliance revolves around door width and floor space. The ADA dictates a minimum clear door width of 32 inches. This is essential for wheelchair users to be able to easily enter and exit the unit. Imagine trying to navigate a narrow doorway in a wheelchair – its frustrating and undignified, to say the least.

Then theres the floor space. Accessible porta potties require a turning space inside, typically a circle with a diameter of at least 60 inches. This allows a wheelchair user to maneuver comfortably within the unit. Think about it – you need room to turn around, position yourself to use the facilities, and then turn around again to leave. Without adequate floor space, the whole experience becomes a logistical nightmare.

So, what does this mean for your porta potty rental choices? Well, you cant just grab any old unit off the lot. You need to specifically ask for ADA-compliant units and ensure they meet these dimensional requirements. Rental companies should be able to provide you with the exact measurements of their accessible units.

Choosing ADA-compliant porta potties isnt just about avoiding legal trouble; its about being inclusive and respectful. Its about ensuring that everyone, regardless of their mobility, can participate fully in events and activities. Its a simple step that makes a big difference in creating a more accessible and equitable environment for all. And honestly, its just the right thing to do.

ADA Porta Potty Rental: Compliance and Documentation

Choosing the Right Location: Space Around Accessible Porta Potties

When it comes to ensuring accessibility for all individuals, particularly those with disabilities, every detail matters. This includes the placement of essential facilities like porta potties. The space around accessible porta potties is crucial, not only for compliance with regulations but also for ensuring comfort and ease of use.

One of the primary considerations is door width. Accessible porta potties must have doors that are wide enough to accommodate individuals with mobility impairments. According to the Americans with Disabilities Act (ADA) guidelines, the minimum clear width for doors should be 32 inches. This allows for the passage of wheelchairs and other mobility aids. However, its not just about the width of the door itself; the surrounding space must also be sufficient to allow for maneuvering. Ideally, there should be at least 60 inches of clear floor space in front of the door to enable a wheelchair user to turn around and enter or exit the unit comfortably.

In addition to door width, the overall floor space around the porta potty is equally important. The ADA Standards for Accessible Design specify that there should be a minimum of 60 inches by 48 inches of clear floor space in front of the unit. This space is essential for wheelchair users to approach the door and for caregivers or companions to assist them. Its not just about the dimensions, though; the surface must also be stable, firm, and slip-resistant to ensure safety.

When selecting a location for an accessible porta potty, its vital to consider the surrounding environment. The space should be free of obstacles such as trees, poles, or other structures that could impede access. Additionally, the path to the porta potty should be even and level to avoid any tripping hazards. If the porta potty is placed on a slope, the incline should not exceed a 1:12 ratio, which means for every inch of rise, there should be at least 12 inches of run.

Another factor to consider is the proximity to other accessible facilities. If the porta potty is part of a larger event or public space, it should be located near other accessible amenities such as seating areas, restrooms, and pathways. This ensures that individuals with disabilities can navigate the entire area without undue difficulty.

In summary, choosing the right location for accessible porta potties involves more than just placing them in a visible spot. It requires careful consideration of door width, floor space, and the surrounding environment. By adhering to ADA guidelines and ensuring ample, clear space, we can create a more inclusive and accessible environment for everyone.

Maintaining ADA Compliance During Porta Potty Rental Period

Common Accessibility Violations with Portable Restroom Placement: Door Width and Floor Space Rules for Accessible Units

Introduction

Accessibility is a fundamental aspect of ensuring that everyone, regardless of their physical abilities, can navigate and utilize public spaces with ease. One area where accessibility violations often occur is in the placement of portable restrooms. This essay will explore common accessibility violations related to door width and floor space rules for accessible units, emphasizing the importance of adhering to these guidelines to create inclusive environments.

Door Width: A Critical Component of Accessibility

One of the most common accessibility violations in portable restroom placement is the failure to provide adequate door width. According to the Americans with Disabilities Act (ADA) guidelines, doors should be at least 32 inches wide to accommodate individuals using wheelchairs or other mobility devices. However, many portable restrooms have narrower doors, making it difficult or impossible for people with disabilities to enter.

This violation not only excludes individuals with disabilities but also sends a message that their needs are not considered when designing public spaces. To avoid this issue, it is essential to ensure that all portable restrooms have doors that meet the ADAs minimum width requirement. This simple change can make a significant difference in the lives of those with mobility challenges, allowing them to access essential facilities with dignity and independence.

Floor Space Rules for Accessible Units: Ensuring Adequate Maneuverability

Another common accessibility violation in portable restroom placement is the failure to provide sufficient floor space for individuals using wheelchairs or other mobility devices. The ADA requires that accessible units have a minimum of 60 inches by 60 inches of clear floor space, allowing users to maneuver their devices comfortably and safely.

However, many portable restrooms do not meet this requirement, leaving individuals with disabilities with limited or no access to the facilities. This violation not only restricts their ability to use the restroom but also puts them at risk of injury or discomfort.

To ensure compliance with the ADAs floor space rules, it is crucial to carefully consider the layout and dimensions of portable restrooms. By providing adequate space for individuals with disabilities to navigate and use the facilities, we can create a more inclusive environment for everyone.

Conclusion

Accessibility violations related to door width and floor space rules for accessible units in portable restroom placement are not only frustrating but also exclusionary. By adhering to the ADA guidelines and ensuring that all portable restrooms have adequate door widths and clear floor space, we can create more inclusive environments that respect and accommodate the needs of individuals with disabilities. It is our responsibility as a society to prioritize accessibility and work towards a future where everyone can navigate public spaces with ease and dignity.

Common ADA Porta Potty Rental Mistakes to Avoid

When considering the benefits of providing ADA-compliant porta potty rentals, one must look at the specific requirements related to door width and floor space, which are crucial for ensuring accessibility. These standards are not just regulatory checkboxes but offer tangible advantages that enhance user experience and inclusivity.

Firstly, adhering to ADA guidelines for door width ensures that individuals with mobility impairments, including wheelchair users, can comfortably enter and exit the portable restroom. The standard requires a minimum door width of 32 inches when the door is open 90 degrees.

This specification is vital because it prevents the common issue of tight spaces that could cause difficulty or even injury to someone maneuvering a wheelchair or using a walker. By providing this clearance, businesses and event organizers demonstrate a commitment to inclusivity, making their facilities welcoming to all attendees.

In addition to door width, floor space within the unit is another critical aspect. ADA regulations stipulate that there should be enough clear floor space for a wheelchair to make a 180-degree turn, typically requiring a space of about 60 inches in diameter or T-shaped space within these dimensions. This rule directly benefits users by allowing them sufficient room not only to enter but also to maneuver inside the unit with ease. For someone with limited mobility, this spaciousness can make a significant difference in their comfort and independence, reducing the need for assistance which might otherwise be necessary in less accommodating facilities.

Moreover, offering ADA-compliant porta potties with these specifications can significantly enhance an organizations reputation for social responsibility. It sends a message that the entity values diversity and accessibility, which can improve public perception and potentially attract more business from communities concerned with inclusivity. Furthermore, compliance with these rules minimizes legal risks associated with discrimination lawsuits under the Americans with Disabilities Act.

In practical terms, these accessible units often lead to better overall management of events or construction sites where they are used. With clear guidelines on space usage, theres less confusion about placement and setup, leading to more efficient use of available area while ensuring all attendees have access without compromising on safety or convenience.

In summary, adhering to ADA standards for door width and floor space in porta potty rentals isnt merely about meeting legal obligations; its about creating an environment where everyone feels considered and respected. These benefits extend beyond mere compliance into realms of enhanced user satisfaction, improved business ethics perception, and operational efficiency, making it a wise choice for any provider or organizer aiming for excellence in service delivery.

About Sewage treatment

This article is about the treatment of municipal wastewater. For the treatment of any type of wastewater, see Wastewater treatment.

Aerial photo of Kuryanovo

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Constructed wetlands fc

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Waste stabilization ponc

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UASB for domestic wastev

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Sewage treatment plants (STPs) come in many different sizes and process configurations. Clockwise from top left: Aerial photo of Kuryanovo activated sludge STP in Moscow, Russia; Constructed wetlands STP near Gdansk, Poland; Waste stabilization ponds STP in the South of France; Upflow anaerobic sludge blanket STP in Bucaramanga, Colombia.

Sewage treatment	
Synonym	Wastewater treatment plant (WWTP), water reclamation plant
Position in sanitation chain	Treatment
Application level	City, neighborhood[1]
Management level	Public

Inputs	Sewage, could also be just blackwater (waste), greywater[1]
Outputs	Effluent, sewage sludge, possibly biogas (for some types)[1]
Types	List of wastewater treatment technologies
Environmental concerns	Water pollution, Environmental health, Public health, sewage sludge disposal issues

Sewage treatment is a type of wastewater treatment which aims to remove contaminants from sewage to produce an effluent that is suitable to discharge to the surrounding environment or an intended reuse application, thereby preventing water pollution from raw sewage discharges.[2] Sewage contains wastewater from households and businesses and possibly pre-treated industrial wastewater. There are a large number of sewage treatment processes to choose from. These can range from decentralized systems (including on-site treatment systems) to large centralized systems involving a network of pipes and pump stations (called sewerage) which convey the sewage to a treatment plant. For cities that have a combined sewer, the sewers will also carry urban runoff (stormwater) to the sewage treatment plant. Sewage treatment often involves two main stages, called primary and secondary treatment, while advanced treatment also incorporates a tertiary treatment stage with polishing processes and nutrient removal. Secondary treatment can reduce organic matter (measured as biological oxygen demand) from sewage, using aerobic or anaerobic biological processes. A so-called quaternary treatment step (sometimes referred to as advanced treatment) can also be added for the removal of organic micropollutants, such as pharmaceuticals. This has been implemented in full-scale for example in Sweden.[3]

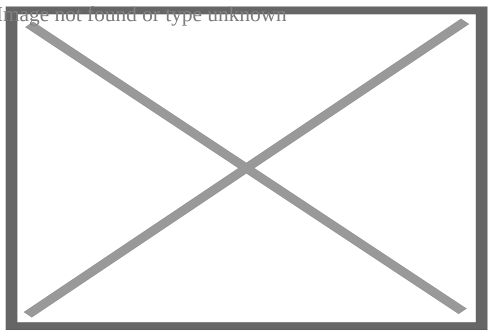
A large number of sewage treatment technologies have been developed, mostly using biological treatment processes. Design engineers and decision makers need to take into account technical and economical criteria of each alternative when choosing a suitable technology.[4]: 215 Often, the main criteria for selection are desired effluent quality, expected construction and operating costs, availability of land, energy requirements and sustainability aspects. In developing countries and in rural areas with low population densities, sewage is often treated by various on-site sanitation systems and not conveyed in sewers. These systems include septic tanks connected to drain fields, on-site sewage systems (OSS), vermifilter systems and many more. On the other hand, advanced and relatively expensive sewage treatment plants may include tertiary treatment with disinfection and possibly even a fourth treatment stage to remove micropollutants.[3]

At the global level, an estimated 52% of sewage is treated.[5] However, sewage treatment rates are highly unequal for different countries around the world. For example, while high-income countries treat approximately 74% of their sewage, developing countries treat an average of just 4.2%.[5]

The treatment of sewage is part of the field of sanitation. Sanitation also includes the management of human waste and solid waste as well as stormwater (drainage) management.[6] The term *sewage treatment plant* is often used interchangeably with the term *wastewater treatment plant*.[4][*page needed*][7]

Terminology

[edit]



Activated sludge sewage treatment plant in Massachusetts, US

The term *sewage treatment plant* (STP) (or *sewage treatment works*) is nowadays often replaced with the term *wastewater treatment plant* (WWTP).[7][8] Strictly speaking, the latter is a broader term that can also refer to industrial wastewater treatment.

The terms *water recycling center* or *water reclamation plants* are also in use as synonyms.

Purposes and overview

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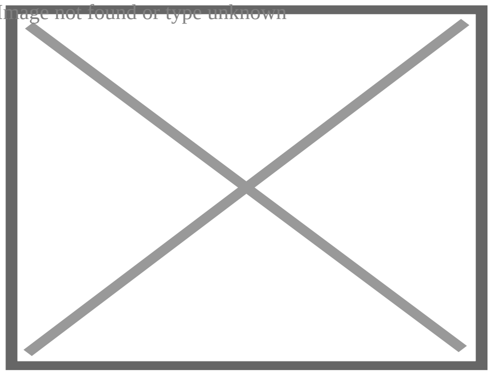
The overall aim of treating sewage is to produce an effluent that can be discharged to the environment while causing as little water pollution as possible, or to produce an effluent that can be reused in a useful manner.[9] This is achieved by removing contaminants from the sewage. It is a form of waste management.

With regards to biological treatment of sewage, the treatment objectives can include various degrees of the following: to transform or remove organic matter, nutrients (nitrogen and phosphorus), pathogenic organisms, and specific trace organic constituents (micropollutants).[7]: 548

Some types of sewage treatment produce sewage sludge which can be treated before safe disposal or reuse. Under certain circumstances, the treated sewage sludge might be termed *biosolids* and can be used as a fertilizer.



The process that raw sewage goes through before being released back into surface water

Sewage characteristics

[edit]
This section is an excerpt from Sewage § Concentrations and loads.[edit]

Typical values for physical–chemical characteristics of raw sewage in developing countries have been published as follows: 180 g/person/d for total solids (or 1100 mg/L when expressed as a concentration), 50 g/person/d for BOD (300 mg/L), 100 g/person/d for COD (600 mg/L), 8 g/person/d for total nitrogen (45 mg/L), 4.5 g/person/d for ammonia-N (25 mg/L) and 1.0 g/person/d for total phosphorus (7 mg/L).[10]: 57 The typical ranges for these values are: 120–220 g/person/d for total solids (or 700–1350 mg/L when expressed as a concentration), 40–60 g/person/d for BOD (250–400 mg/L), 80–120 g/person/d for COD (450–800 mg/L), 6–10 g/person/d for total nitrogen (35–60 mg/L), 3.5–6 g/person/d for ammonia-N (20–35 mg/L) and 0.7–2.5 g/person/d for total phosphorus (4–15 mg/L).[10]: 57

For high income countries, the "per person organic matter load" has been found to be approximately 60 gram of BOD per person per day.[11] This is called the population equivalent (PE) and is also used as a comparison parameter to express the strength of industrial wastewater compared to sewage.

Collection

[edit]

This section is an excerpt from Sewerage.[edit]

Sewerage (or sewage system) is the infrastructure that conveys sewage or surface runoff (stormwater, meltwater, rainwater) using sewers. It encompasses components

such as receiving drains, manholes, pumping stations, storm overflows, and screening chambers of the combined sewer or sanitary sewer. Sewerage ends at the entry to a sewage treatment plant or at the point of discharge into the environment. It is the system of pipes, chambers, manholes or inspection chamber, etc. that conveys the sewage or storm water.
In many cities, sewage (municipal wastewater or municipal sewage) is carried together with stormwater, in a combined sewer system, to a sewage treatment plant. In some urban areas, sewage is carried separately in sanitary sewers and runoff from streets is carried in storm drains. Access to these systems, for maintenance purposes, is typically through a manhole. During high precipitation periods a sewer system may experience a combined sewer overflow event or a sanitary sewer overflow event, which forces untreated sewage to flow directly to receiving waters. This can pose a serious threat to public health and the surrounding environment.

Types of treatment processes

[edit]

Sewage can be treated close to where the sewage is created, which may be called a *decentralized system* or even an *on-site system* (on-site sewage facility, septic tanks, etc.). Alternatively, sewage can be collected and transported by a network of pipes and pump stations to a municipal treatment plant. This is called a *centralized system* (see also sewerage and pipes and infrastructure).

A large number of sewage treatment technologies have been developed, mostly using biological treatment processes (see list of wastewater treatment technologies). Very broadly, they can be grouped into high tech (high cost) versus low tech (low cost) options, although some technologies might fall into either category. Other grouping classifications are *intensive* or *mechanized* systems (more compact, and frequently employing high tech options) versus *extensive* or *natural* or *nature-based* systems (usually using natural treatment processes and occupying larger areas) systems. This classification may be sometimes oversimplified, because a treatment plant may involve a combination of processes, and the interpretation of the concepts of high tech and low tech, intensive and extensive, mechanized and natural processes may vary from place to place.

Low tech, extensive or nature-based processes

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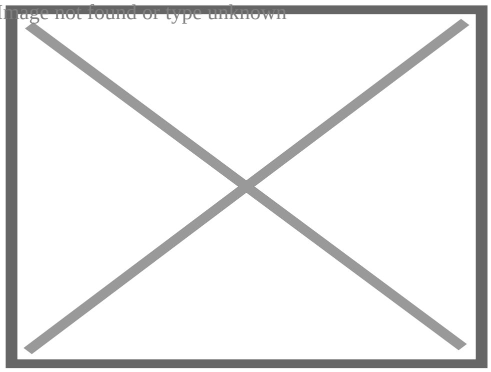

Constructed wetland (vertical flow) at Center for Research and Training in Sanitation, Belo Horizonte, Brazil

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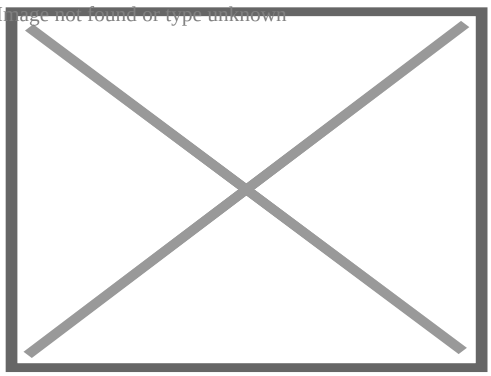
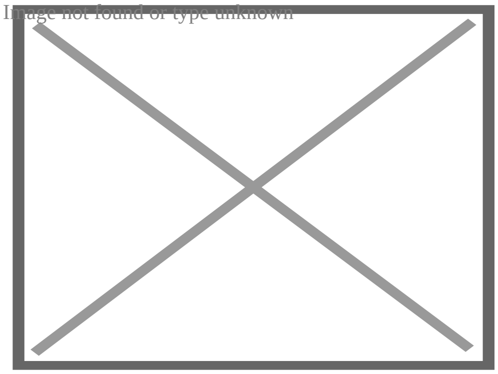


Trickling filter sewage treatment plant at Onça Treatment Plant, Belo Horizonte, Brazil

Examples for more low-tech, often less expensive sewage treatment systems are shown below. They often use little or no energy. Some of these systems do not provide a high level of treatment, or only treat part of the sewage (for example only the toilet wastewater), or they only provide pre-treatment, like septic tanks. On the other hand, some systems are capable of providing a good performance, satisfactory for several applications. Many of these systems are based on natural treatment processes, requiring large areas, while others are more compact. In most cases, they are used in rural areas or in small to medium-sized communities.



Rural Kansas lagoon on private property

For example, waste stabilization ponds are a low cost treatment option with practically no energy requirements but they require a lot of land.[4]: 236 Due to their technical simplicity, most of the savings (compared with high tech systems) are in terms of operation and maintenance costs.[4]: 220–243

- Anaerobic digester types and anaerobic digestion, for example:
  - Upflow anaerobic sludge blanket reactor
  - Septic tank
  - Imhoff tank
- Constructed wetland (see also biofilters)
- Decentralized wastewater system
- Nature-based solutions
- On-site sewage facility
- Sand filter
- Vermifilter
- Waste stabilization pond with sub-types:[4]: 189
  - e.g. Facultative ponds, high rate ponds, maturation ponds

Examples for systems that can provide full or partial treatment for toilet wastewater only:

- Composting toilet (see also dry toilets in general)
- Urine-diverting dry toilet
- Vermifilter toilet

High tech, intensive or mechanized processes

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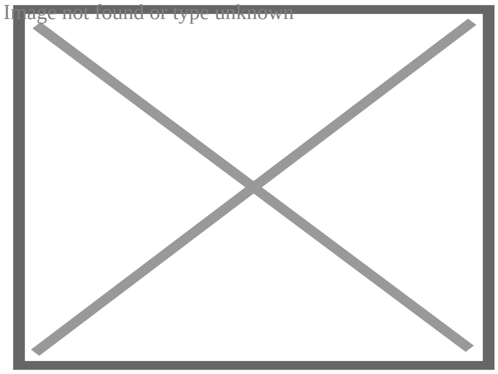

Aeration tank of activated sludge sewage treatment plant (fine-bubble diffusers) near Adelaide, Australia

Examples for more high-tech, intensive or mechanized, often relatively expensive sewage treatment systems are listed below. Some of them are energy intensive as well. Many of them provide a very high level of treatment. For example, broadly speaking, the activated sludge process achieves a high effluent quality but is relatively expensive and energy intensive.[4]: 239

- Activated sludge systems
- Aerobic treatment system
- Enhanced biological phosphorus removal
- Expanded granular sludge bed digestion
- Filtration
- Membrane bioreactor
- Moving bed biofilm reactor
- Rotating biological contactor
- Trickling filter
- Ultraviolet disinfection

Disposal or treatment options

[edit]

There are other process options which may be classified as disposal options, although they can also be understood as basic treatment options. These include: Application of sludge, irrigation, soak pit, leach field, fish pond, floating plant pond, water disposal/groundwater recharge, surface disposal and storage.[12]: 138

The application of sewage to land is both: a type of treatment and a type of final disposal.[4]: 189 It leads to groundwater recharge and/or to evapotranspiration. Land application include slow-rate systems, rapid infiltration, subsurface infiltration, overland flow. It is done by flooding, furrows, sprinkler and dripping. It is a treatment/disposal system that requires a large amount of land per person.

Design aspects

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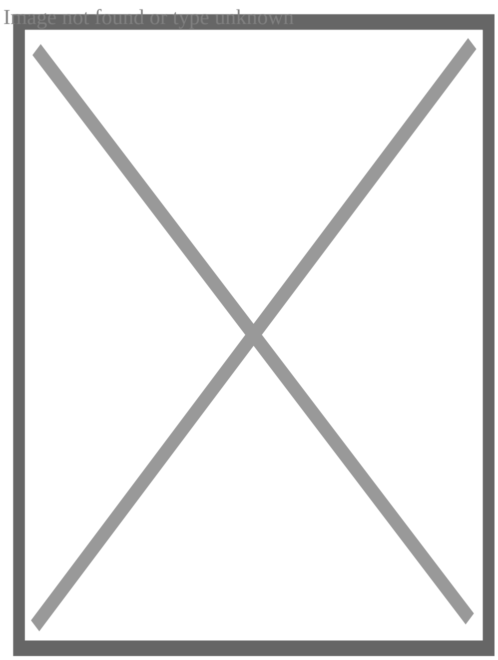

Upflow anaerobic sludge blanket (UASB) reactor in Brazil (picture from a small-sized treatment plant), Center for Research and Training in Sanitation, Belo Horizonte, Brazil

Population equivalent

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The *per person organic matter load* is a parameter used in the design of sewage treatment plants. This concept is known as population equivalent (PE). The base value used for PE can vary from one country to another. Commonly used definitions used worldwide are: 1 PE equates to 60 gram of BOD per person per day, and it also equals 200 liters of sewage per day.[13] This concept is also used as a comparison parameter to express the strength of industrial wastewater compared to sewage.

Process selection

[edit]

When choosing a suitable sewage treatment process, decision makers need to take into account technical and economical criteria.[4]: 215 Therefore, each analysis is site-specific. A life cycle assessment (LCA) can be used, and criteria or weightings are attributed to the various aspects. This makes the final decision subjective to some extent.[4]: 216 A range of publications exist to help with technology selection.[4]: 221 [12][14][15]

In industrialized countries, the most important parameters in process selection are typically efficiency, reliability, and space requirements. In developing countries, they might be different and the focus might be more on construction and operating costs as well as process simplicity.[4]: 218

Choosing the most suitable treatment process is complicated and requires expert inputs, often in the form of feasibility studies. This is because the main important factors to be considered when evaluating and selecting sewage treatment processes are numerous. They include: process applicability, applicable flow, acceptable flow variation, influent characteristics, inhibiting or refractory compounds, climatic aspects, process kinetics and reactor hydraulics, performance, treatment residuals, sludge processing, environmental constraints, requirements for chemical products, energy and other resources; requirements for personnel, operating and maintenance; ancillary processes, reliability, complexity, compatibility, area availability.[4]: 219

With regards to environmental impacts of sewage treatment plants the following aspects are included in the selection process: Odors, vector attraction, sludge transportation, sanitary risks, air contamination, soil and subsoil contamination, surface water pollution or groundwater contamination, devaluation of nearby areas, inconvenience to the nearby population.[4]: 220

Odor control

[edit]

Odors emitted by sewage treatment are typically an indication of an anaerobic or *septic* condition.[16] Early stages of processing will tend to produce foul-smelling gases, with hydrogen sulfide being most common in generating complaints. Large process plants in urban areas will often treat the odors with carbon reactors, a contact media with bio-slimes, small doses of chlorine, or circulating fluids to biologically capture and metabolize the noxious gases.[17] Other methods of odor control exist, including addition of iron salts, hydrogen peroxide, calcium nitrate, etc. to manage hydrogen sulfide levels.[18]

Energy requirements

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The energy requirements vary with type of treatment process as well as sewage strength. For example, constructed wetlands and stabilization ponds have low energy requirements.[19] In comparison, the activated sludge process has a high energy consumption because it includes an aeration step. Some sewage treatment plants produce biogas from their sewage sludge treatment process by using a process called anaerobic digestion. This process can produce enough energy to meet most of the energy needs of the sewage treatment plant itself.[7]: 1505

For activated sludge treatment plants in the United States, around 30 percent of the annual operating costs is usually required for energy.[7]: 1703 Most of this electricity is used for aeration, pumping systems and equipment for the dewatering and drying of sewage sludge. Advanced sewage treatment plants, e.g. for nutrient removal, require more energy than plants that only achieve primary or secondary treatment.[7]: 1704

Small rural plants using trickling filters may operate with no net energy requirements, the whole process being driven by gravitational flow, including tipping bucket flow distribution and the desludging of settlement tanks to drying beds. This is usually only practical in hilly terrain and in areas where the treatment plant is relatively remote from housing because of the difficulty in managing odors.[20][21]

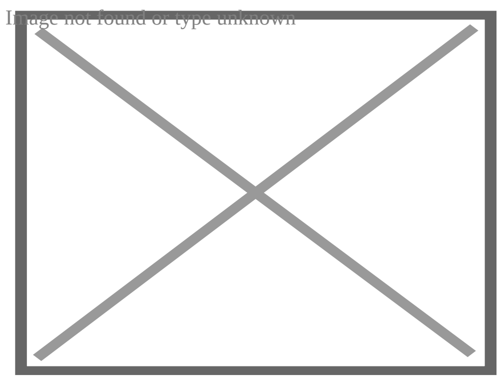
Co-treatment of industrial effluent

[edit]

In highly regulated developed countries, industrial wastewater usually receives at least pretreatment if not full treatment at the factories themselves to reduce the pollutant load, before discharge to the sewer. The pretreatment has the following two main aims: Firstly, to prevent toxic or inhibitory compounds entering the biological stage of the sewage treatment plant and reduce its efficiency. And secondly to avoid toxic compounds from accumulating in the produced sewage sludge which would reduce its beneficial reuse options. Some industrial wastewater may contain pollutants which cannot be removed by sewage treatment plants. Also, variable flow of industrial waste associated with production cycles may upset the population dynamics of biological treatment units.[*citation needed*]

Design aspects of secondary treatment processes

[edit]
Main article: Secondary treatment § Design considerations



A poorly maintained anaerobic treatment pond in Kariba, Zimbabwe (sludge needs to be removed)

Non-sewered areas

[edit]

Urban residents in many parts of the world rely on on-site sanitation systems without sewers, such as septic tanks and pit latrines, and fecal sludge management in these cities is an enormous challenge.[22]

For sewage treatment the use of septic tanks and other on-site sewage facilities (OSSF) is widespread in some rural areas, for example serving up to 20 percent of the homes in the U.S.[23]

Available process steps

[edit]

Sewage treatment often involves two main stages, called primary and secondary treatment, while advanced treatment also incorporates a tertiary treatment stage with polishing processes.[13] Different types of sewage treatment may utilize some or all of the process steps listed below.

Preliminary treatment

[edit]

Preliminary treatment (sometimes called pretreatment) removes coarse materials that can be easily collected from the raw sewage before they damage or clog the pumps and sewage lines of primary treatment clarifiers.

Screening

[edit]

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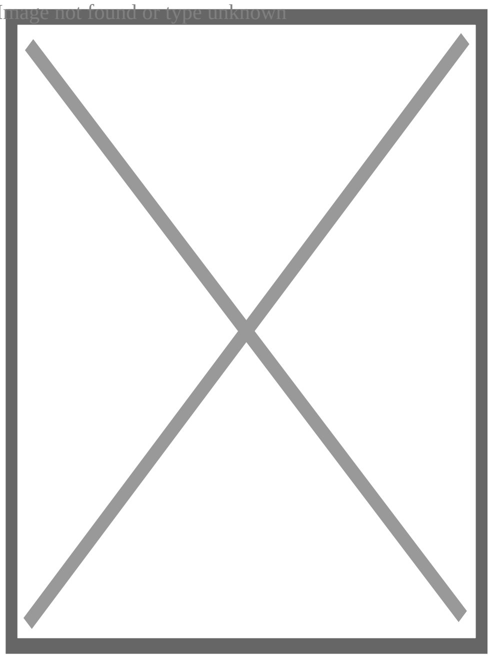


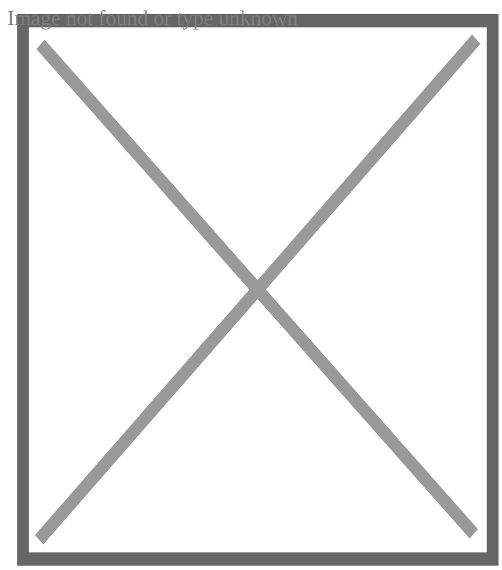
Preliminary treatment arrangement at small and medium-sized sewage treatment plants: Manually-cleaned screens and grit chamber (Jales

Treatment Plant, São Paulo, Brazil)

The influent in sewage water passes through a bar screen to remove all large objects like cans, rags, sticks, plastic packets, etc. carried in the sewage stream.[24] This is most commonly done with an automated mechanically raked bar screen in modern plants serving large populations, while in smaller or less modern plants, a manually cleaned screen may be used. The raking action of a mechanical bar screen is typically paced according to the accumulation on the bar screens and/or flow rate. The solids are collected and later disposed in a landfill, or incinerated. Bar screens or mesh screens of varying sizes may be used to optimize solids removal. If gross solids are not removed, they become entrained in pipes and moving parts of the treatment plant, and can cause substantial damage and inefficiency in the process.[25]: 9

Grit removal

[edit]



Preliminary treatment: Horizontal flow grit chambers at a sewage treatment plant in Juiz de Fora, Minas Gerais, Brazil

Grit consists of sand, gravel, rocks, and other heavy materials. Preliminary treatment may include a sand or grit removal channel or chamber, where the velocity of the incoming sewage is reduced to allow the settlement of grit. Grit removal is necessary to (1) reduce formation of deposits in primary sedimentation tanks, aeration tanks, anaerobic digesters, pipes, channels, etc. (2) reduce the frequency of tank cleaning caused by excessive accumulation of grit; and (3) protect moving mechanical equipment from abrasion and accompanying abnormal wear. The removal of grit is essential for equipment with closely machined metal surfaces such as comminutors, fine screens, centrifuges, heat exchangers, and high pressure diaphragm pumps.

Grit chambers come in three types: horizontal grit chambers, aerated grit chambers, and vortex grit chambers. Vortex grit chambers include mechanically induced vortex, hydraulically induced vortex, and multi-tray vortex separators. Given that traditionally, grit removal systems have been designed to remove clean inorganic particles that are greater than 0.210 millimetres (0.0083 in), most of the finer grit passes through the grit removal flows under normal conditions. During periods of high flow deposited grit is resuspended and the quantity of grit reaching the treatment plant increases substantially.[7]

Flow equalization

[edit]

Equalization basins can be used to achieve flow equalization. This is especially useful for combined sewer systems which produce peak dry-weather flows or peak wet-weather flows that are much higher than the average flows.[7]: 334 Such basins can improve the performance of the biological treatment processes and the secondary clarifiers.[7]: 334

Disadvantages include the basins' capital cost and space requirements. Basins can also provide a place to temporarily hold, dilute and distribute batch discharges of toxic or high-strength wastewater which might otherwise inhibit biological secondary treatment (such was wastewater from portable toilets or fecal sludge that is brought to the sewage treatment plant in vacuum trucks). Flow equalization basins require variable discharge control, typically include provisions for bypass and cleaning, and may also include aerators and odor control.[26]

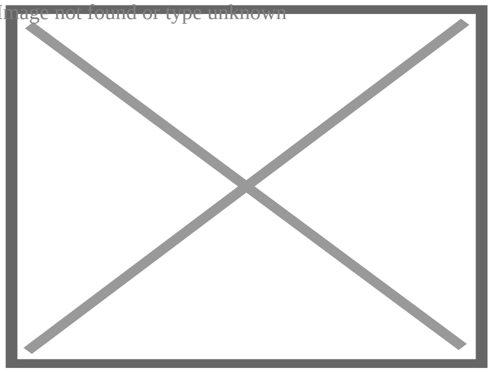
Fat and grease removal

[edit]

In some larger plants, fat and grease are removed by passing the sewage through a small tank where skimmers collect the fat floating on the surface. Air blowers in the base of the tank may also be used to help recover the fat as a froth. Many plants, however, use primary clarifiers with mechanical surface skimmers for fat and grease removal.

Primary treatment

[edit]



Rectangular primary settling tanks at a sewage treatment plant in Oregon, US

Primary treatment is the "removal of a portion of the suspended solids and organic matter from the sewage".[7]: 11 It consists of allowing sewage to pass slowly through a basin where heavy solids can settle to the bottom while oil, grease and lighter solids float to the surface and are skimmed off. These basins are called *primary sedimentation tanks* or *primary clarifiers* and typically have a hydraulic retention time (HRT) of 1.5 to 2.5 hours.[7]: 398 The settled and floating materials are removed and the remaining liquid may be discharged or subjected to secondary treatment. Primary settling tanks are usually equipped with mechanically driven scrapers that continually drive the collected sludge towards a hopper in the base of the tank where it is pumped to sludge treatment facilities.[25]: 9–11

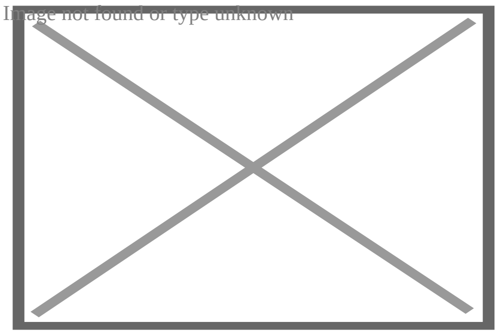
Sewage treatment plants that are connected to a combined sewer system sometimes have a bypass arrangement after the primary treatment unit. This means that during very heavy rainfall events, the secondary and tertiary treatment systems can be bypassed to protect them from hydraulic overloading, and the mixture of sewage and storm-water receives primary treatment only.[27]

Primary sedimentation tanks remove about 50–70% of the suspended solids, and 25–40% of the biological oxygen demand (BOD).[7]: 396

Secondary treatment

[edit]

Main article: Secondary treatment



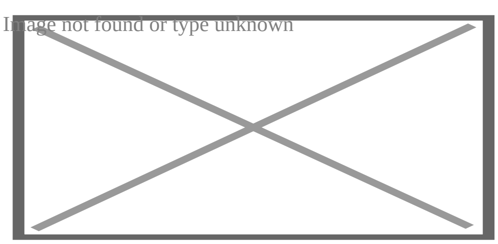
Simplified process flow diagram for a typical large-scale treatment plant using the activated sludge process

The main processes involved in secondary sewage treatment are designed to remove as much of the solid material as possible.[13] They use biological processes to digest and remove the remaining soluble material, especially the organic fraction. This can be done with either suspended-growth or biofilm processes. The microorganisms that feed on the organic matter present in the sewage grow and multiply, constituting the biological solids, or biomass. These grow and group together in the form of flocs or biofilms and, in some specific processes, as granules. The biological floc or biofilm and remaining fine solids form a sludge which can be settled and separated. After separation, a liquid remains that is almost free of solids, and with a greatly reduced concentration of pollutants.[13]

Secondary treatment can reduce organic matter (measured as biological oxygen demand) from sewage, using aerobic or anaerobic processes. The organisms involved in these processes are sensitive to the presence of toxic materials, although these are not expected to be present at high concentrations in typical municipal sewage.

Tertiary treatment

[edit]



Overall setup for a micro filtration system

Advanced sewage treatment generally involves three main stages, called primary, secondary and tertiary treatment but may also include intermediate stages and final polishing processes. The purpose of tertiary treatment (also called *advanced treatment*) is to provide a final treatment stage to further improve the effluent quality before it is discharged to the receiving water body or reused. More than one tertiary treatment process may be used at any treatment plant. If disinfection is practiced, it is always the final process. It is also called *effluent polishing*. Tertiary treatment may include biological nutrient removal (alternatively, this can be classified as secondary treatment), disinfection and partly removal of micropollutants, such as environmental persistent pharmaceutical pollutants.

Tertiary treatment is sometimes defined as anything more than primary and secondary treatment in order to allow discharge into a highly sensitive or fragile ecosystem such as estuaries, low-flow rivers or coral reefs.[28] Treated water is sometimes disinfected chemically or physically (for example, by lagoons and microfiltration) prior to discharge into a stream, river, bay, lagoon or wetland, or it can be used for the irrigation of a golf course, greenway or park. If it is sufficiently clean, it can also be used for groundwater recharge or agricultural purposes.

Sand filtration removes much of the residual suspended matter.[25]: 22–23 Filtration over activated carbon, also called *carbon adsorption,* removes residual toxins.[25]: 19 Micro filtration or synthetic membranes are used in membrane bioreactors and can also remove pathogens.[7]: 854

Settlement and further biological improvement of treated sewage may be achieved through storage in large human-made ponds or lagoons. These lagoons are highly aerobic, and colonization by native macrophytes, especially reeds, is often encouraged.

Disinfection

[edit]

Disinfection of treated sewage aims to kill pathogens (disease-causing microorganisms) prior to disposal. It is increasingly effective after more elements of the foregoing treatment sequence have been completed.[29]: 359 The purpose of disinfection in the treatment of sewage is to substantially reduce the number of pathogens in the water to be discharged back into the environment or to be reused. The target level of reduction of biological contaminants like pathogens is often regulated by the presiding governmental authority. The effectiveness of disinfection depends on the quality of the water being treated (e.g. turbidity, pH, etc.), the type of disinfection being used, the disinfectant dosage (concentration and time), and other environmental variables. Water with high turbidity will be treated less successfully, since solid matter can shield organisms, especially from ultraviolet light or if contact times are low. Generally, short contact times, low doses and high flows all militate against effective disinfection. Common methods of disinfection include ozone, chlorine, ultraviolet light, or sodium hypochlorite.[25]: 16 Monochloramine, which is used for drinking water, is not used in the treatment of sewage because of its persistence.

Chlorination remains the most common form of treated sewage disinfection in many countries due to its low cost and long-term history of effectiveness. One disadvantage is that chlorination of residual organic material can generate chlorinated-organic compounds that may be carcinogenic or harmful to the environment. Residual chlorine or chloramines may also be capable of chlorinating organic material in the natural aquatic environment. Further, because residual chlorine is toxic to aquatic species, the treated effluent must also be chemically dechlorinated, adding to the complexity and cost of treatment.

Ultraviolet (UV) light can be used instead of chlorine, iodine, or other chemicals. Because no chemicals are used, the treated water has no adverse effect on organisms that later consume it, as may be the case with other methods. UV radiation causes damage to the genetic structure of bacteria, viruses, and other pathogens, making them incapable of reproduction. The key disadvantages of UV disinfection are the need for frequent lamp maintenance and replacement and the need for a highly treated effluent to ensure that the target microorganisms are not shielded from the UV radiation (i.e., any solids present in the treated effluent may protect microorganisms from the UV light). In many countries, UV light is becoming the most common means of disinfection because of the concerns about the impacts of chlorine in chlorinating residual organics in the treated sewage and in chlorinating organics in the receiving water.

As with UV treatment, heat sterilization also does not add chemicals to the water being treated. However, unlike UV, heat can penetrate liquids that are not transparent. Heat disinfection can also penetrate solid materials within wastewater, sterilizing their contents. Thermal effluent decontamination systems provide low resource, low maintenance effluent decontamination once installed.

Ozone (O_3) is generated by passing oxygen (

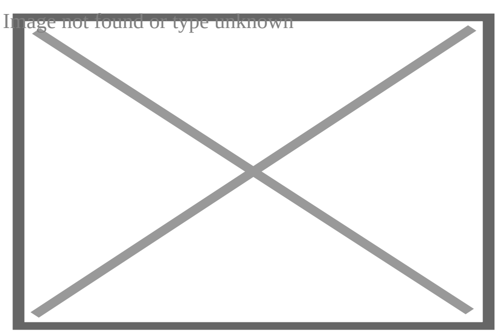
O_2) through a high voltage potential resulting in a third oxygen atom becoming attached and forming

O_3. Ozone is very unstable and reactive and oxidizes most organic material it comes in contact with, thereby destroying many pathogenic microorganisms. Ozone is considered to be safer than chlorine because, unlike chlorine which has to be stored on site (highly poisonous in the event of an accidental release), ozone is generated on-site as needed from the oxygen in the ambient air. Ozonation also produces fewer disinfection by-products than chlorination. A disadvantage of ozone disinfection is the high cost of the ozone generation equipment and the requirements for special operators. Ozone sewage treatment requires the use of an ozone generator, which decontaminates the water as ozone bubbles percolate through the tank.

Membranes can also be effective disinfectants, because they act as barriers, avoiding the passage of the microorganisms. As a result, the final effluent may be devoid of pathogenic organisms, depending on the type of membrane used. This principle is applied in membrane bioreactors.

Biological nutrient removal

[edit]



Nitrification process tank at an activated sludge plant in the United States

Sewage may contain high levels of the nutrients nitrogen and phosphorus. Typical values for nutrient loads per person and nutrient concentrations in raw sewage in developing countries have been published as follows: 8 g/person/d for total nitrogen (45 mg/L), 4.5 g/person/d for ammonia-N (25 mg/L) and 1.0 g/person/d for total phosphorus (7 mg/L).[4]: 57 The typical ranges for these values are: 6–10 g/person/d for total nitrogen (35–60 mg/L), 3.5–6 g/person/d for ammonia-N (20–35 mg/L) and 0.7–2.5 g/person/d for total phosphorus (4–15 mg/L).[4]: 57

Excessive release to the environment can lead to nutrient pollution, which can manifest itself in eutrophication. This process can lead to algal blooms, a rapid growth, and later decay, in the population of algae. In addition to causing deoxygenation, some algal species produce toxins that contaminate drinking water supplies.

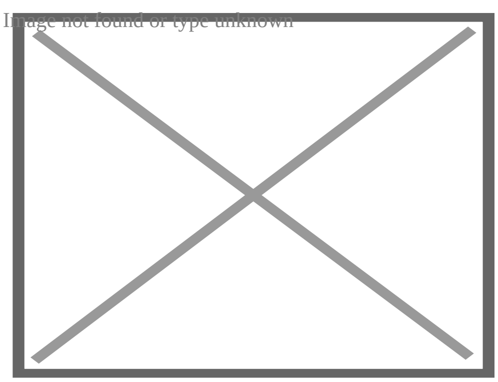
Ammonia nitrogen, in the form of free ammonia (NH_3) is toxic to fish. Ammonia nitrogen, when converted to nitrite and further to nitrate in a water body, in the process of nitrification, is associated with the consumption of dissolved oxygen. Nitrite and nitrate may also have public health significance if concentrations are high in drinking water, because of a disease called metahemoglobinemia.[4]: 42

Phosphorus removal is important as phosphorus is a limiting nutrient for algae growth in many fresh water systems. Therefore, an excess of phosphorus can lead to eutrophication. It is also particularly important for water reuse systems where high phosphorus concentrations may lead to fouling of downstream equipment such as reverse osmosis.

A range of treatment processes are available to remove nitrogen and phosphorus. Biological nutrient removal (BNR) is regarded by some as a type of secondary treatment process,[7] and by others as a *tertiary* (or *advanced*) treatment process.

Nitrogen removal

[edit]



Constructed wetlands (vertical flow) for sewage treatment near Shanghai, China

Nitrogen is removed through the biological oxidation of nitrogen from ammonia to nitrate (nitrification), followed by denitrification, the reduction of nitrate to nitrogen gas. Nitrogen gas is released to the atmosphere and thus removed from the water.

Nitrification itself is a two-step aerobic process, each step facilitated by a different type of bacteria. The oxidation of ammonia (NH_4^+) to nitrite ($NO_2^?$) is most often facilitated by bacteria such as *Nitrosomonas* spp. (*nitroso* refers to the formation of a nitroso functional group). Nitrite oxidation to nitrate ($NO_3^?$), though traditionally believed to be facilitated by *Nitrobacter* spp. (nitro referring the formation of a nitro functional group), is now known to be facilitated in the environment predominantly by *Nitrospira* spp.

Denitrification requires anoxic conditions to encourage the appropriate biological communities to form. *Anoxic conditions* refers to a situation where oxygen is absent but nitrate is present. Denitrification is facilitated by a wide diversity of bacteria. The activated sludge process, sand filters, waste stabilization ponds, constructed wetlands and other processes can all be used to reduce nitrogen.[25]: 17–18 Since denitrification is the reduction of nitrate to dinitrogen (molecular nitrogen) gas, an electron donor is needed. This can be, depending on the wastewater, organic matter (from the sewage itself), sulfide, or an added donor like methanol. The sludge in the anoxic tanks (denitrification tanks) must be mixed well (mixture of recirculated mixed liquor, return activated sludge, and raw influent) e.g. by using submersible mixers in order to achieve the desired denitrification.

Over time, different treatment configurations for activated sludge processes have evolved to achieve high levels of nitrogen removal. An initial scheme was called the Ludzack–Ettinger Process. It could not achieve a high level of denitrification.[7]: 616 The Modified Ludzak–Ettinger Process (MLE) came later and was an improvement on the original concept. It recycles mixed liquor from the discharge end of the aeration tank to the head of the anoxic tank. This provides nitrate for the facultative bacteria.[7]: 616

There are other process configurations, such as variations of the Bardenpho process.[30]: 160 They might differ in the placement of anoxic tanks, e.g. before and after the aeration tanks.

Phosphorus removal

[edit]

Studies of United States sewage in the late 1960s estimated mean per capita contributions of 500 grams (18 oz) in urine and feces, 1,000 grams (35 oz) in synthetic detergents, and lesser variable amounts used as corrosion and scale control chemicals in water supplies.[31] Source control via alternative detergent formulations has subsequently reduced the largest contribution, but naturally the phosphorus content of urine and feces remained unchanged.

Phosphorus can be removed biologically in a process called enhanced biological phosphorus removal. In this process, specific bacteria, called polyphosphate-accumulating organisms (PAOs), are selectively enriched and accumulate large quantities of phosphorus within their cells (up to 20 percent of their mass).[30]:

148–155

Phosphorus removal can also be achieved by chemical precipitation, usually with salts of iron (e.g. ferric chloride) or aluminum (e.g. alum), or lime.[25]: 18 This may lead to a higher sludge production as hydroxides precipitate and the added chemicals can be expensive. Chemical phosphorus removal requires significantly smaller equipment footprint than biological removal, is easier to operate and is often more reliable than biological phosphorus removal. Another method for phosphorus removal is to use granular laterite or zeolite.[32][33]

Some systems use both biological phosphorus removal and chemical phosphorus removal. The chemical phosphorus removal in those systems may be used as a backup system, for use when the biological phosphorus removal is not removing enough phosphorus, or may be used continuously. In either case, using both biological and chemical phosphorus removal has the advantage of not increasing sludge production as much as chemical phosphorus removal on its own, with the disadvantage of the increased initial cost associated with installing two different systems.

Once removed, phosphorus, in the form of a phosphate-rich sewage sludge, may be sent to landfill or used as fertilizer in admixture with other digested sewage sludges. In the latter case, the treated sewage sludge is also sometimes referred to as biosolids. 22% of the world's phosphorus needs could be satisfied by recycling residential wastewater.[34][35]

Fourth treatment stage

[edit]
Further information: Environmental impact of pharmaceuticals and personal care products

Micropollutants such as pharmaceuticals, ingredients of household chemicals, chemicals used in small businesses or industries, environmental persistent pharmaceutical pollutants (EPPP) or pesticides may not be eliminated in the commonly used sewage treatment processes (primary, secondary and tertiary treatment) and therefore lead to water pollution.[36] Although concentrations of those substances and their decomposition products are quite low, there is still a chance of harming aquatic organisms. For pharmaceuticals, the following substances have been identified as toxicologically relevant: substances with endocrine disrupting effects, genotoxic substances and substances that enhance the development of bacterial resistances.[37] They mainly belong to the group of EPPP.

Techniques for elimination of micropollutants via a fourth treatment stage during sewage treatment are implemented in Germany, Switzerland, Sweden[3] and the Netherlands and tests are ongoing in several other countries.[38] In Switzerland it has been enshrined in law since 2016.[39] Since 1 January 2025, there has been a recast of the Urban Waste Water Treatment Directive in the European Union. Due to the large number of amendments that have now been made, the directive was rewritten on November 27, 2024 as Directive (EU) 2024/3019, published in the EU Official Journal on December 12, and entered into force on January 1, 2025. The member states now have 31 months, i.e. until July 31, 2027, to adapt their national legislation to the new directive ("implementation of the directive").

The amendment stipulates that, in addition to stricter discharge values for nitrogen and phosphorus, persistent trace substances must at least be partially separated. The target, similar to Switzerland, is that 80% of 6 key substances out of 12 must be removed between discharge into the sewage treatment plant and discharge into the water body. At least 80% of the investments and operating costs for the fourth treatment stage will be passed on to the pharmaceutical and cosmetics industry according to the polluter pays principle in order to relieve the population financially and provide an incentive for the development of more environmentally friendly products. In addition, the municipal wastewater treatment sector is to be energy neutral by 2045 and the emission of microplastics and PFAS is to be monitored.

The implementation of the framework guidelines is staggered until 2045, depending on the size of the sewage treatment plant and its population equivalents (PE). Sewage treatment plants with over 150,000 PE have priority and should be adapted immediately, as a significant proportion of the pollution comes from them. The adjustments are staggered at national level in:

- 20% of the plants by 31 December 2033,
- 60% of the plants by 31 December 2039,
- 100% of the plants by 31 December 2045.

Wastewater treatment plants with 10,000 to 150,000 PE that discharge into coastal waters or sensitive waters are staggered at national level in:

- 10% of the plants by 31 December 2033,
- 30% of the plants by 31 December 2036,
- 60% of the plants by 31 December 2039,
- 100% of the plants by 31 December 2045.

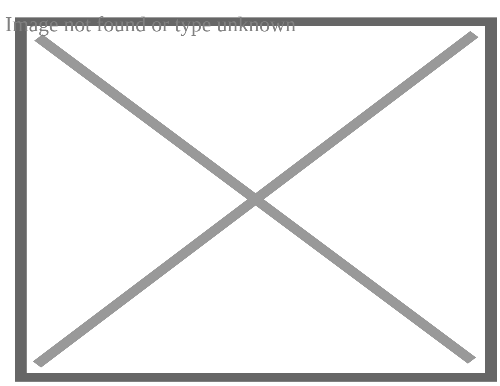
The latter concerns waters with a low dilution ratio, waters from which drinking water is obtained and those that are coastal waters, or those used as bathing waters or used for mussel farming. Member States will be given the option not to apply fourth treatment in these areas if a risk assessment shows that there is no potential risk from micropollutants to human health and/or the environment.[40][41]

Such process steps mainly consist of activated carbon filters that adsorb the micropollutants. The combination of advanced oxidation with ozone followed by granular activated carbon (GAC) has been suggested as a cost-effective treatment combination for pharmaceutical residues. For a full reduction of microplasts the combination of ultrafiltration followed by GAC has been suggested. Also the use of enzymes such as laccase secreted by fungi is under investigation.[42][43] Microbial biofuel cells are investigated for their property to treat organic matter in sewage.[44]

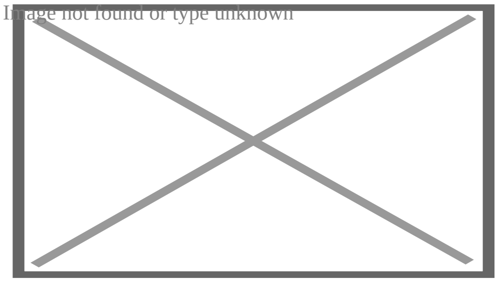
To reduce pharmaceuticals in water bodies, source control measures are also under investigation, such as innovations in drug development or more responsible handling of drugs.[37][45] In the US, the National Take Back Initiative is a voluntary program with the general public, encouraging people to return excess or expired drugs, and avoid flushing them to the sewage system.[46]

Sludge treatment and disposal

[edit]



View of a belt filter press at the Blue Plains Advanced Wastewater Treatment Plant, Washington, D.C.



Mechanical dewatering of sewage sludge with a centrifuge at a large sewage treatment plant (Arrudas Treatment Plant, Belo Horizonte, Brazil)

This section is an excerpt from Sewage sludge treatment.[edit]

Sewage sludge treatment describes the processes used to manage and dispose of sewage sludge produced during sewage treatment. Sludge treatment is focused on reducing sludge weight and volume to reduce transportation and disposal costs, and on reducing potential health risks of disposal options. Water removal is the primary means of weight and volume reduction, while pathogen destruction is frequently accomplished through heating during thermophilic digestion, composting, or incineration. The choice of a sludge treatment method depends on the volume of sludge generated, and comparison of treatment costs required for available disposal options. Air-drying and composting may be attractive to rural communities, while limited land availability may make aerobic digestion and mechanical dewatering preferable for cities, and economies of scale may encourage energy recovery alternatives in metropolitan areas.

Sludge is mostly water with some amounts of solid material removed from liquid sewage. Primary sludge includes settleable solids removed during primary treatment in primary clarifiers. Secondary sludge is sludge separated in secondary clarifiers that are used in secondary treatment bioreactors or processes using inorganic oxidizing agents. In intensive sewage treatment processes, the sludge produced needs to be removed from the liquid line on a continuous basis because the volumes of the tanks in the liquid line have insufficient volume to store sludge.[47] This is done in order to keep the treatment processes compact and in balance (production of sludge approximately equal to the removal of sludge). The sludge removed from the liquid line goes to the sludge treatment line. Aerobic processes (such as the activated sludge process) tend to produce more sludge compared with anaerobic processes. On the other hand, in extensive (natural) treatment processes, such as ponds and constructed wetlands, the produced sludge remains accumulated in the treatment units (liquid line) and is only removed after several years of operation.[48]

Sludge treatment options depend on the amount of solids generated and other site-specific conditions. Composting is most often applied to small-scale plants with aerobic digestion for mid-sized operations, and anaerobic digestion for the larger-scale operations. The sludge is sometimes passed through a so-called pre-thickener which de-waters the sludge. Types of pre-thickeners include centrifugal sludge thickeners,[49] rotary drum sludge thickeners and belt filter presses.[50] Dewatered sludge may be incinerated or transported offsite for disposal in a landfill or use as an agricultural soil amendment.[51]

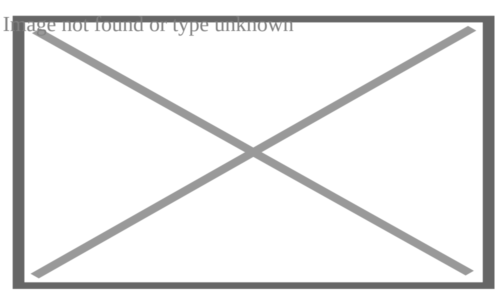
Environmental impacts

[edit]

Sewage treatment plants can have significant effects on the biotic status of receiving waters and can cause some water pollution, especially if the treatment process used is only basic. For example, for sewage treatment plants without nutrient removal, eutrophication of receiving water bodies can be a problem.

This section is an excerpt from Water pollution.[edit]

Water pollution (or aquatic pollution) is the contamination of water bodies, with a negative impact on their uses.[52]: 6 It is usually a result of human activities. Water bodies include lakes, rivers, oceans, aquifers, reservoirs and groundwater. Water pollution results when contaminants mix with these water bodies. Contaminants can come from one of four main sources. These are sewage discharges, industrial activities, agricultural activities, and urban runoff including stormwater.[53] Water pollution may affect either surface water or groundwater. This form of pollution can lead to many problems. One is the degradation of aquatic ecosystems. Another is spreading water-borne diseases when people use polluted water for drinking or irrigation.[54] Water pollution also reduces the ecosystem services such as drinking water provided by the water resource.



Treated effluent from sewage treatment plant in D??ín, Czech Republic, is discharged to surface waters.

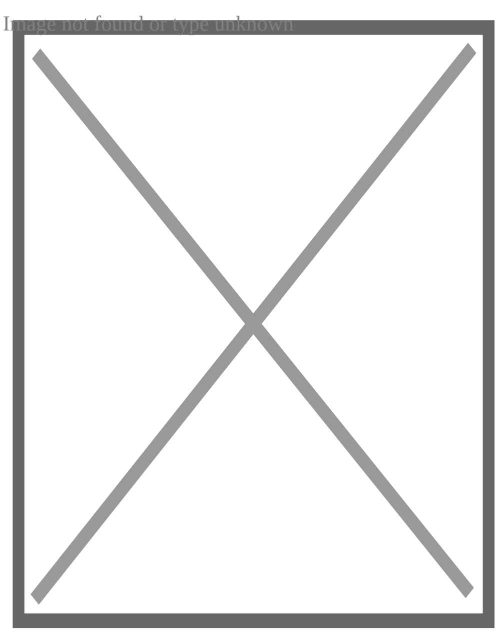
In 2024, The Royal Academy of Engineering released a study into the effects wastewater on public health in the United Kingdom.[55] The study gained media attention, with comments from the UKs leading health professionals, including Sir Chris Whitty. Outlining 15 recommendations for various UK bodies to dramatically reduce public health risks by increasing the water quality in its waterways, such as rivers and lakes.

After the release of the report, The Guardian newspaper interviewed Whitty, who stated that improving water quality and sewage treatment should be a high level of importance and a "public health priority". He compared it to eradicating cholera in the 19th century in the country following improvements to the sewage treatment network.[56] The study also identified that low water flows in rivers saw high concentration levels of sewage, as well as times of flooding or heavy rainfall. While heavy rainfall had always been associated with sewage overflows into streams and rivers, the British media went as far to warn parents of the dangers of paddling in shallow rivers during warm weather.[57]

Whitty's comments came after the study revealed that the UK was experiencing a growth in the number of people that were using coastal and inland waters recreationally. This could be connected to a growing interest in activities such as open water swimming or other water sports.[58] Despite this growth in recreation, poor water quality meant some were becoming unwell during events.[59] Most notably, the 2024 Paris Olympics had to delay numerous swimming-focused events like the triathlon due to high levels of sewage in the River Seine.[60]

Reuse

[edit]
Further information: Reuse of excreta

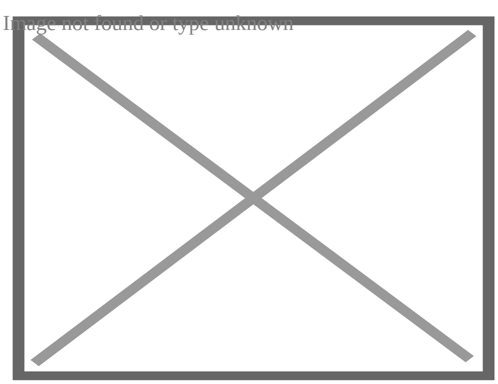


Sludge drying beds for sewage sludge treatment at a small treatment plant at the Center for Research and Training in Sanitation, Belo Horizonte, Brazil

Irrigation

[edit]
See also: Sewage farm

Increasingly, people use treated or even untreated sewage for irrigation to produce crops. Cities provide lucrative markets for fresh produce, so are attractive to farmers. Because agriculture has to compete for increasingly scarce water resources with industry and municipal users, there is often no alternative for farmers but to use water polluted with sewage directly to water their crops. There can be significant health hazards related to using water loaded with pathogens in this way. The World Health Organization developed guidelines for safe use of wastewater in 2006.[61] They advocate a 'multiple-barrier' approach to wastewater use, where farmers are encouraged to adopt various risk-reducing behaviors. These include ceasing irrigation a few days before harvesting to allow pathogens to die off in the sunlight, applying water carefully so it does not contaminate leaves likely to be eaten raw, cleaning vegetables with disinfectant or allowing fecal sludge used in farming to dry before being used as a human manure.[62]



Circular secondary sedimentation tank at activated sludge sewage treatment plant at Arrudas Treatment Plant, Belo Horizonte, Brazil

Reclaimed water

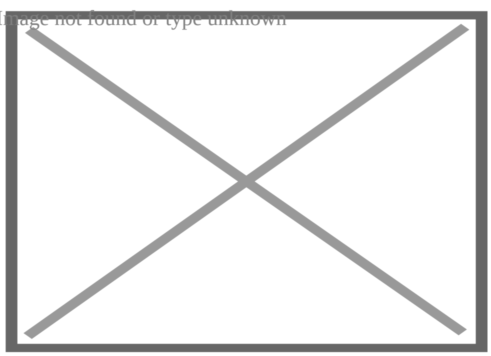
[edit]

This section is an excerpt from Reclaimed water.[edit]

Water reclamation is the process of converting municipal wastewater or sewage and industrial wastewater into water that can be reused for a variety of purposes. It is also called wastewater reuse, water reuse or water recycling. There are many types of reuse. It is possible to reuse water in this way in cities or for irrigation in agriculture. Other types of reuse are environmental reuse, industrial reuse, and reuse for drinking water, whether planned or not. Reuse may include irrigation of gardens and agricultural fields or replenishing surface water and groundwater. This latter is also known as groundwater recharge. Reused water also serve various needs in residences such as toilet flushing, businesses, and industry. It is possible to treat wastewater to reach drinking water standards. Injecting reclaimed water into the water supply distribution system is known as direct potable reuse. Drinking reclaimed water is not typical.[63] Reusing treated municipal wastewater for irrigation is a long-established practice. This is especially so in arid countries. Reusing wastewater as part of sustainable water management allows water to remain an alternative water source for human activities. This can reduce scarcity. It also eases pressures on groundwater and other natural water bodies.[64]

Global situation

[edit]



Share of domestic wastewater that is safely treated (in 2018)[65]

Before the 20th century in Europe, sewers usually discharged into a body of water such as a river, lake, or ocean. There was no treatment, so the breakdown of the human waste was left to the ecosystem. This could lead to satisfactory results if the assimilative capacity of the ecosystem is sufficient which is nowadays not often the case due to increasing population density.[4]: 78

Today, the situation in urban areas of industrialized countries is usually that sewers route their contents to a sewage treatment plant rather than directly to a body of water. In many developing countries, however, the bulk of municipal and industrial wastewater is discharged to rivers and the ocean without any treatment or after preliminary treatment or primary treatment only. Doing so can lead to water pollution. Few reliable figures exist on the share of the wastewater collected in sewers that is being treated worldwide. A global estimate by UNDP and UN-Habitat in 2010 was that 90% of all wastewater generated is released into the environment untreated.[66] A more recent study in 2021 estimated that globally, about 52% of sewage is treated.[5] However, sewage treatment rates are highly unequal for different countries around the world. For example, while high-income countries treat approximately 74% of their sewage, developing countries treat an average of just 4.2%.[5] As of 2022, without sufficient treatment, more than 80% of all wastewater generated globally is released into the environment. High-income nations treat, on average, 70% of the wastewater they produce, according to UN Water.[34][67][68] Only 8% of wastewater produced in low-income nations receives any sort of treatment.[34][69][70]

The Joint Monitoring Programme (JMP) for Water Supply and Sanitation by WHO and UNICEF report in 2021 that 82% of people with sewer connections are connected to sewage treatment plants providing at least secondary treatment.[71]: 55 However, this value varies widely between regions. For example, in Europe, North America, Northern Africa and Western Asia, a total of 31 countries had universal (>99%) wastewater treatment. However, in Albania, Bermuda, North Macedonia and Serbia "less than 50% of sewered wastewater received secondary or better treatment" and in Algeria, Lebanon and Libya the value was less than 20% of sewered wastewater that was being treated. The report also found that "globally, 594 million people have sewer connections that don't receive sufficient treatment. Many more are connected to wastewater treatment plants that do not provide effective treatment or comply with effluent requirements.".[71]: 55

Global targets

[edit]

Sustainable Development Goal 6 has a Target 6.3 which is formulated as follows: "By 2030, improve water quality by reducing pollution, eliminating,dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally."[65] The corresponding Indicator 6.3.1 is the "proportion of wastewater safely treated". It is anticipated that wastewater production would rise by 24% by 2030 and by 51% by 2050.[34][72][73]

Data in 2020 showed that there is still too much uncollected household wastewater: Only 66% of all household wastewater flows were collected at treatment facilities in 2020 (this is determined from data from 128 countries).[8]: 17 Based on data from 42 countries in 2015, the report stated that "32 per cent of all wastewater flows generated from point sources received at least some treatment".[8]: 17 For sewage that has indeed been collected at centralized sewage treatment plants, about 79% went on to be safely treated in 2020.[8]: 18

History

[edit]
Further information: History of water supply and sanitation § Sewage treatment

The history of sewage treatment had the following developments: It began with land application (sewage farms) in the 1840s in England, followed by chemical treatment and sedimentation of sewage in tanks, then biological treatment in the late 19th century, which led to the development of the activated sludge process starting in 1912.[74][75]

This section is an excerpt from History of water supply and sanitation § Biological treatment.[edit]

It was not until the late 19th century that it became possible to treat the sewage by biologically decomposing the organic components through the use of microorganisms and removing the pollutants. Land treatment was also steadily becoming less feasible, as cities grew and the volume of sewage produced could no longer be absorbed by the farmland on the outskirts.

Edward Frankland conducted experiments at the sewage farm in Croydon, England during the 1870s and was able to demonstrate that filtration of sewage through porous gravel produced a nitrified effluent (the ammonia was converted into nitrate) and that the filter remained unclogged over long periods of time.[76] This established the then revolutionary possibility of biological treatment of sewage using a contact bed to oxidize the waste. This concept was taken up by the chief chemist for the London Metropolitan Board of Works, William Dibdin, in 1887:

> ...in all probability the true way of purifying sewage...will be first to separate the sludge, and then turn into neutral effluent... retain it for a sufficient period, during which time it should be fully aerated, and finally discharge it into the stream in a purified condition. This is indeed what is aimed at and imperfectly accomplished on a sewage farm.[77]

From 1885 to 1891, filters working on Dibdin's principle were constructed throughout the UK and the idea was also taken up in the US at the Lawrence Experiment Station in Massachusetts, where Frankland's work was confirmed.[78] In 1890, the LES developed a 'trickling filter' that gave a much more reliable performance.[79]

Regulations

[edit]

In most countries, sewage collection and treatment are subject to local and national regulations and standards.

By country

[edit]

Overview

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Wastewater treatment by country

- Benin
- China
- Costa Rica
- Egypt
- Ireland
- Jordan
- Morocco
- Pakistan
- Palestine
- Peru
- Portugal
- South Africa
- Uganda
- Yemen

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Water supply and sanitation by country

- Afghanistan
- Algeria
- Angola
- Argentina
- Australia
- Azerbaijan
- Bangladesh
- Belgium
- Belize
- Benin
- Bhutan
- Bolivia
- Bosnia and Herzegovina
- Brazil
- Burkina Faso
- Cambodia
- Canada
- Chile
- China
- Colombia
- Costa Rica
- Cuba
- Democratic Republic of the Congo
- Denmark
- Dominican Republic
- Ecuador
- Egypt
- El Salvador
- Ethiopia
- France
- Georgia
- Germany
- Ghana
- Greece
- Grenada
- Guatemala
- Guyana
- Haiti
- Honduras
- India
- Indonesia
- Iran
- Iraq
- Ireland
- Israel
- Italy
- Jamaica

Europe

[edit]

In the European Union, 0.8% of total energy consumption goes to wastewater treatment facilities.[34][80] The European Union needs to make extra investments of €90 billion in the water and waste sector to meet its 2030 climate and energy goals.[34][81][82]

In October 2021, British Members of Parliament voted to continue allowing untreated sewage from combined sewer overflows to be released into waterways.[83][84]

This section is an excerpt from Urban Waste Water Treatment Directive § Description.
[edit]
The Urban Waste Water Treatment Directive (full title "Council Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment") is a European Union directive regarding urban wastewater collection, wastewater treatment and its discharge, as well as the treatment and discharge of "waste water from certain industrial sectors". It was adopted on 21 May 1991.[85] It aims "to protect the environment from the adverse effects of urban waste water discharges and discharges from certain industrial sectors" by mandating waste water collection and treatment in urban agglomerations with a population equivalent of over 2000, and more advanced treatment in places with a population equivalent above 10,000 in sensitive areas.[86]

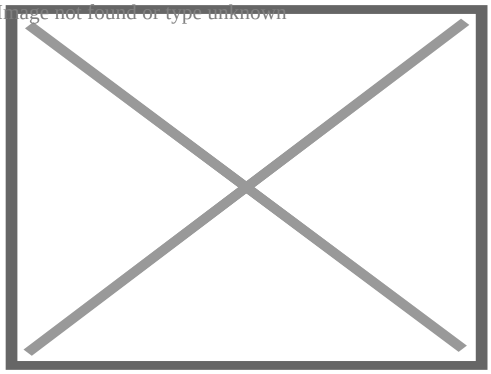
Asia

[edit]

India

[edit]

This section is an excerpt from Water supply and sanitation in India § Wastewater treatment.[edit]



Picture of a wastewater stream

In India, wastewater treatment regulations come under three central institutions, the ministries of forest, climate change housing, urban affairs and water.[87] The various water and sanitation policies such as the "National Environment Policy 2006" and "National Sanitation Policy 2008" also lay down wastewater treatment regulations. State governments and local municipalities hold responsibility for the disposal of sewage and construction and maintenance of "sewerage infrastructure". Their efforts are supported by schemes offered by the Government of India, such as the National River Conservation Plan, Jawaharlal Nehru National Urban Renewal Mission, National Lake Conservation Plan. Through the Ministry of Environment and Forest, India's government also has set up incentives that encourage industries to establish "common facilities" to undertake the treatment of wastewater.[88]

The 'Delhi Jal Board' (DJB) is currently operating on the construction of the largest sewage treatment plant in India. It will be operational by the end of 2022 with an estimated capacity of 564 MLD. It is supposed to solve the existing situation wherein untreated sewage water is being discharged directly into the river 'Yamuna'.

Japan

[edit]

This section is an excerpt from Water supply and sanitation in Japan § Wastewater treatment and sanitation.[edit]
Currently, Japan's methods of wastewater treatment include rural community sewers, wastewater facilities, and on-site treatment systems such as the Johkasou system to treat domestic wastewater.[89] Larger wastewater facilities and sewer systems are generally used to treat wastewater in more urban areas with a larger population. Rural sewage systems are used to treat wastewater at smaller domestic wastewater treatment plants for a smaller population. Johkasou systems are on-site wastewater treatment systems tanks. They are used to treat the wastewater of a single household or to treat the wastewater of a small number of buildings in a more decentralized

manner than a sewer system.[90]

Africa

[edit]

Libya

[edit]

This section is an excerpt from Environmental issues in Libya § Wastewater treatment.[edit]

In Libya, municipal wastewater treatment is managed by the general company for water and wastewater in Libya, which falls within the competence of the Housing and Utilities Government Ministry. There are approximately 200 sewage treatment plants across the nation, but few plants are functioning. In fact, the 36 larger plants are in the major cities; however, only nine of them are operational, and the rest of them are under repair.[91]

The largest operating wastewater treatment plants are situated in Sirte, Tripoli, and Misurata, with a design capacity of 21,000, 110,000, and 24,000 m3/day, respectively. Moreover, a majority of the remaining wastewater facilities are small and medium-sized plants with a design capacity of approximately 370 to 6700 m3/day. Therefore, 145,800 m3/day or 11 percent of the wastewater is actually treated, and the remaining others are released into the ocean and artificial lagoons although they are untreated. In fact, nonoperational wastewater treatment plants in Tripoli lead to a spill of over 1,275, 000 cubic meters of unprocessed water into the ocean every day.[91]

Americas

[edit]

United States

[edit]

This section is an excerpt from Water supply and sanitation in the United States § Wastewater treatment.[edit]

The United States Environmental Protection Agency (EPA) and state environmental agencies set wastewater standards under the Clean Water Act.[92] Point sources must obtain surface water discharge permits through the National Pollutant Discharge Elimination System (NPDES). Point sources include industrial facilities, municipal governments (sewage treatment plants and storm sewer systems), other government facilities such as military bases, and some agricultural facilities, such as animal feedlots.[93] EPA sets basic national wastewater standards: The "Secondary Treatment Regulation" applies to municipal sewage treatment plants,[94] and the "Effluent guidelines" which are regulations for categories of industrial facilities.[95]

See also

[edit]

- icon Image not found or type unknown Environment portal
- Decentralized wastewater system
- List of largest wastewater treatment plants
- List of water supply and sanitation by country
- Organisms involved in water purification
- Sanitary engineering
- Waste disposal

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External links

[edit]

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Wikimedia Commons has media related to ***Sewage treatment***.

- Water Environment Federation – Professional association focusing on municipal wastewater treatment

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Wastewater

Sources and types	○ Acid mine drainage ○ Ballast water ○ Bathroom ○ Blackwater (coal) ○ Blackwater (waste) ○ Boiler blowdown ○ Brine ○ Combined sewer ○ Cooling tower ○ Cooling water ○ Fecal sludge ○ Greywater ○ Infiltration/Inflow ○ Industrial wastewater ○ Ion exchange ○ Leachate ○ Manure ○ Papermaking ○ Produced water ○ Return flow ○ Reverse osmosis ○ Sanitary sewer ○ Septage ○ Sewage ○ Sewage sludge ○ Toilet ○ Urban runoff
Quality indicators	○ Adsorbable organic halides ○ Biochemical oxygen demand ○ Chemical oxygen demand ○ Coliform index ○ Oxygen saturation ○ Heavy metals ○ pH ○ Salinity ○ Temperature ○ Total dissolved solids ○ Total suspended solids ○ Turbidity ○ Wastewater surveillance

Treatment options	○ Activated sludge ○ Aerated lagoon ○ Agricultural wastewater treatment ○ API oil–water separator ○ Carbon filtering ○ Chlorination ○ Clarifier ○ Constructed wetland ○ Decentralized wastewater system ○ Extended aeration ○ Facultative lagoon ○ Fecal sludge management ○ Filtration ○ Imhoff tank ○ Industrial wastewater treatment ○ Ion exchange ○ Membrane bioreactor ○ Reverse osmosis ○ Rotating biological contactor ○ Secondary treatment ○ Sedimentation ○ Septic tank ○ Settling basin ○ Sewage sludge treatment ○ Sewage treatment ○ Sewer mining ○ Stabilization pond ○ Trickling filter ○ Ultraviolet germicidal irradiation ○ UASB ○ Vermifilter ○ Wastewater treatment plant

Disposal options

- Combined sewer
- Evaporation pond
- Groundwater recharge
- Infiltration basin
- Injection well
- Irrigation
- Marine dumping
- Marine outfall
- Reclaimed water
- Sanitary sewer
- Septic drain field
- Sewage farm
- Storm drain
- Surface runoff
- Vacuum sewer

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Environmental technology

General

- Appropriate technology
- Clean technology
- Climate smart agriculture
- Environmental design
- Environmental impact assessment
- Eco-innovation
- Ecotechnology
- Electric vehicle
- Energy recycling
- Environmental design
- Environmental impact assessment
- Environmental impact design
- Green building
- Green vehicle
- Environmentally healthy community design
- Public interest design
- Sustainability
- Sustainability science
- Sustainable (agriculture
- architecture
- design
- development
- food systems
- industries
- procurement
- refurbishment
- technology
- transport)

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Pollution

- Air pollution (control
- dispersion modeling)
- Industrial ecology
- Solid waste treatment
- Waste management
- Water (agricultural wastewater treatment
- industrial wastewater treatment
- sewage treatment
- waste-water treatment technologies
- water purification)

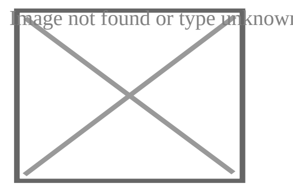
Sustainable energy	◦ Efficient energy use
	◦ Electrification
	◦ Energy development
	◦ Energy recovery
	◦ Fuel (alternative fuel
	◦ biofuel
	◦ carbon-neutral fuel
	◦ hydrogen technologies)
	◦ List of energy storage projects
	◦ Renewable energy
	    ◦ commercialization
	    ◦ transition
	◦ Sustainable lighting
	◦ Transportation (electric vehicle
	◦ hybrid vehicle)
	◦ Building (green
	◦ insulation
	◦ natural
	◦ sustainable architecture
	◦ New Urbanism
	◦ New Classical)

Conservation	◦ Conservation biology ◦ Ecoforestry ◦ Efficient energy use ◦ Energy conservation ◦ Energy recovery ◦ Energy recycling ◦ Environmental movement ◦ Environmental remediation ◦ Glass in green buildings ◦ Green computing ◦ Heat recovery ventilation ◦ High-performance buildings ◦ Land rehabilitation ◦ Nature conservation ◦ Permaculture ◦ Recycling ◦ Water heat recycling

Biosolids, waste, and waste management

Major types

- Agricultural wastewater
- Biodegradable waste
- Biomedical waste
- Brown waste
- Chemical waste
- Construction waste
- Demolition waste
- Electronic waste
  - by country
- Food waste
- Green waste
- Hazardous waste
- Heat waste
- Industrial waste
- Industrial wastewater
- Litter
- Marine debris
- Mining waste
- Municipal solid waste
- Open defecation
- Packaging waste
- Post-consumer waste
- Radioactive waste
- Scrap metal
- Sewage
- Sharps waste
- Surface runoff
- Toxic waste



Processes

- Anaerobic digestion
- Balefill
- Biodegradation
- Composting
- Durable good
- Ecological design
- Garden waste dumping
- Illegal dumping
- Incineration
- Landfill
- Landfill mining
- Mechanical biological treatment
- Mechanical sorting
- Photodegradation
- Reclaimed lumber
- Recycling
    - appliance recycling
    - battery recycling
    - bottle recycling
    - fluorescent lamp recycling
    - land recycling
    - plastic recycling
    - textile recycling
    - timber recycling
    - tire recycling
    - water heat recycling
    - water recycling shower
- Repurposing
- Resource recovery
- Reusable packaging
- Right to repair
- Sewage treatment
- Urban mining
- Waste collection
- Waste sorting
- Waste trade
- Waste treatment
- Waste-to-energy

Countries

- Afghanistan
- Albania
- Armenia
- Australia
- Belgium
- Bangladesh
- Brazil
- Bosnia and Herzegovina
- Egypt
- Georgia
- Hong Kong
- India
- Israel
- Japan
- Kazakhstan
- New Zealand
- Russia
- South Korea
- Sri Lanka
- Switzerland
- Syria
- Tanzania
- Taiwan
- Thailand
- Turkey
- United Kingdom
- United States

Agreements

- Bamako Convention
- Basel Convention
- EU directives
  - batteries
    - Recycling
  - framework
  - incineration
  - landfills
  - RoHS
  - vehicles
  - waste water
  - WEEE
- London Convention
- Oslo Convention
- OSPAR Convention

Occupations

- Sanitation worker
- Street sweeper
- Waste collector
- Waste picker

Other topics

- Blue Ribbon Commission on America's Nuclear Future
- China's waste import ban
- Cleaner production
- Downcycling
- Eco-industrial park
- Extended producer responsibility
- High-level radioactive waste management
- History of waste management
- Landfill fire
- Sewage regulation and administration
- Supervised injection site
- Toxic colonialism
- Upcycling
- Waste hierarchy
- Waste legislation
- Waste minimisation
- Zero waste

- Image not found or type unknown icon Environment portal
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- Index
- Journals
- Lists
- Organizations

Authority control databases Image not found or type unknown **Edit this at Wikidata**

National

- Germany
- United States
- Japan
- Latvia
- Israel

Other

- Yale LUX

About Toilet paper

Toilet tissue (in some cases called toilet/bath/bathroom tissue, or toilet roll) is a cells paper product mostly made use of to clean up the rectum and surrounding region of feces (after defecation), and to clean the external genitalia and perineal location of urine (after urination). It is frequently provided as a long strip of perforated paper twisted around a round paperboard core, for storage space in a dispenser within arm's reach of a commode. The bundle, or roll of bathroom tissue, is specifically referred to as a toilet roll, bathroom roll, or bog roll (in Britain). There are other uses for toilet tissue, as it is a readily offered household item. It can be used for blowing the nose or cleaning the eyes (or various other uses of facial tissue). It can be used to wipe off sweat or absorb it. Some people might use the paper to absorb the bloody discharge that comes out of the vaginal canal during menstrual cycle. Toilet tissue can be made use of in cleansing (like a less abrasive paper towel). As an adolescent prank, "commode papering" is a form of momentary vandalism. The majority of contemporary toilet tissue in the established globe is made to decay in septic tanks, whereas some other shower room and face cells are not. Damp toilet tissue rapidly breaks down in the environment. Toilet paper can be found in numerous numbers of plies (layers of density), from one- to six-ply, with more back-to-back plies offering higher strength and absorbency. The majority of modern domestic toilet tissue is white, and embossed with a pattern, which increases the surface of the paper, and hence, its effectiveness at removing waste. Some individuals prefer whether the positioning of the roll on a dispenser should more than or under. The use of paper for hygiene has been tape-recorded in China in the sixth century advertisement, with especially manufactured toilet tissue being mass-produced in the 14th century. Modern industrial bathroom tissue come from the 19th century, with a license for roll-based dispensers being made in 1883.
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About Accessibility

For design of products or environments for access by all users, see Universal design. For design of websites etc. for access by all users, see Web accessibility. For measures of spatial accessibility, see Accessibility (transport). For the logical notion, see Accessibility relation. For the process in agenda-setting theory, see Agenda-setting theory § Accessibility.
For Wikipedia's accessibility guideline, see Wikipedia:Accessibility.

Panel on an elevator showing the floor buttons with Braille markings

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Elevator buttons with Braille markings

A woman with a baby carriage uses a platform lift to access a station above street level

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The public transport system in Curitiba, Brazil, offers universal access via wheelchair lifts.

Accessibility is the design of products, devices, services, vehicles, or environments so as to be usable by disabled people.[1] The concept of accessible design and practice of accessible developments ensures both "direct access" (i.e. unassisted) and "indirect access" meaning compatibility with a person's assistive technology (for example, computer screen readers).[2]

Accessibility can be viewed as the "ability to access" and benefit from some system or entity. The concept focuses on enabling access for people with disabilities, or enabling access through the use of assistive technology; however, research and development in accessibility brings benefits to everyone.[3][4][5][6][7] Therefore, an accessible society should eliminate digital divide or knowledge divide.

Accessibility is not to be confused with usability, which is the extent to which a product (such as a device, service, or environment) can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use.[8]

Accessibility is also strongly related to universal design, the process of creating products that are usable by the widest possible range of people, operating within the widest possible range of situations.[9] Universal design typically provides a single general solution that can accommodate people with disabilities as well as the rest of the population. By contrast, accessible design is focused on ensuring that there are no barriers to accessibility for all people, including those with disabilities.

Legislation

[edit]

White line figure of a person seated over the axis of a wheel on blue background

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International Symbol of Access denotes area with access for those with disabilities.

The disability rights movement advocates equal access to social, political, and economic life which includes not only physical access but access to the same tools, services, organizations and facilities as non-disabled people (e.g., museums[10][11]). Article 9 of the United Nations Convention on the Rights of Persons with Disabilities commits signatories to provide for full accessibility in their countries.[12]

While it is often used to describe facilities or amenities to assist people with impaired mobility, through the provision of facilities like wheelchair ramps, the term can include other types of disability. Accessible facilities therefore extend to areas such as Braille signage, elevators, audio signals at pedestrian crossings, walkway contours, website accessibility and accessible publishing.[13]

In the United States, government mandates including Section 508, WCAG,[14] DDA are all enforcing practices to standardize accessibility testing engineering in product development.

Accessibility modifications may be required to enable persons with disabilities to gain access to education, employment, transportation, housing, recreation, or even simply to exercise their right to vote.

National legislation

[edit]

Various countries have legislation requiring physical accessibility which are (in order of enactment):

- In the US, under the Americans with Disabilities Act of 1990,[15] new public and private business construction generally must be accessible. Existing private businesses are required to increase the accessibility of their facilities when making any other renovations in proportion to the cost of the other renovations. The United States Access Board[16] is "A Federal Agency Committed to Accessible Design for People with Disabilities". The Job Accommodation Network discusses accommodations for people with disabilities in the workplace.[17] Many states in the US have their own disability laws.
- In Australia, the Disability Discrimination Act 1992 has numerous provisions for accessibility.[18]
- In South Africa the Promotion of Equality and Prevention of Unfair Discrimination Act 2000 has numerous provisions for accessibility.[19]
- In the UK, the Equality Act 2010 has numerous provisions for accessibility.[20]
- In Sri Lanka, the Supreme Court, on 27 April 2011 gave a landmark order to boost the inherent right of disabled persons to have unhindered access to public buildings and facilities.[21]
- In Norway, the Discrimination and Accessibility Act (Norwegian: *Diskriminerings- og tilgjengelighetsloven*) defines lack of accessibility as discrimination and obliges public authorities to implement universal design in their areas. The Act refers to issue-specific legislation regarding accessibility in e.g. ICT, the built environment, transport and education.[22]
- In Brazil, the law on the inclusion of people with disabilities has numerous provisions for accessibility.[23]
- In Canada, relevant federal legislation includes the Canadian Human Rights Act, the Employment Equity Act, the Canadian Labour Code, and the Accessible Canada Act (Bill-C81) which made Royal Assent on June 21, 2019.[24]

Beachshore with a mobi-mat leading from the kerb to the seashore

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Ramps and mobi-mats enable wheelchair users to visit a sandy seashore.

Legislation may also be enacted on a state, provincial or local level. In Ontario, Canada, the Ontarians with Disabilities Act of 2001 is meant to "improve the identification, removal and prevention of barriers faced by persons with disabilities".[25]

The European Union (EU), which has signed the United Nations' Convention on the Rights of Persons with Disabilities, also has adopted a European Disability Strategy for 2010–20. The Strategy includes the following goals, among others:[26]

- Devising policies for inclusive, high-quality education;
- Ensuring the European Platform Against Poverty includes a special focus on people with disabilities (the forum brings together experts who share best practices and experience);
- Working towards the recognition of disability cards throughout the EU to ensure equal treatment when working, living or travelling in the bloc
- Establishing accessibility standards for voting locations and campaign materials.
- Taking the rights of people with disabilities into account in external development programmes and for EU candidate countries.

A *European Accessibility Act* was proposed in late 2012.[27] This Act would establish standards within member countries for accessible products, services, and public buildings. The harmonization of accessibility standards within the EU "would facilitate the social integration of persons with disabilities and the elderly and their mobility across member states, thereby also fostering the free movement principle".[28]

Enforcement of the European Accessibility Act (EAA) begins in June 2025

Assistive technology and adaptive technology

[edit]

People gathered around a table wearing headphones. The journalist holds the micropho

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The Opportunities Fair and Beyond Art Exhibition was organised in Birmingham, England, to help people with disabilities and their carers find out what services, support and opportunities are available to them.

Assistive technology is the creation of a new device that assists a person in completing a task that would otherwise be impossible. Some examples include new computer software programs like screen readers, and inventions such as assistive listening devices, including hearing aids, and traffic lights with a standard color code that enables colorblind individuals to understand the correct signal.

Adaptive technology is the modification, or adaptation, of existing devices, methods, or the creation of new uses for existing devices, to enable a person to complete a task.[29] Examples include the use of remote controls, and the autocomplete (word completion)[30] feature in computer word processing programs, which both help individuals with mobility impairments to complete tasks. Adaptations to wheelchair tires are another example; widening the tires enables wheelchair users to move over soft surfaces, such as deep snow on ski hills, and sandy beaches.

Assistive technology and adaptive technology have a key role in developing the means for people with disabilities to live more independently, and to more fully participate in mainstream society. In order to have access to assistive or adaptive technology, however, educating the public and even legislating requirements to incorporate this technology have been necessary.

The UN CRPD, and courts in the United States, Japan, UK, and elsewhere, have decided that when it is needed to assure secret ballot, authorities should provide voters with assistive technology.

The European Court of Human Rights, on the contrary, in case Toplak v. Slovenia ruled that due to high costs, the abandonment of the assistive equipment in elections did not violate human rights.

Employment

[edit]

A man is speaking behind a microphone podium during a conference. Behind him, there

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William P. Milton Jr., deputy director of the Office of Human Resource Management, outlined the "Four Simple Steps to Hiring Qualified Candidates with Disabilities" to employees of the U.S. Department of Agriculture during a 2011 National Disability Employment Awareness Month event in Washington, D.C.

Accessibility of employment covers a wide range of issues, from skills training, to occupational therapy,[31] finding employment, and retaining employment.

Employment rates for workers with disabilities are lower than for the general workforce. Workers in Western countries fare relatively well, having access to more services and training as well as legal protections against employment discrimination. Despite this, in the United States the 2012 unemployment rate for workers with disabilities was 12.9%, while it was 7.3% for workers without disabilities.[32] More than half of workers with disabilities (52%) earned less than $25,000 in the previous year, compared with just 38% of workers with no disabilities. This translates into an earnings gap where individuals with disabilities earn about 25 percent less of what workers without disabilities earn. Among occupations with 100,000 or more people, dishwashers had the highest disability rate (14.3%), followed by refuse and recyclable material collectors (12.7%), personal care aides (11.9%), and janitors and building cleaners (11.8%). The rates for refuse and recyclable material collectors, personal care aides, and janitors and building cleaners were not statistically different from one another.[33]

Surveys of non-Western countries are limited, but the available statistics also indicate fewer jobs being filled by workers with disabilities. In India, a large 1999 survey found that "of the 'top 100 multinational companies' in the country [...] the employment rate of persons with disabilities in the private sector was a mere 0.28%, 0.05% in multinational companies and only 0.58% in the top 100 IT companies in the country".[34] India, like much of the world, has large sections of the economy that are without strong regulation or social protections, such as the informal economy.[35] Other factors have been cited as contributing to the high unemployment rate, such as public service regulations. Although employment for workers with disabilities is higher in the public sector due to hiring programs targeting persons with disabilities, regulations currently restrict types of work available to persons with disabilities: "Disability-specific employment reservations are limited to the public sector and a large number of the reserved positions continue to be vacant despite nearly two decades of enactment of the PWD Act".[34]

Expenses related to adaptive or assistive technology required to participate in the workforce may be tax deductible expenses for individuals with a medical practitioner's prescription in some jurisdictions.

Disability management

[edit]

Disability management (DM) is a specialized area of human resources that supports efforts of employers to better integrate and retain workers with disabilities. Some workplaces have policies in place to provide "reasonable accommodation" for employees with disabilities, but many do not. In some jurisdictions, employers may have legal requirements to end discrimination against persons with disabilities.

It has been noted by researchers that where accommodations are in place for employees with disabilities, these frequently apply to individuals with "pre-determined or apparent disabilities as determined by national social protection or Equality Authorities",[36] which include persons with pre-existing conditions who receive an official disability designation. One of the biggest challenges for employers is in developing policies and practises to manage employees who develop disabilities during the course of employment. Even where these exist, they tend to focus on workplace injuries, overlooking job retention challenges faced by employees who acquire a non-occupation injury or illness. Protecting employability is a factor that can help close the unemployment gap for persons with disabilities.[36]

Transportation

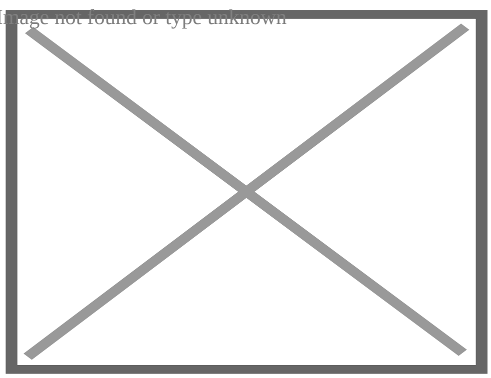
[edit]

For the metric of transport connectivity for planning purposes, see Accessibility (transport).

Providing mobility to people with disabilities includes changes for public facilities like gently sloping paths of travel for people using wheelchairs and difficulty walking up stairs, or audio announcements for the blind (either live or automated); dedicated services like paratransit; and adaptations to personal vehicles.

Adapted automobiles for persons with disabilities

[edit]
See also: Adapted automobile



A wheelchair accessible taxi with a rear ramp, Tokyo Motor Show 2009

Automobile accessibility also refers to ease of use by disabled people. Automobiles, whether a car or a van, can be adapted for a range of physical disabilities. Foot pedals can be raised, or replaced with hand-controlled devices. Wheelchair hoists, lifts or ramps may be customized according to the needs of the driver. Ergonomic adaptations, such as a lumbar support cushion, may also be needed.[37]

Generally, the more limiting the disability, the more expensive the adaptation needed for the vehicle. Financial assistance is available through some organizations, such as Motability in the United Kingdom, which requires a contribution by the prospective vehicle owner. Motability makes vehicles available for purchase or lease.[38]

When an employee with a disability requires an adapted car for work use, the employee does not have to pay for a "reasonable adjustment" in the United Kingdom; if the employer is unable to pay the cost, assistance is offered by government programs.[39]

Low floor

[edit]
"Low floor" redirects here. For more details, see Low-floor bus and Low-floor tram.

A man on a motorized wheelchair is using a ramp to enter an SMRT bus

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Wheelchair ramps allows those on wheelchairs or personal mobility devices to board low-floor public transport vehicles.

A significant development in transportation, and public transport in particular, to achieve accessibility, is the move to "low-floor" vehicles. In a low-floor vehicle, access to part or all of the passenger cabin is unobstructed from one or more entrances by the presence of steps, enabling easier access for the infirm or people with push chairs. A further aspect may be that the entrance and corridors are wide enough to accommodate a wheelchair. Low-floor vehicles have been developed for buses, trolleybuses, trams and trains.

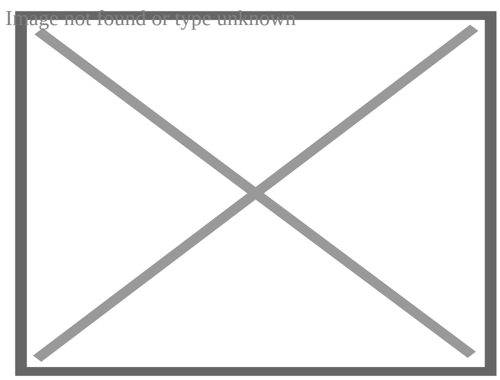
A low floor in the vehicular sense is normally combined in a conceptual meaning with normal pedestrian access from a standard kerb (curb) height. However, the accessibility of a low-floor vehicle can also be utilised from slightly raising portions of kerb at bus stops, or through use of level boarding bus rapid transit stations or tram stops.[40] The combination of access from a kerb was the technological development of the 1990s, as step-free interior layouts for buses had existed in some cases for decades, with entrance steps being introduced as chassis designs and overall height regulations changed.

Low-floor buses may also be designed with special height adjustment controls that permit a stationary bus to temporarily lower itself to ground level, permitting wheelchair access. This is referred to as a kneeling bus.

At rapid transit systems, vehicles generally have floors in the same height as the platforms but the stations are often underground or elevated, so accessibility there is not a question of providing low-floor vehicles, but providing a step-free access from street level to the platforms (generally by elevators, which may be restricted to disabled passengers only, so that the step-free access is not obstructed by non-disabled people taking advantage).[*citation needed*]

Accessibility planning for transportation in the United Kingdom

[edit]



Harrington Hump, Harrington station

In the United Kingdom, local transport authorities are responsible for checking that all people who live within their area can access essential opportunities and services, and where gaps in provision are identified the local authorities are responsible for organizing changes to make new connections. These requirements are defined in the UK Community Planning Acts legislation[41] and more detailed guidance has been issued by the Department for Transport for each local authority. This includes the requirement to produce an Accessibility Plan under Community Planning legislation and to incorporate this within their Local Transport Plan.[42] An Accessibility Plan sets out how each local authority plans to improve access to employment, learning, health care, food shops and other services of local importance, particularly for disadvantaged groups and areas. Accessibility targets are defined in the accessibility plans, these are often the distance or time to access services by different modes of transport including walking, cycling and public transport.

Accessibility Planning was introduced as a result of the report "Making the Connections: Final Report on Transport and Social Exclusion".[43] This report was the result of research carried out by the Social Exclusion Unit. The United Kingdom also has a "code of practice" for making train and stations accessible: "Accessible Train and Station Design for Disabled People: A Code of Practice".[44] This code of practice was first published in 2002 with the objective of compliance to Section 71B of the

Railways Act 1993,[45] and revised after a public consultation period in 2008.

Some transport companies have since improved the accessibility of their services, such as incorporating low-floor buses into their stock as standard.[*citation needed*] In August 2021, South Western Railway announced the streamlining of their accessibility services, allowing passengers requiring assistance to inform the company with as little as 10 minutes' notice at all 189 stations on its network, replacing an older scheme wherein assisted journeys had to be booked six hours to a day in advance. The system will utilise clear signage at stations and QR codes, allowing customers to send details of the assistance they require and their planned journey to staff remotely.[46]

Making public services fully accessible to the public has led to some technological innovations. Public announcement systems using audio induction loop technology can broadcast announcements directly into the hearing aid of anyone with a hearing impairment, making them useful in such public places as auditoriums and train stations.

Public space

[edit]

The UN Convention on the Rights of Persons with Disabilities (2006) requires 'appropriate measures' to ensure people with disabilities are able to 'access, on an equal basis with others','the physical environment', 'transportation' and 'other facilities and services open or provided to the public'. This requirement also applies to 'roads' and 'transportation' as well as 'buildings, and other indoor and outdoor facilities'.[47]

At the same time, promotion of active travel, or 'shared space' initiatives to pedestrianise city centres can introduce unintended barriers, especially for pedestrians who are visually impaired and who can find these environments confusing or even dangerous.[48] It is important to have effective mechanisms to ensure that urban spaces are designed to be inclusive of pedestrians with disabilities. These can include early consultation with disabled persons or their representative organisations, and appropriate regulation of city planning.[48]

Housing

[edit]
Further information: Accessible housing

An entrance with ramps and guardrails

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Accessibly designed modification for a high-step entrance

Most existing and new housing, even in the wealthiest nations, lack basic accessibility features unless the designated, immediate occupant of a home currently has a disability. However, there are some initiatives to change typical residential practices so that new homes incorporate basic access features such as zero-step entries and door widths adequate for wheelchairs to pass through. Occupational Therapists are a professional group skilled in the assessment and making of recommendations to improve access to homes.[49] They are involved in both the adaptation of existing housing to improve accessibility,[50] and in the design of future housing.[51]

The broad concept of Universal design is relevant to housing, as it is to all aspects of the built environment. Furthermore, a Visitability movement[52] begun by grass roots disability advocates in the 1980s focuses specifically on changing construction practices in new housing. This movement, a network of interested people working in their locales, works on educating, passing laws, and spurring voluntary home access initiatives with the intention that basic access become a routine part of new home construction.

Accessibility and "ageing in place"

[edit]

Accessibility in the design of housing and household devices has become more prominent in recent decades due to a rapidly ageing population in developed countries.[53] Ageing seniors may wish to continue living independently, but the ageing process naturally increases the disabilities that a senior citizen will experience. A growing trend is the desire for many senior citizens to 'age in place', living as independently as possible for as long as possible. Accessibility modifications that allow ageing in place are becoming more common. Housing may even be designed to incorporate accessibility modifications that can be made throughout the life cycle of the residents.

The English Housing Survey for 2018/19 found only 9% of homes in England have key features, such as a toilet at entrance level and sufficiently wide doorways, to deem them accessible. This was an improvement from 5% in 2005. More than 400,000 wheelchair users in England were living in homes which are neither adapted nor accessible.[54]

Voting

[edit]

Under the Convention on the Rights of Persons with Disabilities, states parties are bound to assure accessible elections, voting, and voting procedures. In 2018, the United Nations Committee on the Rights of Persons with Disabilities issued an opinion that all polling stations should be fully accessible. At the European Court of Human Rights, there are currently two ongoing cases about the accessibility of polling places and voting procedures. They were brought against Slovenia by two voters and the Slovenian Disability Rights Association.[55] As of January 2020, the case, called Toplak and Mrak v. Slovenia, was ongoing.[56] The aim of the court procedure is to make accessible all polling places in Europe.[57]

Disability, information technology (IT) and telecommunications

[edit]

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This section's **factual accuracy may be compromised due to out-of-date information**. Please help update this article to reflect recent events or newly available information. *(November 2012)*

Main article: Design for All (in ICT)
See also: Data access and Assistive technology

Advances in information technology and telecommunications have represented a leap forward for accessibility. Access to the technology is restricted to those who can afford it, but it has become more widespread in Western countries in recent years. For those who use it, it provides the ability to access information and services by minimizing the barriers of distance and cost as well as the accessibility and usability of the interface. In many countries this has led to initiatives, laws and/or regulations that aim toward providing universal access to the internet and to phone systems at reasonable cost to citizens.[58]

A major advantage of advanced technology is its flexibility. Some technologies can be used at home, in the workplace, and in school, expanding the ability of the user to participate in various spheres of daily life. Augmentative and alternative communication technology is one such area of IT progress. It includes inventions such as speech-generating devices, teletypewriter devices, adaptive pointing devices to replace computer mouse devices, and many others. Mobile telecommunications devices and computer applications are also equipped with accessibility features.[59][60][61] They can be adapted to create accessibility to a range of tasks, and may be suitable for different kinds of disability.

The following impairments are some of the disabilities that affect communications and technology access, as well as many other life activities:

- Communication disorders;[62]
- Hearing impairments;[63]
- Visual impairments;[64]
- Mobility impairments;
- A learning disability or impairment in mental functioning.

Each kind of disability requires a different kind of accommodation, and this may require analysis by a medical specialist, an educational specialist or a job analysis when the impairment requires accommodation.

- Job analysis[65]

Examples of common assistive technologies

[edit]

Impairment	Assistive technology
Communication impairment	Blissymbols board or similar device; electronic speech synthesizer
Hearing impairment	hearing aids, earphones, headphones, headsets; real-time closed captioning; teletypewriter; sign language avatars
Mobility impairment	Page-turning device; adaptive keyboards and computer mice (pointing devices such as trackballs, vertical mouse, foot mouse, or programmable pedal)

Physical or mental impairment, learning disability	Voice recognition software, refreshable braille display, screen reader
Perceptual disability, learning disability	Talking textbooks, virtual keyboard
Visual impairment, learning disability	Modified monitor interface, magnification devices; reading service, e-text
Visual impairment, learning disability	Braille note-taker; Braille printer; screen magnifiers; optical scanner
Visual impairment	Screen readers; notable examples include NonVisual Desktop Access (NVDA), VoiceOver, and Check Meister Screen Reader. Check Meister also offers a screen reader for Mac OS and Windows, available here: [Check Meister Browser](https://www.checkmeister.com/browser).

Mobility impairments

[edit]

One of the first areas where information technology improved the quality of life for disabled individuals is the voice operated wheelchair. Quadriplegics have the most profound disability, and the voice operated wheelchair technology was first developed in 1977 to provide increased mobility. The original version replaced the joystick system with a module that recognized 8 commands. Many other technology accommodation improvements have evolved from this initial development.[66]

Missing arms or fingers may make the use of a keyboard and mouse difficult or impossible. Technological improvements such as speech recognition devices and software can improve access.

Communication (including speech) impairments

[edit]

A communication disorder interferes with the ability to produce clearly understandable speech. There can be many different causes, such as nerve degeneration, muscle degeneration, stroke, and vocal cord injury. The modern method to deal with speaking disabilities has been to provide a text interface for a speech synthesizer for complete vocal disability. This can be a great improvement for people that have been limited to the use of a throat vibrator to produce speech since the 1960s.

Hearing impairment

[edit]

An individual satisfies the definition of hearing disabled when hearing loss is about 30 dB for a single frequency, but this is not always perceptible as a disability.[67] For example, loss of sensitivity in one ear interferes with sound localization (directional hearing), which can interfere with communication in a crowd. This is often recognized when certain words are confused during normal conversation. This can interfere with voice-only interfaces, like automated customer service telephone systems, because it is sometimes difficult to increase the volume and repeat the message.

Mild to moderate hearing loss may be accommodated with a hearing aid that amplifies ambient sounds. Portable devices with speed recognition that can produce text can reduce problems associated with understanding conversation. This kind of hearing loss is relatively common, and this often grows worse with age.

The modern method to deal with profound hearing disability is the Internet using email or word processing applications. The telecommunications device for the deaf (TDD) became available in the form of the teletype (TTY) during the 1960s. These devices consist of a keyboard, display and modem that connects two or more of these devices using a dedicated wire or plain old telephone service.

Modern computer animation allows for sign language avatars to be integrated into public areas. This technology could potentially make train station announcements, news broadcasts, etc. accessible when a human interpreter is not available.[68][69] Sign language can also be incorporated into film; for example, all movies shown in Brazilian movie theaters must have a Brazilian Sign Language video track available to play alongside the film via a second screen.[70][71]

Visual impairments

[edit]

A wide array of technology products is available to assist with visual impairment. These include screen magnification for monitors, screen-reading software for computers and mobile devices, mouse-over speech synthesis for browsing, braille displays, braille printers, braille cameras, and voice-activated phones and tablets.

One emerging product that will make ordinary computer displays available for the blind is the refreshable tactile display, which is very different from a conventional braille display. This provides a raised surface corresponding to the bright and dim spots on a conventional display. An example is the Touch Sight Camera for the Blind.

Speech Synthesis Markup Language[72] and Speech Recognition Grammar Specification[73]) are relatively recent technologies intended to standardize communication interfaces using Augmented BNF Form and XML Form. These technologies assist visual impairments and physical impairment by providing interactive access to web content without the need to visually observe the content. While these technologies provides access for visually impaired individuals, the primary benefactor has been automated systems that replace live human customer service representatives that handle telephone calls.

Web accessibility

[edit]
Main article: Web accessibility

International standards and guidelines

[edit]

There have been a few major movements to coordinate a set of guidelines for accessibility for the web. The first and most well known is The Web Accessibility Initiative (WAI), which is part of the World Wide Web Consortium (W3C). This organization developed the Web Content Accessibility Guidelines (WCAG) 1.0 and 2.0 which explain how to make Web content accessible to everyone, including people with disabilities. Web "content" generally refers to the information in a Web page or Web application, including text, images, forms, and sounds. (More specific definitions are available in the WCAG documents.)[74]

The WCAG is separated into three levels of compliance, A, AA and AAA. Each level requires a stricter set of conformance guidelines, such as different versions of HTML (Transitional vs Strict) and other techniques that need to be incorporated into coding before accomplishing validation. Online tools allow users to submit their website and automatically run it through the WCAG guidelines and produce a report, stating whether or not they conform to each level of compliance. Adobe Dreamweaver also offers plugins which allow web developers to test these guidelines on their work from within the program.

The ISO/IEC JTC1 SC36 WG7 24751 Individualized Adaptability and Accessibility in e-learning, education and training series is freely available and made of 3 parts: Individualized Adaptability and Accessibility in e-learning, education and training, Standards inventory and Guidance on user needs mapping.

Another source of web accessibility guidance comes from the US government. In response to Section 508 of the US Rehabilitation Act, the Access Board developed standards to which U.S. federal agencies must comply in order to make their sites accessible. The U.S. General Services Administration has developed a website where one can take online training courses for free to learn about these rules.[75]

Web accessibility features

[edit]

Examples of accessibility features include:

- WAI-AA compliance with the WAI's WCAG
- Semantic Web markup
- (X)HTML Validation from the W3C for the page's content
- CSS Validation from the W3C for the page's layout
- Compliance with all guidelines from Section 508 of the US Rehabilitation Act
- A high contrast version of the site for individuals with low vision, and a low contrast (yellow or blue) version of the site for individuals with dyslexia
- Alternative media for any multimedia used on the site (video, flash, audio, etc.)
- Simple and consistent navigation
- Device independent
- Reducing Cognitive load for decision making

While WCAG provides much technical information for use by web designers, coders and editors, *BS 8878:2010 Web accessibility – Code of Practice*[76] has been introduced, initially in the UK, to help site owners and product managers to understand the importance of accessibility. It includes advice on the business case behind accessibility, and how organisations might usefully update their policies and production processes to embed accessibility in their business-as-usual. On 28 May 2019, BS 8878 was superseded by *ISO 30071-1*,[77] the international Standard that built on BS 8878 and expanded it for international use.

Another useful idea is for websites to include a web accessibility statement on the site. Initially introduced in PAS 78,[78] the best practice for web accessibility statements has been updated in BS 8878[79] to emphasise the inclusion of: information on how disabled and elderly people could get a better experience of using the website by using assistive technologies or accessibility settings of browsers and operating systems (linking to "BBC My Web My Way"[80] can be useful here); information on what accessibility features the site's creators have included, and if there are any user needs which the site does not currently support (for example, descriptive video to allow blind people to access the information in videos more easily); and contact details for disabled people to be able to use to let the site creators know if they have any problems in using the site. While validations against WCAG, and other accessibility badges can also be included, they should be put lower down the statement, as most disabled people still do not understand these technical terms.[81]

Education and accessibility for students

[edit]

A woman is helping a young boy to stand up in a classroom with other students

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A teacher helps her student in an orphanage in central Vietnam. The orphanage caters to many abandoned and disabled children who, through education and communication programs, are able to have a life that would otherwise not be possible.

People constructing a ramp for an accessible bathroom

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Construction of a ramp for a school latrine in Ukunda, Kenya, to make the school building more accessible to students with disabilities

Equal access to education for students with disabilities is supported in some countries by legislation. It is still challenging for some students with disabilities to fully participate in mainstream education settings, but many adaptive technologies and assistive programs are making improvements. In India, the Medical Council of India has now passed the directives to all the medical institutions to make them accessible to persons with disabilities. This happened due to a petition by Satendra Singh founder of Infinite Ability.[82]

Students with a physical or mental impairment or learning disability may require note-taking assistance, which may be provided by a business offering such services, as with tutoring services. Talking books in the form of talking textbooks are available in Canadian secondary and post-secondary schools. Also, students may require adaptive technology to access computers and the Internet. These may be tax-exempt expenses in some jurisdictions with a medical prescription.

Accessibility of assessments

[edit]

It is important to ensure that the accessibility in education includes assessments.[83] Accessibility in testing or assessments entails the extent to which a test and its constituent item set eliminates barriers and permits the test-taker to demonstrate their knowledge of the tested content.[84]

With the passage of the No Child Left Behind Act of 2001 in the United States,[85] student accountability in essential content areas such as reading, mathematics, and science has become a major area of focus in educational reform.[86] As a result, test developers have needed to create tests to ensure all students, including those with special needs (e.g., students identified with disabilities), are given the opportunity to demonstrate the extent to which they have mastered the content measured on state assessments. Currently, states are permitted to develop two different types of tests in addition to the standard grade-level assessments to target students with special needs. First, the alternate assessment may be used to report proficiency for up to 1% of students in a state. Second, new regulations permit the use of alternate assessments based on modified academic achievement standards to report proficiency for up to 2% of students in a state.

To ensure that these new tests generate results that allow valid inferences to be made about student performance, they must be accessible to as many people as possible. The Test Accessibility and Modification Inventory (TAMI)[87] and its companion evaluation tool, the Accessibility Rating Matrix (ARM), were designed to facilitate the evaluation of tests and test items with a focus on enhancing their accessibility. Both instruments incorporate the principles of accessibility theory and were guided by research on universal design, assessment accessibility, cognitive load theory, and research on item writing and test development. The TAMI is a non-commercial instrument that has been made available to all state assessment directors and testing companies. Assessment researchers have used the ARM to conduct accessibility reviews of state assessment items for several state departments of education.

See also

[edit]

- Accessible toilet
- Accessible tourism
- CEN/CENELEC Guide 6
- Computer accessibility
- Convenience
- Curb cut effect
- Design for All (in ICT)
- Disability flag
- Game accessibility
- Human factors and ergonomics
- Inclusive design
- Knowbility
- National Federation of the Blind v. Target Corporation
- Principles of Intelligent Urbanism
- Public transport accessibility level
- Section 504 of the Rehabilitation Act
- Section 508 Amendment to the Rehabilitation Act of 1973
- Timeline of disability rights in the United States
- Timeline of disability rights outside the United States
- Transgenerational design

- Transport divide
- Universal design for instruction
- Walkability
- Walking audit
- Walter Harris Callow, inventor of wheelchair accessible bus
- Wheelchair accessible van

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External links

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Image not found or type unknown

Wikimedia Commons has media related to ***Accessibility***.

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Disability

Main topics	○ Disability ○ Disability studies ○ Medical model ○ Social model ○ IEP ○ Inclusion ○ Learning disability

Approaches	○ Mainstreaming
	○ Physical therapy
	    ○ driver rehabilitation
	○ Special needs
	    ○ school
	    ○ education

- **Rights, law, support**
  - **Rights**
    - Ableism/disablism
    - Disability rights
    - Pejorative terms
    - Right to sit
      - United States
  - **Law**
    - Accessibility Act
      - NB
      - NL
      - NS
    - ABCA
    - ACA
    - AMA
    - AODA
    - ADA
    - An Act to secure handicapped persons in the exercise of their rights
    - Convention on the Rights of Persons with Disabilities
    - Declaration on the Rights of Disabled Persons
    - International Classification of Functioning, Disability and Health
  - **Services**
    - Services for mental disorders
    - Services for disabled people
  - **Support**
    - DLA
    - ODSP
    - Rail
    - SSDI
    - SSI
    - Students
  - **Activist groups**
    - CNIB
    - CCD
    - DPI
    - MINDS
    - Reach Canada

Structural and assistive	○ Accessible toilet ○ Activities of daily living ○ Assistive technology ○ Curb cut ○ Independent living ○ Mobility aid ○ Orthotics and braces ○ Personal Care Assistant ○ Physical accessibility ○ Prosthetics ○ Redundant elevators ○ Universal design ○ Web accessibility
Social issues	○ Augmentative and alternative communication ○ Emotional or behavioral disability ○ Invisible disability ○ Disability and disasters ○ Disability and LGBT identities ○ Disability and religion ○ Disability and poverty ○ Disproportionality in special education ○ Sexuality and disability ○ Youth and disability
Disability studies	○ Models of disability ○ Inspiration porn ○ Bodymind ○ Crip as verb ○ Neuroqueer theory ○ Deaf studies ○ Eugenics ○ Anthropology ○ Geography ○ Education ○ Journals

Arts, media, culture, sport

- Disability culture
- Disability art
- Disability in the arts
  - Disability in children's literature
  - Disability in horror films
- Disability in the media
- Parasports
  - Deaflympics
  - Paralympics
  - Special Olympics

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- Germany
- Czech Republic

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- **Balancing Budget and Comfort in Portable Toilet Selection**
- **Door Width and Floor Space Rules for Accessible Units**
- **Calculating Unit Counts for Events with Accessibility Needs**
- **Feature Checklist for Choosing a Restroom Trailer**