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# Household Hazardous Waste: Handling, Precaution and Hazard Reduction

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**Abstract**

The house can be considered as a factory for the production of various products. Every unit in this plant generates some wastes. Some of these wastes are dangerous called household hazardous wastes (HHHW) and must be dealt with carefully, and some of them are less dangerous and easy to deal with. Regarding hazardous household wastes, it must be defined to avoid the dangers resulting from handling it incorrectly. Some products that contain hazardous ingredients can be replaced with others that do not. The house was divided into different rooms according to the activity. The wastes produced from each room were individually identified, and the hazardous components of these wastes were identified, and the method of safe disposal of them. Some alternatives have also been suggested to reduce the danger of household wastes so that the house is safe for humans as well as domestic animals. This review aims to identify the HHHWs and how to deal with it safely. The goal extends to finding some safe or less dangerous alternatives to maintain safety and health inside homes.

*Keywords:* Carcinogenic; Corrosive; Irritant; By-product; Disposal

## 1. Introduction

Household wastes, which includes any wastes generated at home, accounts for more than two-thirds of the municipal solid waste (MSW) stream [1]. The household hazardous products have corrosive, poisonous, ignitable, or reactive components, including paints, cleaners, oils, batteries, and pesticides ingredients, and must be handled and disposed of with care [2]. Each area has a list of potentially hazardous products that are used frequently [3]. Figs. 1-5 show the schematic diagram of the hazardous wastes in each room.

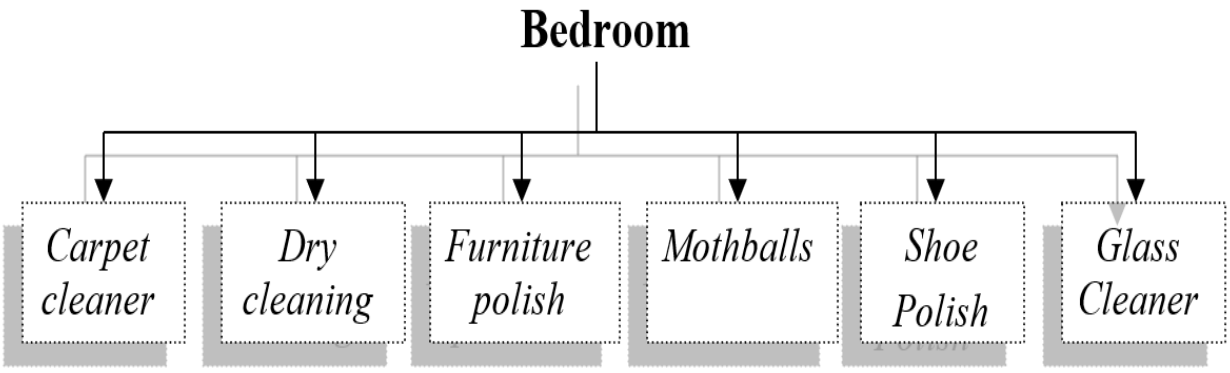


Fig. 1. The schematic diagram for the bedroom's hazardous waste.

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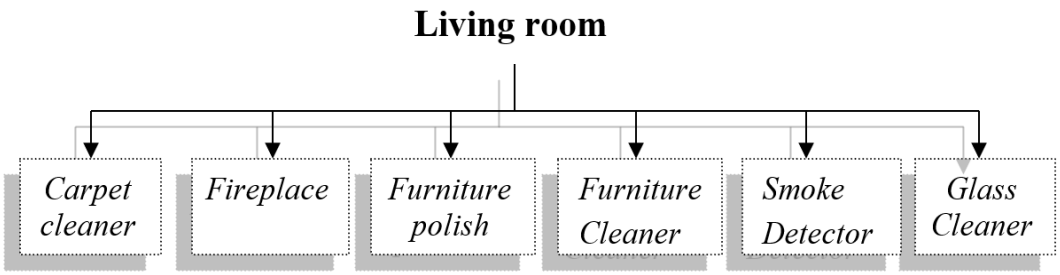


Fig. 2. The schematic diagram for the livingroom's hazardous waste

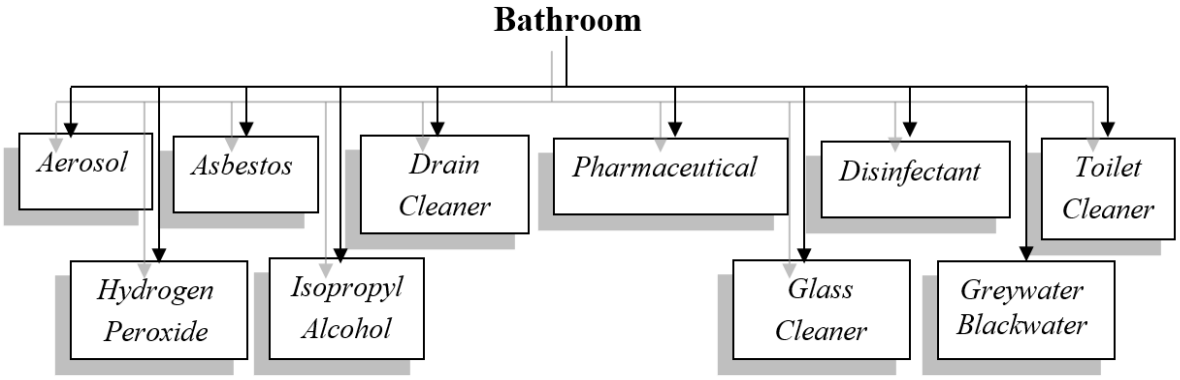


Fig. 3. The schematic diagram for the bathroom's hazardous waste

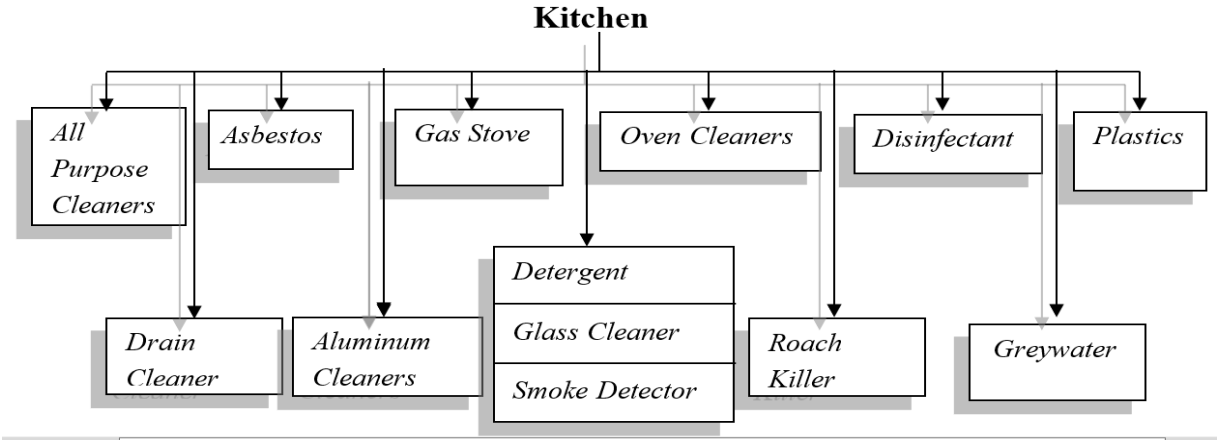


Fig 4. The schematic diagram for the kitchen's hazardous waste

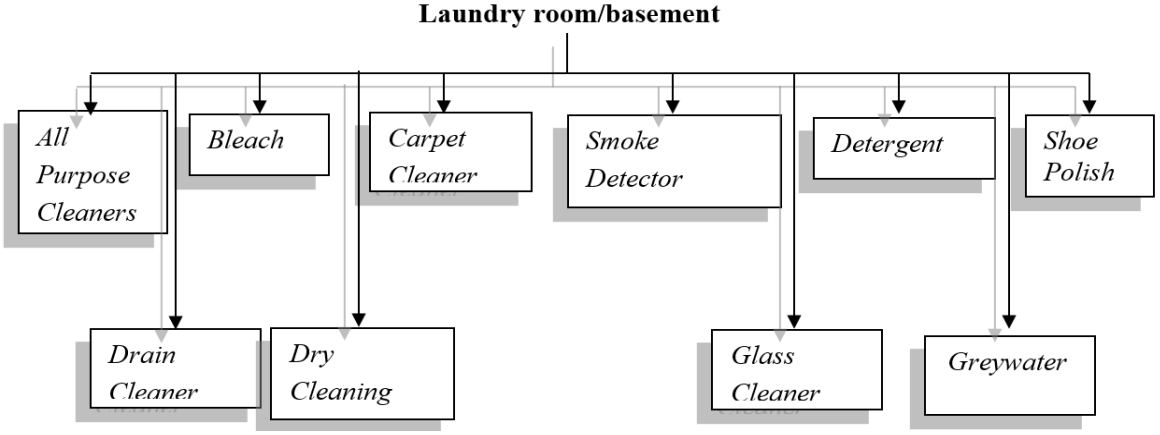


Fig. 5. Schematic diagram for the laundry room/basement's hazardous waste

**2. Aerosols**

Air freshener, furniture polish, and deodorant are among the aerosol sprays. These pressurized compounds consist of an active ingredient and a liquid or gaseous propellant. These pressurized aerosol containers are combustible and potentially harmful. The aerosol substance itself, such as some oven cleansers, might be caustic or dangerous, necessitating extreme caution [1-3]

Aerosol sprays should be used with care. Aerosol sprays produce fine particles that are easily inhaled deeply into the lungs and quickly absorbed into the circulation. Thus, a chemical that is harmless to your skin can become very dangerous if it is inhaled as aerosols. Acute symptoms include headache, nausea, dizziness, shortness of breath, eye and throat irritation, skin rash, burns, lung inflammation, and liver damage [2].

An aerosol container should never be heated significantly above room temperature because it can explode. Cans stored in bright sunlight, car trunks, or near furnaces, stoves, and ovens are all at risk of exploding. Heating, aerosol gases such as fluorine, chlorine, hydrogen fluoride, or phosgene can become dangerous gases (military nerve gases). Breathing these vapors can be very harmful to human beings [4-5].

Significant environmental impact from aerosol sprays led to alterations in their design. Several of the chlorofluorocarbons (CFCs) that have been used in aerosol sprays in the past reacted with and reduced the ozone layer in the upper atmosphere. Reduction in the ozone layer and the resulting rise in ultraviolet radiation reaching the earth can result in increased rates of skin cancer, skin aging, eye damage, and Vitamin D poisoning. Before buying or using aerosol sprays, weigh their convenience against their potential health and environmental hazards.

Use: Consider alternatives to aerosol sprays, including alternative methods of application. If you are using an aerosol spray, try not to breathe the released particles; stand out of the way of the mist and make certain the mist is being blown away from the user.

Storage: Keep away from direct heating and fire sources. Keep out of reach of youngsters.

Disposal: If the aerosol container is empty, discard it in the garbage that will be sent to the landfill. Aerosol cans burned in trash barrels can explode, scattering propellant and product. If ingredients are left in the can the best thing to do is to use the product up as intended. If you must dispose of an aerosol can that isn't empty, discharge the contents of the container into a deep cardboard box outdoors, and allow it to dry. When the can is empty, it and the cardboard box can be thrown in the trash. If you spray the contents, use extreme caution and avoid spraying near children, animals, or locations where people congregate, such as gardens or playgrounds. Inhale the vapors is dangerous.

Alternatives: Try to purchase products in a pump spray, roll-on, liquid, or non-aerosol spray [7].

**3. All-purpose cleaners**

The ingredients in all-purpose cleaners are a combination of detergents, grease-cutting agents, and possibly solvents and disinfectants. Repeated use can cause chronic inflammation. Ammonia-based cleaners should not be mixed with bleach-based cleaners. There will be toxic gases as a result. Phosphate-containing cleaners pose a threat to water quality. Table 1 shows the expected effects of the different constituents of the all-purposes cleaners.

Use: Wear gloves. Make sure that the ventilation is adequate. Do not mix different cleaners together as toxic fumes may result [8].

Table 1: Constituents of all-purpose cleaners and their possible effects

| **Hazardous Constituent** | **Possible Effects** |
|---|---|
| Ammonia | Fumes irritate the eyes and lungs; they can cause skin burns or rashes; and, when coupled with chlorine-containing compounds, can form fatal chloramine gas. |
| Ethylene Glycol Monobutyl Acetate | Poisons animals drawn to sweet smells; can harm internal organs through skin absorption; can produce dizziness if inhaled. |

**4. Aluminum Cleaners**

Hydrofluoric acid, which is exceedingly corrosive and dangerous, is found in many aluminum cleansers. It damages the flesh down to the bone when it comes into contact with it, as the fluoride ion continues to function until it is neutralized by calcium storage. Low concentrations in the eyes can cause intense irritation; high concentrations, immediate blindness [8].

Use: Use hydrofluoric acid-free products. You can't presume the product doesn't contain hydrofluoric acid if the aluminum cleaning ingredients aren't listed on the label. If you are using a product that contains this ingredient, protect all exposed skin in addition to wearing protective gloves, safety goggles, and a respirator with an acid gas cartridge [8].

Storage: Store away from children.

Disposal: If an aluminum cleaner is in a liquid form take it to a household hazardous wastes collection. If collection is not available, then flush down the drain with plenty of water. Dispose of tiny amounts over several days if you're using a septic tank or lagoon. If the cleaner is in a solid paste form and has completely solidified, it can be thrown away to the landfill [1, 9].

**5. Arts & crafts**

The 1988 "Labeling of Hazardous Art Materials Act" mandated that any art and craft materials that pose a long-term threat be labeled with a WARNING message, and an additional warning that it is inappropriate for use by children. The Law directed the Consumer Product Safety Commission to set guidelines determining whether arts and crafts present chronic long-term hazards to both adults and children. All arts and crafts products must have a list of dangerous substances, safe-use instructions, a statement that the product complies with the law, and the buyer's contact information with a phone number to call for additional information. This information must appear on the label, the packaging, or the display for the product [10].

Standard arts and crafts supplies include permanent felt-tip markers, rubber cement, spray fixatives, powdered clay, and instant papier-mâché. If inhaled, absorbed, or swallowed, these items contain substances that are harmful. Mishandling, eating, sucking, inhaling, or ingesting art supplies and adorning their hands and faces with them is especially common among children [11].

Use: Carefully read labels to identify products that are certified or not. Refrain from eating or drinking while using these products and wash your hands thoroughly when finished [1, 9].

Alternatives: In order to choose safe art supplies to keep at home, for school projects, or just for fun, consider the following tips (Table 2):

Table 2: Substitution of some hazardous paints with safe alternatives

| Keep out | Alternative |
|---|---|
| Dust-generating tempera paints, pastels, chalks, or dry markers | Vegetable dyes, onion skin colours, tea, flower dyes, and other food dyes are examples of natural dyes. |
| Oil-based paints, turpentine, benzene, toluene, and rubber cement and its thinner | Water-based paints, glues, inks, etc. |

**6. Car Batteries**

Automobile, boats, and tractor batteries are wet cell batteries that contain lead and a solution of sulfuric acid. When activated, the electrolyte solution in the battery produces explosive gases which are easily ignited. Producers of sulfuric acid batteries must include warning labels that inform consumers about the dangers of battery acid and stored gases. Sulfuric acid is extremely caustic. Fumes are strongly irritating, and contact can cause burning and charring of the skin; it is exceedingly dangerous to the eyes. Lead is harmful in all forms, and it builds up in people's bodies and the environment.

Use: Wear gloves to protect your hands. Avoid contact with battery acid with skin or clothing. If this happens, immediately wash your hands and body, then sprinkle baking soda on the areas where the battery acid has splattered on your clothes. It's not recommended to try to neutralize acids on the skin or when they've been consumed. The acid-base interaction generates thermal heat, which causes severe harm when flushed with or consumed with sodium bicarbonate. While the motor is running, do not stand near an open battery; it may splash on you. Before contacting your eyes or mouth after touching a battery, wash your hands thoroughly. Keep all sources of flames, including cigarettes, away from batteries.

Storage: Store away from children, especially curious children who might want to break the battery to see what is inside. Keep away from all sources of sparks, including flames. Store under a tarp or in a covered area.

Disposal: Recycle used batteries! Improper disposal of batteries presents an environmental hazard. It is important and easy to dispose of batteries by recycling them and it is usually possible to trade in old batteries where you purchase new ones [1, 9].

**7. Dry Batteries**

Dry cell and disc or button batteries are used in flashlights, radios, hearing aids, watches, cameras, calculators, toys, and other items in the home. Zinc, lead, alkalis, mercury, nickel, cadmium, silver, and electrolytes may be found in these batteries. If batteries leak or explode the chemical substances contained in these batteries can cause internal and external burns and irritation. Batteries that explode can spew their contents on unsuspecting victims. Batteries can explode for two reasons: when trying to recharge non-rechargeable batteries, gases can build up and cause the battery to explode; and when batteries are thrown into a fire, burned in a barrel, or otherwise

cremated, they can explode. Chewing or puncturing batteries might cause them to leak.

When randomly disposed of, batteries pose a danger to the environment. Heavy metals like silver, nickel, cadmium, lead, mercury, lithium, manganese, and zinc are found in batteries and can collect and concentrate in aquatic life, wildlife, and humans.

Use: Keep batteries out of the reach of youngsters. Do not put disc batteries in your mouth under any circumstances. They're slick and easy to swallow.

Storage: Keep out of reach of youngsters and away from fires when storing.

Disposal: Mercuric oxide and silver oxide batteries are collected by workers' companies and sold for the metal recovery process. Many towns are isolating batteries from their waste streams and hiring firms to recycle, neutralize, or dispose of them properly. Some recycling companies have recently begun to accept nickel-cadmium batteries and are willing to provide collection containers as well as cover the cost of bulk transportation to processors and recycling facilities [1, 3, 9].

**8. Gasoline**

Gasoline is flammable and highly toxic. Tetraethyl lead, an extremely hazardous metal compound, is found in leaded gasoline. Benzene, ethylene dichloride are carcinogens, and methanol, all of which have a high octane value, are all found in unleaded gasoline (a highly toxic compound). Gasoline can be harmful through skin contact, skin absorption, inhalation, or ingestion. Flushing, slurred speech, staggering, and bewilderment are the initial signs of poisoning. Overexposure might cause a coma and even death. Antioxidants, which are used to prevent gasoline from degrading and generating resins, can cause skin and eye burns.

Use: Never smoke near gasoline. Keep the lid on the can when not in use. Never siphon gasoline using the mouth because chemical pneumonia may result.

Do not use, leaded gasoline for camp fuel, gasoline to ignite brush fires or wood stoves, and any sort of gasoline to remove paint or grease from your body.

Wear nitrile or polyvinyl chloride gloves when handling gasoline and thoroughly wash your hands before eating or smoking. Avoid inhaling the vapors.

Storage: Keep out of the reach of children and pets. Store in an approved safety container in a garage or outbuilding with good ventilation. If you have a water heater, furnace, or other sources of ignition in your garage, it may not be a safe place to store your gasoline. Keep away from heat, flame, and sources of ignition. Do not completely fill the container - gasoline needs room to expand. While it is a good idea to carry an empty gasoline can in the car, do not keep the can filled with gasoline; the gasoline could explode upon impact.

Disposal: Generally, disposal of gasoline is no problem because it will be used up in an engine. However, dirty or contaminated gasoline cannot be burned in engines and must be saved for disposal by a licensed hazardous waste contractor or through a professional household hazardous waste collection program. For this reason, and health reasons, do not use gasoline as a cleaner or solvent. Never mix gasoline with waste oil. This would produce a highly flammable mixture [1, 3, 9].

**9. Bleach**

Liquid household chlorine bleaches contain approximately 5% sodium hypochlorite solution. The skin, eyes, nose, and throat are all irritated by chlorine bleach liquid and fumes. Direct skin contact can cause dermatitis. Ingestion can cause esophageal injury, stomach irritation and prolonged nausea, and vomiting. bleach, when mixed with acidic substances such as ammonia, toilet bowl cleaners, drain cleaner, or vinegar, poisonous fumes are produced, causing coughing, loss of voice, a burning sensation, asphyxia, and even death. Bleach should not be mixed with other cleansers.

Use: Wear protective gloves. Use only in well-ventilated areas with plenty of fresh air.

Storage: Store in a well-ventilated area and away from children.

Disposal: Use exactly as directed. Flush any leftovers down the drain with plenty of water to get rid of them. Dispose of tiny amounts over several days if you're using a septic tank or lagoon.

Alternatives: Borax is a disinfectant that can be used in the home. Oxygen (dry) bleaches perform effectively for bleaching garments [3].

**10. Carpet Cleaner**

These ingredients are most commonly found in commercial "spot removers", rather than water-based detergent products or rub-in cleansing powders [1, 3, 12]. Table 3 shows the possible effects of carpet cleaners' constituents of the carpet cleaners.

Table 3: Constituents of carpet cleaners and their possible effects

| Hazardous Constituent | Possible Effects |
|---|---|
| Perchloroethylene | Fumes are carcinogenic and acutely toxic, cause dizziness, sleepiness, nausea, loss of appetite and disorientation |
| Naphthalene | Damages liver; prolonged vapor exposure has led to cataract formation |

**11. Detergent**

Detergent refers to non-soap, synthetic surfactant-based household cleaning products that are generally used for laundry and dishwashing. Automatic dishwashing, hand dishwashing, enzyme, and low-phosphate detergents are among the several types of detergents available.

All detergents contain cationic, anionic, or non-ionic detergents. Cationic detergent consumption can produce nausea, vomiting, shock, convulsions, and coma as quickly as one to four hours after ingesting due to fast absorption. Anionic detergents have low toxicity on their own, causing minor, local irritation of the skin and eyes. The toxicity of non-ionic detergents is minimal. Mild inflammation of the skin and mucous membranes is the most common symptom.

Many poisonings in the home are caused by detergents. Part of the issue is that detergent boxes are brightly colored and appealing, and they are frequently stored in low, accessible areas. Low-phosphate detergents are frequently misunderstood as "safe." Low phosphate detergents are less caustic than phosphate detergents, although they are 100 to 1000 times more caustic. This means that ingesting even a small amount of low-phosphate detergent can result in significant burns. If there are children in the house, powdered detergents may be a safer alternative to liquid detergents because powdered granules are more difficult to consume accidentally. Detergents should be kept and out of reach of children.

***11.1. Automatic Dishwashing Detergent***

Most automatic dishwashing detergents are alkaline with pH values of 10.5 to 12 and maybe classified as irritants or corrosives depending upon their composition, concentration, and physical form. Skin irritation or burns may occur following exposure to dissolved detergents. Phosphate is found in automated dishwashing detergents, which causes environmental issues. It may be preferable to get a powdered automatic detergent over a liquid one because powdered detergents are more difficult to swallow accidentally.

***11.2. Hand Dishwashing Detergent***

Hand dishwashing detergents are much less toxic than automatic dishwashing detergents. Hand dishwashing detergents are combinations of anionic and non-ionic detergents, glycols, alcohols, and salts. Exposure to the membranes of the mouth, throat, and gastrointestinal tract may be irritating but not caustic. Hand dishwashing detergents are generally considered low in toxicity [1, 3, 12].

**12. Disinfectant**

Disinfectants are considered pesticides. They reduce some germs and are a temporary measure at best for making your home “germ-free”. Skin contact and vapors can be irritating and corrosive to the respiratory system and skin. When disinfectants are sprayed via aerosol cans, they are extremely dangerous since the disinfectant can readily be eaten by the nose and mouth. Ammonia, cationic detergents, cresol, phenol, and pine oil are all dangerous compounds that can be found in disinfectants.

Use: Avoid using aerosol dispensers to obviate corrosive effects and absorption via the skin, handle disinfectant with gloves, and safety eyewear. Make sure there is adequate ventilation and plenty of fresh air. Food, animals, and children should not be exposed to disinfectants.

Storage: Store to be out of reach of children in a well-ventilated environment for the container.

Disposal: Use up according to the instructions. To dispose of unused or unwanted portions take the product to a hazardous household waste collection center. If collection is not possible, flush the product down the toilet with plenty of water. Dispose of tiny amounts over several days if using a septic tank or lagoon [13].

**13. Drain Cleaner**

Chemical drain cleaners are extremely corrosive and dangerous to use. Common ingredients in drain cleaners include lye or sulfuric acid. These chemicals perform by consuming materials, including your skin, if it comes into contact with them. Vapors are also dangerous. If you have a septic system, you should be aware that drain cleaners are bad for it since they destroy the microbiological bacteria that are essential to the septic tank's operation. The use of chemical drain cleaners as a "preventative" measure is not a good idea. Weekly drain cleaning with boiling water

or a handful of baking soda and a half cup of vinegar is at least as effective as chemical drain cleaners and is safer for both humans and the environment. Many brands of enzymatic cleaners are very efficient, especially in preventing clogs. If the clog persists after using a chemical drain cleaner, do not use a plunger or a pressurized drain opener to clear the drain. This would only invite splashback. Also, do not add other cleaners to the drain following the use of a commercial drain cleaner. The combination of chemicals can produce toxic gas or become reactive and will be harmful to humans.

Use: Wear protective gloves and safety goggles. Avoid fumes.

Storage: Store away from children.

Disposal: Use up as intended. Take the unused product to a hazardous household waste collection center. If collection is not available and if you are connected to a sanitary sewer or municipal sewer treatment, you may dispose of unwanted portions of drain cleaner by an excess of water to flush the drain. If you are on a septic tank or lagoon, small amounts of drain cleaner may be flushed with plenty of water over a number of days. It would be best, however, to ask a friend, relative, or neighbor who is on a sanitary or municipal system to allow you to use their drain to dispose of your household quantity of drain cleaner [14].

**14. Furniture Polish**

There are three general types of commercial furniture polish: solvents, emulsions, and aerosol sprays. Solvent polishes dissolve the oil or wax in a liquid state using a chemical solvent. Emulsion polishes are a type of polish that suspends or waxes in a liquid, usually water. Solvents or emulsions packed under pressure make up aerosol sprays.

The vast majority of polishes are combustible. Chemicals such as nitrobenzene, ammonia, phenol, and petroleum distillates can be found in furniture polish. Inhalation of fumes (particularly from aerosols) and poisoning through eating are the two most common health risks connected with furniture polish. Children are particularly drawn to polishes that appear to be drinkable, such as strawberry soda or milk.

Use: When using furniture polish, wear gloves, and avoid contact with skin. Use in a well-ventilated area. When using nitrobenzene-containing polishes and stains, exercise caution.

Storage: Keep out of reach of children and flames.

Disposal: Keep unused fragments of furniture polish that include petroleum distillates or nitrobenzene instead of tossing them away; they can be collected as hazardous waste. The best way to avoid a disposal dilemma is to fully and carefully use the product up [13, 14].

**15. Glass Cleaner**

Window and glass cleaner commonly contains isopropyl alcohol or ammonia, water, and coloring. It has the potential to irritate the nose, throat, eyes, and skin.

Use: Window and glass cleaners should always be used in a well-ventilated location.

Storage: Keep out of children's reach.

Disposal: Unused or unwanted portions of window or glass cleaner should be flushed down the drain with plenty of water [13, 14].

**16. Glues & Adhesives**

Glues, rubber cement, epoxy, and other adhesives contain a solvent that, when applied, evaporates out leaving the solid adhesive portion behind. Hazardous solvents are present in rubber cement, epoxy, instant glues, model glues, and plastic adhesives. Many adhesives have high flammability. Some adhesives are allergen-sensitizers and skin and lung irritants, while others can cause skin and eye burns. When inhaled in high doses, several of the solvents used in adhesives and glues have narcotic, potentially deadly effects. Coughing and bronchial spasms might occur after inhaling fumes from cured epoxy resins for several days [15, 16].

The safest glues on the market are white glue, library paste, yellow wood glue, and glue sticks. Most porous and semi-porous materials, such as paper, cloth, wood, and ceramics, adhere well with white glue. Large projects, such as laying hardwood floors, might also benefit from the usage of white glue [16].

Use: When feasible, use white glue, glue sticks, or yellow glue. Never use toxic adhesives on laminated cutting boards, bowls, or a product that contacts food. Carefully read the label. Wear protective gloves with adhesives and types cement. If the glue contains solvents, use only in a well-ventilated area with plenty of fresh air. Avoid wearing soft contacts, which may absorb solvent vapors. If the glue is flammable, make sure all sources of ignition (such as pilot lights) are turned off before using a substantial amount of the solvent in a room with a source of flame. When you're not using the glue, keep the lid tightly closed [17].

Storage: Keep out of reach of children and open flames. Make sure the cap or lid is tightly secured.

Disposal: The easiest approach to avoid a trash disposal issue is to dispose of it properly. If the adhesive or glue isn't immediate, white, or yellow, it should be disposed of by a certified hazardous waste handler or saved for a household hazardous waste pickup. However, if the glue or adhesive has hardened, it may be thrown in the trash destined for the landfill [14].

**17. Hydrogen Peroxide**

Common household hydrogen peroxide contains a 3-5% concentration. It is used as a disinfectant and deodorizer. Ingestion or skin contact with tiny doses of household hydrogen peroxide will not create any major side effects. It gives off a yellowish tinge and might irritate the skin and mucous membranes. When used as a wood or hair bleaching treatment, industrial level hydrogen peroxide (10 percent concentration $H_2O_2$) can cause serious burns to the gastrointestinal tract, skin, and even throat.

Disposal: Household hydrogen peroxide that has been used or is no longer needed should be brought to a hazardous household waste collection center. If a collection center is not available, 3-5 % peroxide solutions can be flushed down the drain. If you use a septic tank or lagoon, dispose of small quantities over several days [14].

**18. Insect Repellent**

Insect repellents deter mosquitoes, and other insects from biting and disturbing the user, as the name implies. Compounds such as bicycloheptene dicarboximide, diethyl toluanide, dimethyl phathlate, ethyl hexanediol, indalone, tetrahydrofuraldehyde, and di-n-propylisocinchoronate are all common repellent active components. Symptoms included loss of coordination, anxiety, behavioral changes, and mental confusion. Liver and kidney damage have been linked to indalone and ethyl hexanediol. In rats, long-term indalone cutaneous treatment caused liver and kidney damage. Ethyl hexanediol can harm your liver and kidneys. Ingestion of significant amounts of insect repellant can result in loss of coordination, depression of the central nervous system, and even coma [18]. Table 4 reflects the possible impact of the of insect repellents' constituents.

Use only a little amount. Prohibit contact with irritated eyes, mouth, and skin.

Storing: Keep out of the reach of children.

Table 4: Constituents of insect repellents and their possible effects

| Hazardous Content | Potential impact |
|---|---|
| Butopyronoxyl | Possible cause slight necrosis in liver and kidney |
| Cimethyl Phthalate | Ingestion depresses the central nervous system |
| Diethyltoluamide | Skin and respiratory tract tissues are irritated |

Disposal: Pesticides are insect repellents. The best way to get rid of insect repellents, with the exception of those containing banned or otherwise restricted chemicals, is to use them up as directed. Insect repellents should never be burned, buried, combined, put on the ground, dropped in water, or flushed. Leftover portions of all pesticides, including insect repellents, must be disposed of by a licensed hazardous waste handler or through a professional household hazardous waste collection [14, 18].

**19. Oven Cleaners**

Most of the oven cleansers contain sodium hydroxide or potassium hydroxide (lye), a very caustic chemical. Lye can harm skin, eyes, and internal organs, whether it's in the form of an aerosol spray, a liquid, a paste, or a powder. Because minute droplets of lye can float and land on skin, eyes, and sensitive lung surfaces, lye in aerosol form is highly dangerous (Table 5) [14, 19].

Table 5: Constituents of oven cleaners and their possible effects.

| Hazardous Content | Potential impact |
|---|---|
| Sodium Hydroxide | Severe corrosive, burns skin and eyes; usually fatal if swallowed; aerosols disperse chemicals, increasing inhalation dangers |
| Potassium Hydroxide | |

Use: Aerosol oven cleaners should be avoided. Wear an apron, protective gloves, safety eyewear, and an organic vapor cartridge respirator. Make sure there's enough fresh air and ventilation in the room [19].

Storage: Keep out of the reach of children.

Disposal: Use up as intended. Take unused oven cleaners to a hazardous household waste collection center. If there isn't a collection site nearby, wrap the items in many layers of newspaper and toss them in the garbage [14, 20].

Alternatives: Use a non-toxic oven cleaner [20].

**20. Paint**

A typical paint mixture contains 5 to 25% pigment and 75 to 95% solvent. The toxicity of the paint is mostly determined by the pigment and solvent employed. If paint fumes are breathed or paint is consumed, it can be dangerous. Flammability is another risk connected with some paints. If the paint you're using is flammable, it should say so on the label. Water-based paint with the exception of latex paint, mineral spirits (naphtha), toluene, xylene, and other petroleum distillate solvents are commonly used in paints. These solvents have the potential to irritate the eyes, skin, and lungs. Headaches, nausea, dizziness, and exhaustion can all be caused by inhaling paint fumes. Toxic gases can build up in enclosed places and regions with inadequate ventilation. Acute and chronic symptoms include muscle weakness, liver and kidney damage, and respiratory problems. Oil-based paints and varnishes have a high solvent content; thus women should avoid using them while pregnant. Unless swallowed in high quantities, indoor water-soluble latex paints may be low in toxicity. To promote mildew resistance, exterior latex paint may contain a mercury insecticide that is exceedingly hazardous if consumed [21, 22].

Use: If available, use latex paint instead of oil-based or other paints that need to be cleaned with a solvent. Not only will you eliminate the hazards from the solvents in the paint, but you will also eliminate the need to use additional solvents to clean brushes. Wear protective gloves. If you need to clean oil-based paint from your skin, massage with a few drops of baby oil, butter, or margarine. Clean with soap and water after wiping dry [14, 23].

Whenever possible, paint outdoors. When painting inside make sure ventilation is adequate. Make use of a fan to divert fumes away from your workspace and into the outside air. Take frequent stops to get some fresh air. Place flammable paints away from fires, spark sources, and regions of extreme heat. Never smoke around paints or while painting [23].

Storage: Seal can tightly when not in use. Keep all paints and paint products away from children and pets. Store flammable paint away from heat, flame and source of ignition. Do not allow the paint to freeze [14, 23].

Disposal: Using up paint is the greatest way to get rid of it. Paint boards, signs, dog and bird shelters, or using it as an undercoat for another project are some ideas for repurposing old paint. Paint can be recycled if there is more than one litter of usable paint and the paint is in the original can with a legible label. When you have usable recyclable paint that you are unable to use, donate it to someone who can, such as friends, neighbors, schools, or theatrical groups [2, 14].

When the paint inside the can has completely dried, it can be thrown away in a sanitary landfill. If you have liquid paint which cannot be used or recycled, secure and hold for a professional household hazardous waste collection or give it to a licensed hazardous waste handler [1, 14].

**21. Paint Thinner**

Thinning paints and varnishes with turpentine and mineral spirits are usual. Although both substances are combustible and harmful, mineral spirits have lower toxicity. Mineral spirits, a petroleum distillate, can be harmful if inhaled, comes into contact with skin or eyes, or is consumed. Contact and inhalation can cause irritation of the eyes, nose, and throat, as well as dizziness and dermatitis. Ingestion can cause depression in the central nervous system. If mineral spirits are consumed and subsequently vomited, they might cause lung damage. Turpentine is a sticky mixture of resin and oil extracted from pine trees that is unpleasant and can induce tissue death as well as kidney impairment. Vapor intoxication induces depression in the central nervous system, resulting in headaches, nausea, confusion, and blurred vision, among other symptoms. Inhaling fumes for an extended period of time can increase the risk of pneumonia and chronic kidney irritation. Vapors can irritate the eyes, nose, and throat even in low amounts [24].

Use: Put on a respirator with an organic vapor cartridge and gloves to protect your hands. Only use paint thinners when appropriate ventilation is available, and take frequent fresh air intervals. If skin contact occurs, wash the area immediately with soap and water [25].

Storage: Make sure it's out of reach of kids. In a well-ventilated atmosphere, keep away from flames and ignition sources [14].

Disposal: The used paint thinner can be readily recycled and reused at home. Pour the contaminated paint thinner into a well-sealed container with a clear label. In a heated atmosphere, plastic containers such as milk jugs may not be sturdy enough to survive the vapour pressure. Glass jars work well but never use a beverage container because it can be easily mistaken for something to drink. Clearly label the container with the type of solvent and the date. Draw or write a clearly

visible warning. Store for several weeks to months away from sources of sparks until the paint sludge settles to the bottom. Pour the clean solvent off the top with care. This solvent can be reused. Allow the remaining paint sludge to dry completely in a well-ventilated area, outside of your home and away from pets and children. The dried sludge can be discarded in the trash once all of the liquids have evaporated. Small amounts of dirty paint solvent can be poured into a paint can of the same color and mixed well. This thinned paint can then be used for a second coat or another project. The simplest approach to get rid of leftover paint thinners is to either use them yourself or find someone who will. Unwanted portions of mineral licensed hazardous waste handler or a professional household hazardous waste collection [14, 26].

**22. Paint & Varnish Remover**

Paint and varnish removal products come in a number of different formulas (also called paint and varnish strippers). Organic solvents, which are dangerous to human health, are found in most paint and varnish removers. The majority of them are extremely combustible. When non-flammable items come into touch with flame, they can emit a poisonous gas. Acetone, benzene, isopropyl alcohol, methanol, methylene chloride, petroleum distillates, toluene, trichloroethane, and xylene are just a few of the toxic compounds that can be found in paint and varnish removers. Through skin contact, skin absorption, ingestion, and inhalation, hazardous substances in paint and varnish removers can harm your body. Methylene chloride, a major part, is a powerful narcotic that breaks down in the body to generate carbon monoxide, potentially depriving the body of oxygen. People with cardiac problems have died as a result of using methylene chloride-containing paint and varnish removers. Methylene chloride is also a probable human carcinogen and a confirmed animal carcinogen [1].

Use: Never use benzene-based paint and varnish removers. Do not use methylene chloride-containing goods if you have a cardiac issue. Follow label directions carefully. Do not smoke while using these products. Do not use paint and varnish removers near flames, sparks, sources of ignition, or areas of intense heat. When the gas furnace is on, avoid applying paint and varnish removers. The fumes could corrode your furnace, and the pilot light could ignite the vapors, causing them to explode [14, 27]. Wear protective gloves and safety goggles. Work outdoors and in the shade. If you have to work inside, make sure there's enough ventilation. Take frequent breaks to allow your body to breathe fresh air. You are inhaling the solvents if you can smell the substance, and you should use an authorized respirator with an organic solvent cartridge. To clean your hands, avoid using paint and varnish remover. To remove oil-based paint from the skin, use a few drops of baby oil, butter, or margarine. Dry with a towel and then wash with soap and water. After you've finished working, properly wash your hands and all exposed skin before eating or drinking. Store solvent-covered rags and newspapers in a metal container with a lid and place them outside of the home when you're done for the day. Place the container next to your household trash for collection [27].

Storage: Store in a cool, dry, well-ventilated area out of reach of children and pets. Containers must be tightly shut. Keep a safe distance from sources of ignition, sparks, and flames [27, 28].

Disposal: The best approach to get rid of unused paint and varnish remover is to utilize it or give it to someone who will. If you can't locate a place to donate the paint and varnish remover, or if it contains benzene, keep it for a professional household hazardous waste collection or give it to a licensed hazardous waste handler to dispose of [14, 27].

**23. Pharmaceuticals**

Pharmaceuticals, which include both prescription and over-the-counter medications, can be quickly and safely disposed of. Returning the unwanted portion of drugs to your pharmacist is the best approach to dispose of them. Many pharmacists are prepared to take unused medications and properly dispose of them. Taking the medicines to a hazardous household collection center is the second best option. Many drugs can be flushed down a toilet connected to a sanitary sewer if a collecting site is not accessible. This does not include chemotherapy treatments, antineoplastic medicines, or head lice shampoos, which should never be flushed. If you have a septic tank or a lagoon, return your unneeded pills to the pharmacy or deliver them to a sanitary sewer-connected household. Do not throw medications out where youngsters can try them and get hurt. Chemotherapy and antineoplastic medicines that are no longer needed should be returned to the pharmacist or cancer clinic where they were given, or delivered to a major hospital for proper disposal. These drugs are extremely toxic. The insecticide lindane is found in certain head lice shampoos. As a result, any unneeded shampoos should be retained and preserved for hazardous waste collection [27, 29].

Disposal: Many households use disposable hypodermic syringes and needles to administer medications like allergy insulin and injections. Waste handlers can be injured if needles are not disposed of properly. Place the hypodermic needles in a hard, puncture-resistant, leak-proof container to dispose of them. Seal the container with duct tape once it is filled and drop it in the garbage going for the sanitary landfill [30, 31].

**24. Mothballs**

Mothballs are a flammable chemical with a distinct odor intended to keep moths away. Mothballs, a pesticide, may look like candy to a toddler. When consumed, they are dangerous, and convulsions can occur in less than an hour. Mothballs are made entirely of naphthalene or paradichlorobenzene. When inhaled, both of these chemicals can cause injury. Long-term inhalation of mothball fumes can induce nose, throat, and lung irritation, as well as headaches, dizziness, excitation, or depression, as well as damage to both liver and kidney [10, 23]. Naphthalene-containing mothballs are of particular concern because naphthalene can cause hemolytic anemia by promoting the destruction of red blood cells. In its mildest form, hemolytic anemia can just produce weariness. Acute renal failure can occur in more severe situations. Young children are especially vulnerable. Poisonings have been documented after newborns were dressed in garments that had been stored with naphthalene mothballs, implying that naphthalene can be absorbed through the skin [32].

"Avoid extended inhaling of vapors" says the warning label on mothball products. This label contradicts the traditional use of mothballs. Mothballs have a distinct stench due to the substances they contain. These vapors tend to fill the entire house, making extended breathing of vapors extremely impossible to prevent unless you live outside. When mothballs are placed in closets or rooms with insufficient ventilation, the fumes build up to high concentrations, complicating the issue even further. When you're around these products, vapors seep into your clothes, blankets, and bedding, resulting in direct exposure [33].

Use: These products should be avoided. If you must use mothballs, do so in moderation. Paradichlorobenzene-containing mothballs may be safer, if only because they do not cause hemolytic anemia [34].

Storage: Keep away from children and pets in a well-ventilated area. If stored indoors, mothballs should be properly wrapped in two plastic bags [34].

Disposal: Take mothballs to a qualified hazardous waste handler or store them for a professional household hazardous waste collection program [20, 35].

**25. Scouring Powder**

Calcium carbonate is used as an abrasive in most scouring powders, and chlorine bleach may also be used. To avoid the creation of hazardous gas, do not mix bleach-based cleaners with other ammonia-based cleaners such as toilet bowl cleaner, oven cleaner, or all-purpose cleaners. Chloramine gas is produced when bleach and ammonia are combined. For insensitive people, scouring powder containing chlorine can irritate and redden the skin [1, 36].

Disposal: Use it up or donate it to someone who will benefit from it. Flush leftovers down the toilet with a lot of water if you have any. If using a septic tank or lagoon, however, dispose of little amounts over several days [7].

Alternatives: Scouring powder can be simply replaced with baking soda or salt. Diatomaceous earth-based commercial products are relatively safe, effective, and non-abrasive. Nylon and other non-metallic scrubbing pads may also be effective [14, 20].

**26. Shoe Polish**

Many commercial products contain either trichloroethylene, methylene chloride, or nitrobenzene. These suspected human carcinogens can be easily absorbed through the skin [37, 38].

Use: Wear gloves when polishing or cleaning shoes. After polishing your shoes, be sure they are dry before wearing them. If you're drinking, never wear shoes that aren't completely dry, and never polish shoes when consuming alcoholic beverages. The harmful effects of nitrobenzene are amplified when alcohol is present in the system. When dangerous amounts of nitrobenzene are absorbed, the person's fingernail beds, lips, ear lobes, and tongue turn blue. The consequences can be fatal. Most shoe polishes, unfortunately, do not list their ingredients [38].

Storage: Keep out of reach of children.

Disposal: Use it up or pass it on to someone who will. Bring any leftovers to a hazardous trash collection center [14].

**27. Smoke Detector**

Early detection of fires is critical, which is why smoke detectors are so crucial. Photoelectric smoke detectors detect only visible products of combustion, while ionizing smoke detectors detect both visible and invisible products of combustion. Ionizing (or ion chamber) smoke detectors contain a trace quantity of radioactive Americium-241 material (Am-241). Am-241 emits alpha particles and has a half-life of 458 years. The ionizing smoke detector is built in such a way that accessing the radioactive portions would necessitate the smoke detector's complete destruction. Returning an ionizing smoke detector to the manufacturer is the best method to get rid of it. The photoelectric smoke detector is safe to throw away [39, 40].

**28. Toilet Cleaner**

Phenol, commonly known as carbolic acid, is highly poisonous, flammable, and corrosive. Phenolic compounds have a distinct odor and are used in disinfectants, deodorizers, paints, and as an anesthetic for the skin. Even modest doses can result in vomiting, circulatory collapse, paralysis, convulsions, and coma. Skin absorption can result in fatal poising. All proteins they come into contact with, including skin, are promptly denatured by phenol and similar chemicals. Contact may result in severe burns. There have been numerous reports of skin ulcers, rashes, swelling, acne, and hives. Phenols' anesthetic effects can cause severe skin tissue damage before pain is felt [20, 41]. Table 6 reflect the hazardous effects of the ingredients of the toilet cleaners.

Table 6: Constituents of toilet cleaners and their possible effects.

| Hazardous Content | Potential impact |
|---|---|
| Sodium bisulfate | produces sulfuric acid, which is corrosive and burns skin |
| Oxalic acid | damages kidney and liver, irritates eyes and respiratory tract, and corrodes mouth and stomach |
| 5-dimethyldantoin | produces hypochlorite (corrosive to skin) in water, and mucous membranes |
| Hydrochloric acid | fumes are extremely corrosive, and burns skin |
| Phenol | central nervous system depression, severely affects circulatory system, corrosive to skin, and suspected carcinogen |

**29. Plastics**

Some plastics, on the other hand, are linked to hazards throughout the manufacturing process, when mistreated, and in other situations: during their whole lifecycle from manufacture to the final disposal. They also comprise a significant fraction of the entire municipal waste stream. As a result, the principles of source reduction, reuse, and recycling are just as valid for plastics as for other waste materials [42].

***29.1 General Impacts***

While plastics have numerous useful applications and are safe to use in the home, they do pose some risks. These are the environmental and health impacts throughout the lifecycle of plastics from manufacture to use to ultimate disposal. Plastics are a significant component of the overall waste stream. In 1998 they comprised 10.2% by weight and 24 % by volume (USEPA, Polystyrene Packaging Council). They comprise about 6 percent of all litter [43]. Plastics do not degrade readily. Because their composition is non-biodegradable by microorganisms, they never completely biodegrade in the environment. They are carried by air and water or gather in low regions, streams, and along fences, if they are not picked up by highway workers or volunteers [44].

***29.2. Reasonable Responses***

Plastics must be used carefully and sparingly for the reasons indicated previously. Reduce, reuse, and recycle is an important pattern to follow.

***29.3. Reduce the Source***

You can reduce your household's consumption of plastic by:

- Requesting paper bags at the store
- In stores that offer food and beverages in plastic foam, ask for paper containers
- Purchase products that are packaged in recyclable materials (such as aluminum, paper, and glass)
- Avoid multi-layer packaging and advocate for limitations

***29.4. Reuse***

Plastic (or paper) can be reused.

***29.5. Recycle***

Recycling could be feasible by the following:

- Locating a collection or recycling facility that will accept it.

Advocating for bottle-bill legislation that imposes a fee or a deposit on plastic containers.

The quantity and impact of plastic recycling have increased dramatically. Since 1990, the amount of post-consumer plastic produced annually has increased by at least sixfold, reaching 1.45 million pounds in 1998. However, this represents less than 10% of total yearly plastic output; it is predicted that at least 80% of all thermoplastics might be melted down and recycled into new goods [43, 44].

**30. Roach Killer**

Bait and trap devices are usually much safer than broadcast or spray pesticide use [14, 45]. Table 7 shows the possible effect of the roach killers' ingredients.

Table 7: Constituents of roach killer and its possible effects.

| Hazardous Content | Potential impact |
|---|---|
| Organophosphates | Carcinogenic in rats; teratogenic in chick embryos; affect nervous system; acutely toxic causing headache, dizziness, twitching, nausea |
| Carbamates | Carcinogenic in rats; mutagenic, teratogenic in dogs and mice; affects nervous system |

**31. E-waste**

The e-wastes are classified as general trash and refer to any unwanted electronic item or cathode ray tube (CRT). Hazardous elements, primarily lead and mercury, are regularly found in e-waste. There are several types of E-waste i.e. televisions and computer monitors, liquid crystal display (LCD) desktop computer monitors and laptop computers, LCD televisions, Plasma televisions, Portable DVD players with LCD screens, oscilloscopes, computers, computer keyboards, and other peripherals, telephones, cell phones, and answering machines, stereo equipment, radios, tape and CD players/recorders, phonographs, video cassette recorders and calculators, and Microwaves [46].

***31.1. E-waste Treatment & Disposal Methods***

There are two major methods for E-waste treatment.

- Recycling of e-waste:

Monitors & CRT, keyboards, laptops, modems, telephone boards, hard drives, floppy drives, compact disks, mobiles, fax machines, printers, CPUs, memory chips, connecting wires & cables can be recycled.

Recycling involves dismantling i.e. separation of plastic, removal of CRT, segregation of ferrous and non-ferrous metals, and printed circuit boards from other portions of e-waste including harmful compounds such as PCB and Hg. To extract precious metals like copper, lead, and gold, recyclers employ strong acids. If appropriate technologies are utilized, the value of recycling from the element might be substantially higher. Without a mask and professional skill, recyclers working in poorly ventilated enclosed locations are exposed to harmful and slow poisoning substances.

The existing dumping grounds in India are full and overflowing beyond capacity and it is difficult to get new dumping sites due to scarcity of land. Consequently, recycling is the most cost-effective method of e-waste disposal [47].

- Re-use:

It refers to the usage of secondhand equipment that has been slightly modified from its original state. It is often used for electrical devices such as laptops, cell phones, and other similar devices. After refilling, an inkjet cartridge is also used. This strategy also cuts down on the amount of e-waste generated. We can treat and dispose of e-waste using the procedures indicated above. It is preferable to avoid its production. To accomplish this, obligatory buyback of outdated electronic equipment will be implemented. Large enterprises should buy back used equipment from customers and ensure that e-waste is properly treated and disposed of using authorized ways. This can significantly minimize the amount of e-waste produced [48, 49].

**32. Fluorescent lamp**

Mercury-containing lamps include tubular and compact fluorescent lamps, high-intensity discharge lamps (mercury vapor, metal halide, high-pressure sodium), and fluorescent backlights in flat panels, and liquid crystal displays commonly used as monitors, TVs, and instrument displays [50, 51].

The amount of mercury in a fluorescent lamp varies, depending on the type of lamp, manufacturer, and date of manufacture, but typically ranges between 1.7 milligrams and 15 milligrams. Although manufacturers have greatly reduced the amount of mercury used in fluorescent lamps over the past 20

years and are currently taking additional steps to further reduce their mercury content, mercury is an essential component of fluorescent lamps and cannot be eliminated completely [27, 52].

Mercury is not released when lamps are intact or in use; exposure is possible only when a lamp has been broken. When a lamp is broken some of the mercury in the bulb is immediately released into the air as mercury vapor [53, 54]. Elemental mercury primarily causes adverse health effects when it is breathed as a vapor and is absorbed through the lungs. Higher exposures occur in warm or poorly-ventilated indoor spaces. Breaking a number of fluorescent bulbs in an uncontrolled or poorly controlled manner (e.g., by poorly handling and storing lamps, such that a large number break or by using a drum-top crusher that does not have a filtration system or that is incorrectly assembled) can directly expose people to dangerous levels of mercury vapor [55, 65].

**Recycling Fluorescent Lamps**

It is strongly encouraged the recycling of all spent fluorescent lamps as the preferred approach to managing lamps throughout their full product lifecycle. Recycling fluorescent lamps properly not only reduce mercury release into the environment, but also allows the glass, metals, and other materials that make up a fluorescent lamp to be reused. Virtually all components of a lamp can be recycled. Recycling fluorescent lamps reduce the amount of waste going into a landfill, saves energy, and reduces greenhouse gas (GHG) and mercury emissions. Spent lamps can be sent to or picked up by the recycler whole (unbroken), they can be crushed using a drum-top crusher (DTC) onsite [56-58].

When a fluorescent or other mercury-containing light bulb fails, what should you do?

***32.1. Before Clean-up: Air Out the Room***

- Ask everyone to leave the room, including pets, and don't let them walk through the breakage area on their way out.
- Leave the room for at least 15 minutes with a window open.
- If you have a central forced-air heating/air conditioning system, turn it off.

***32.2. Clean-Up Steps for Hard Surfaces***

- Using stiff paper or cardboard, carefully scoop up glass bits and powder and place them in a glass jar with a metal top (such as a canning jar) or a sealed plastic bag.
- Pick up any residual small glass fragments and powder using sticky tape, such as duct tape.
- Use damp paper towels or disposable wet wipes to clean the area. • Do not use a vacuum or sweep to clean up the shattered bulb on hard surfaces; instead, place towels in the glass jar or plastic bag.

***32.3. Clean-up Steps for Carpeting or Rug***

- Pick up glass fragments with care and place them in a glass jar with a metal top (like a canning jar) or a sealed plastic bag.
- • Pick up any residual small glass fragments and powder using sticky tape, such as duct tape.
- If vacuuming is needed after all visible materials are removed, vacuum the area where the bulb was broken.
- Remove the vacuum bag (or empty and wipe the canister) and put the bag or vacuum debris in a sealed plastic bag.

***32.4. Clean-up Steps for Clothing, Bedding, and Other Soft Materials***

- If broken glass or mercury-containing powder from inside the bulb comes into direct contact with clothes or bedding materials, the clothing or bedding should be discarded.
- You can wash clothing or other materials that have been exposed to mercury vapor from a broken CFL, such as the clothing you were wearing when you cleaned up the broken CFL, as long as they have not come into direct contact with the materials from the broken bulb.
- If shoes come into direct contact with broken glass or mercury-containing powder from the bulb, wipe them off with damp paper towels or disposable wet wipes. Dispose of the towels or wipes in a glass container or plastic bag.

***32.5. Disposal of Clean-up Materials***

- Place all clean-up materials outside in a garbage can or a protected area until the next scheduled trash disposal.
- Wash your hands after disposing of the jars or plastic bags containing clean-up materials.
- Check about disposal requirements in your specific area [59, 60].

**33. Thermometers**

When a mercury thermometer breaks, the mercury vaporizes, posing an immediate and serious health risk. Mercury can harm the central nervous system if

inhaled or absorbed via the skin, especially during fetal and childhood development [61].

When a Mercury Thermometer Fails, What Should You Do?

Do not vacuum!

1. Make sure the spill area is adequately ventilated.
2. Wear rubber gloves to prevent skin contact. Keep hands away from your face especially your eyes, nose and mouth.
3. Isolate the spill immediately. If it is on a raised surface, contain it so that mercury doesn't roll onto the floor. Divert spilled mercury from drains, cracks, and crevices.
4. Carefully pick up broken glass. Wrap or fold in a paper towel or tissue and place in a leak-proof plastic bag.
5. Working from the outside of the spill area toward the center, push small mercury beads together with a card, stiff paper, or squeegee to form larger droplets. Use an eyedropper or two stiff pieces of paper to pick up droplets and place them into a leak-proof plastic bag.
6. Pick up any remaining glass or mercury droplets with the sticky side of the duct or masking tape (two inches or wider). Pay special attention to tile or wood floor cracks or crevices. Fill a leak-proof bag with glass, mercury, and tape.
7. Look all around the spill location with a flashlight. The mercury beads will reflect light, making them easier to see. Using the process outlined above, pick up any drips.
8. When finished, carefully remove the rubber gloves and place them in the leak-proof plastic bag.
9. Place all mercury-containing clean-up debris (gloves, tape, mercury, etc. contained in a leak-proof plastic bag) into another leak-proof plastic bag, twist or snap shut, and seal the opening with tape.
10. Take the bag to a household hazardous waste collection facility or collection event [62].

## 34. Greywater and blackwater

Municipal wastewater separation into black and greywater has been shown to be an effective approach for preventing greywater pollution, reducing the volume of fecal polluted wastewater, and lowering treatment costs [63-66]. Greywater is described as domestic wastewater that does not come from toilets and includes wastewater from bathing, showering, hand washing, laundry, and the kitchen sink. Greywater has been estimated to account for about 70–75 vol.% of domestic wastewater [67-68]. After the proper treatment, on-site greywater reuse has the potential to play a significant role. In affluent nations, indoor household water consumption (excluding garden irrigation and other exterior applications) typically varies between 100 and 180 L/d PE or 36–66 m3/y PE [69–71], accounting for 30–70% of total urban water demand. [69-71], comprising 30–70% of the total urban water demand. The most practical greywater reuse alternative in urban settings is toilet flushing, which may cut individual in-house net water consumption by 40–60 L/d PE. If this approach becomes widely used, it is possible to reduce urban water consumption by 10–25%. As an example, Friedler and Galil [71] showed that in 2023, with a 30% penetration ratio (i.e., 30% of houses having greywater reuse units installed), greywater reuse for toilet flushing in the household sector, Mediterranean nations might save roughly 50 MCM each year. This consists of about 5% of the projected national urban water demand and equals the capacity of a medium-size seawater desalination plant. The authors further demonstrated that reaching 30% penetration in 20 years is realistic if the government would promote and encourage such a practice [72]. Indeed, on-site greywater reuse has been investigated extensively in the last decade, especially in the EU, Japan, the USA, and Australia. However, full-scale commercial systems are not getting common [64, 73].

Treatment of greywater (with low fecal pollution) could be accomplished using simple techniques. Sand filter, constructed wetland, sequential patch reactor (SBR), and membrane bioreactor (MBR) are among the commonly used systems for this purpose [67-68]. On the other hand, blackwater reuse requires extensive treatment. Septic tank or upflow anaerobic sludge blanket (UASB) reactor followed the above-mentioned techniques could be used. This study was carried in Egypt during the period from 2003 to 2008 within the framework of an EU project [67, 68, 74].

## 35. Conclusions

- It was found from the previous narrative that many of the products that are used inside homes are either hazardous or contain some hazardous ingredients, or if they are mixed with another product give hazardous by-products.
- Some instructions should be placed on the packaging warning the user of the danger of this.
- Attach an MSDS-style flyer with hazardous products that are used in homes.

- Hotlines should be established to receive inquiries from residents of the country for guidance on how to handle HHHWs.
- Small videos should be made for each type of these hazardous household waste on social networking sites to raise awareness of HHHWs.
- Make special brochures for each HHHW.

## 36. Conflicts of interest

There are no conflicts of interest to declare.

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