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Are we being poisoned?

Toxins are substances which accumulate in the body. They are considered harmful or poisonous to the system. Toxins have been studied for centuries and their effects on humans and animals have been documented in detail. Toxins are growing in number and variety. New agents are being added to the list periodically. Herein lies the problem.

Our ancestors used toxic plant and animal extracts in hunting and warfare. Even in ancient times, knowledge of toxins and antidotes was well developed. However, a quantum development in knowledge took place in the middle ages in the possibility of using toxins as medicines.

By the late nineteenth century, many scientists began to focus their research to find answers to the reasons for certain chemicals being poisonous and identifying their effects on the body. Such efforts continue till this day as newer toxins are identified and others are re-evaluated.

Classification

Toxins can be generically grouped according to:

* Their source: plant, animal, and man made (artificial).
* Their purpose / use: pesticides, food additives.
* The organs affected: hepatotoxins, carcinogens.

Regardless of the manner of classification, toxins are assessed by a standard set of criteria. The first set of questions in evaluating a toxin depends on exposure; how it occurs, and at what frequency. How a toxin enters the human body can have a tremendous impact on what its effects might be. Toxins can enter the body through the skin, mouth or inhalation. Exposure can occur at the work place, while commuting or at the residence. Exposure can also occur because of an accident or through a deliberate act such as a suicide attempt.
Toxicologists divide the frequency of exposure into acute or chronic durations. Acute health effects are characterized by sudden and severe exposure and rapid absorption of the substance. Normally, a single large

TOXINS

exposure is involved. Acute health effects are often irreversible. Examples: carbon monoxide. Chronic health effects on the other hand are characterized by prolonged or repeated exposure over many days, months or years. The symptoms may not be immediately apparent. Thus, chronic health effects are often irreversible. Examples: lead or mercury poisoning, cancer caused due to toxins.

The effects of exposure can vary from minimal discomfort to serious effects like heart attack or even death. Effects are not always immediately apparent. The effects of some exposures are not seen for years as in the case of cancer or damage to the nervous system.

Toxicology is 'the science that deals with the nature and effects and treatments of poisons.'

Branches of toxicology

- Environmental toxicology: The toxicity and toxicology of environmental pollutants and natural toxins in the environment.
- Economic toxicology: Concerns drugs, food additives etc having direct relation to the economy.
- Clinical toxicology: Deals with poisons, effects, signs and symptoms.
- ·Forensic toxicology: Relates to the application of toxicology to the purposes of the law.

Routes of entry into human body

The route of exposure describes the way the chemical enters the body. Paradoxically, the same chemicals may

"All substances are poisons; there is none which is not a poison. The right dose differentiates a poison…." Paracelsus (1493-1541)

FALGUNI RAJKUMAR
Additional Chief Secretary &
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Message

The world is becoming increasingly aware of the toxins we ingest through the air, water and food. Research has shown that 95 per cent of cancer in humans is caused by diet and environment toxicity. As a consequence, people are turning to organic foods and natural products in increasing numbers.

At this juncture, citizens in general, school and college students in particular, would benefit greatly if information on toxins is provided to them in an easily understandable format. A newsletter on the subject will be useful and timely.

(FALGUNI RAJKUMAR)
Additional Chief Secretary &
Development Commissioner

have serious effects on the human body by one route, and the minimal effect by another.

Hazardous chemicals may enter the body by:
- Breathing
- Skin contact
- Ingestion (through eating or smoking with contaminated hands or in contaminated work areas)
- Injection directly into the bloodstream.(through mechanical injury from sharp objects or from an insect, spider or snake bite)

Biochemistry of toxicity

Depending on the biochemistry of toxins, toxicity of a substance can vary. Toxins may act directly or get converted into more toxic substances. For example, while mercuric ion is highly toxic, some compounds of mercury such as calomel are insoluble in bodily fluids and will pass through the human body with little harmful effect.

When a toxic chemical enters an organism such as a human, it becomes one of countless different chemicals moving around the body. Often, the toxic effect occurs when a toxic chemical replaces a chemical normally present as part of the structure of proteins and enzymes, thereby rendering them incapable of performing their normal functions. Cyanide and arsenic both work in this way.

The body has several systems such as the liver, kidneys and lungs, that change chemicals into less toxic forms (detoxify) and eliminate them. If your rate of exposure to a chemical exceeds the rate at which you can eliminate it, some of the chemical will accumulate in your body. For example, if you work with a chemical for eight hours each day, you have the rest of the day (16 hours) to eliminate it from your body before you are exposed again the next day. If your body cannot eliminate all the chemical in 16 hours and you continue to be exposed, the amount in the body will accumulate each day you are exposed. Illness that affects the organs for detoxification and elimination, such as hepatitis (inflammation of the liver), can also decrease their ability to eliminate chemicals from the body.

Accumulation does not continue indefinitely. There is a point where the amount in the body reaches a maximum and remains the same as long as your exposure remains the same. This point will be different for each chemical. Some chemicals such as ammonia and formaldehyde leave the body quickly and do not accumulate at all. Other chemicals are stored in the body for long periods. For instance, lead is stored in the bone, calcium in the liver and kidneys, and polychlorinated biphenyls (PCBs) in fat. There are a few substances, such as asbestos fibres that, once deposited, remain in the body forever.

The human body has its own defense against toxins and there are many mechanisms by which the immune system handles toxins. The major organs of toxin elimination in the human body are the kidneys, lungs and the colon. The liver is a special organ that helps break toxins down into a form that can be eliminated from the kidneys, lung and colon. The lungs and the kidneys are also sites where some toxins are bio-chemically altered into a form that can be eliminated from the body.

The importance of dosage

The concept of dosage, or concentration in the organism, is also important. Even everyday substances such as oxygen would be toxic if taken in excess doses. The risk of poisoning from such substances is very low because of the high dosage needed.

Many substances may be essential for the proper functioning of an organism at low doses but can be dangerous at higher doses. Vitamin A and iodine are two such examples.

Since it is the concentration of the substance that is important, the same dose of a poison may affect a small individual of a species but pass through a larger individual unnoticed.

Although the lethal dose varies between test animal species and animals and humans, the relative toxicity of substances is usually constant. Therefore a highly toxic substance in an animal model is likely to be highly toxic to humans.

The potential for a substance to cause chronic health effects (such as permanent damage to vital organs, cancer or reproductive effects) can be studied in human populations (epidemiology studies), animal test populations, or in some cases specific cell lines. Studies report the dose rate (milligrams of test substance per kilogram of body weight per day) that caused adverse health effects and/or the "no observed effect level" (NOEL) which is that dose at which no adverse health effect was observed. Material that have been identified as causing chronic health effects should be handled in a manner that minimizes exposure.

Detecting toxins

Toxins in a human body can be detected in blood, urine, tissues and other body fluids. Long exposure to the toxins can be identified with the bones, hair and nails.

Local vs. systemic health effects

'Local effect' is an adverse health effect that takes place at the point or area of contact. The site may be skin, mucous membrane, the respiratory tract, gastro-intestinal system, eyes, etc. Absorption need not necessarily occur. Example: strong acid or alkali.

Systemic effect is an adverse health effect that takes place at a location distant from the body's initial point of contact and presupposes absorption has taken place. Examples: arsenic effects to the blood, nervous system, liver, kidneys and skin; benzene effects to the bone marrow.

Substances with systemic effects often have 'specific organ damage' in which they accumulate and exert their toxic effect. Some substances that cause systemic effects are cumulative poisons. These substances tend to build up in the body as a result of numerous chronic exposures. The effects are not seen until a critical body burden is reached. Example: heavy metals such as lead.

When exposure occurs to several substances simultaneously, the resultant systemic toxic effect may be significantly greater in combination than the additive toxic effect of each substance alone. This is called a 'synergistic' or 'potentiating' effect. Example: exposure to alcohol and chlorinated solvents; or smoking and asbestos.

Parasites and intestinal bacteria are major sources of toxins absorbed by the body. To minimize the amount of toxins absorbed from intestinal sources, it is important to do a periodic parasite cleanse. Parasites such as intestinal worms (pinworms, tape worms), amoeba, etc. can invade the body through various sources such as raw, uncooked foods like vegetables and fruits. They can also be introduced from pets and insects. Parasites produce toxins as their waste products, which can then be absorbed into the body. Under normal circumstances, a healthy individual can tolerate the toxins produced by a few parasites. However, if the body's toxin elimination systems are overloaded and the parasites large in number, this extra toxin load can push the individual's health into a downward spiral, culminating in chronic diseases.

Toxins in our environment

The sources of toxins are either natural or man-made chemicals but their effect is the same on the ecosystem. A report by the Columbia University School of Public Health estimates that 95 per cent of cancer is caused by diet and environmental toxicity. The main sources of entry of the poisons are through air, water and food. Food is packed with natural chemicals that are essential to our health, such as vitamins and minerals. But some foods contain potentially harmful substances called natural toxins.

Most natural toxins occur naturally in just a few foods. Other natural toxins are produced when the food is damaged, or when moulds or

What to do if exposed to hazardous chemicals ?

- Remove yourself immediately from the source of exposure
- Remove clothes (wash or destroy)
- Thorough personal wash – shower is best
- Get plenty of fresh air
- Drink at least 2 litres of water daily
- Take Vitamin C
- Drink diluted fruit juice
- Have epsom salt baths to draw out toxins
- Have steam bath (not to exceed 70 °C)
- Take a bath in the immediate aftermath

other fungi grow on the food. Some examples of natural toxins are listed below:

- Enzyme inhibitors:
  - Cholinesterase inhibitors in potatoes, tomatoes and brinjal
  - Protease inhibitors in raw soybeans.
  - Amylase inhibitors in wheat flour.
  - Tannins in tea, coffee and cocoa.
- Cyanogenic glycosides in cassava.
- Goitrogens (glucosinolates) in Brassica species: cabbage, broccoli, Brussels sprouts, etc.
- Lectin proteins (phytohemagglutinins) in red kidney beans.
- Lathyrogens in chick peas.
- Pyrrolizidine alkaloids in crops contaminated with weeds.
- Anti-vitamins: Although not toxic, the anti-vitamins can cause problems as a result of their interference with the function or absorption of essential nutrients
  - Anti-thiamin compounds - in moong beans, rice bran, beets, Brussels sprouts
  - Avidin in raw egg white

The following toxins are among the most prevalent in air, water and / or food:

PCBs (polychlorinated biphenyls): This industrial chemical is a proven carcinogenic and has shown teratogenic effects in animal experiments (supposed to be carcinogenic for humans). Oxidation products of PCB's are more toxic than PCB itself.
Risks: Cancer, impaired foetal brain development

Pesticides: According to the Environmental Protection Agency (EPA), 60 per cent of herbicides, 90 per cent of fungicides and 30 per cent of insecticides are known to be carcinogenic.
Risks: Cancer, Parkinson's disease, miscarriage, nerve damage, birth defects, blocking the absorption of food nutrients
Major sources: Food (fruits, vegetables and commercially raised meats), bug sprays

Mold and other fungal toxins: One in three people has had an allergic reaction to mold. Mycotoxins (fungal toxins) can cause a range of health problems with exposure to only a small amount.
Risks: Cancer, heart disease, asthma, multiple sclerosis, diabetes
Major sources: Contaminated buildings, food like peanuts, wheat, corn, alcoholic beverages and bad indoor air quality (refer ENVIS issue of July 2006).

Phthalates: These chemicals are used to lengthen the life of fragrances and soften plastics.
Risks: Endocrine system damage (phthalates chemically mimic hormones and are particularly dangerous to children)
Major sources: Plastic wrap, plastic bottles, plastic food storage containers. All of these can leach phthalates into our food.

VOCs (Volatile organic compounds): VOCs are a major contributing factor to ozone, an air pollutant. According to the EPA, VOCs tend to be even higher (two to five times) in indoor air than outdoor air, likely because they are present in so many household products.
Risks: Cancer, eye and respiratory tract irritation, headaches, dizziness, visual disorders, and memory impairment

Major sources: Carpet, paints, deodorants, cleaning fluids, varnishes, cosmetics, dry-cleaned clothing, moth repellants, air fresheners.

Dioxins: Chemical compounds formed as a result of combustion processes such as commercial or municipal waste incineration and from burning fuels (like wood, coal or oil). Dioxins build up in living tissue (bioaccumulate) over time, so even small exposures may accumulate to dangerous levels.

Risks: Cancer, reproductive and developmental disorders, chloracne (a severe skin disease with acne-like lesions), skin rashes, skin discoloration, excessive body hair, mild liver damage, damage to the immune systems, diabetes.
Major sources: Animal fats: Over 95 per cent of exposure comes from eating commercial animal fats.

Asbestos roofing common for industrial and other sheds is risk-laden.

Asbestos: This material is widely used for insulating. Problems arise when the material becomes old and crumbly, releasing fibres into the air.
Risks: Cancer, scarring of the lung tissue, mesothelioma (a rare form of cancer)
Major sources: Insulation on floors, ceilings, water pipes and construction industry.

 20 heavy metal toxins can impact human health and each toxin will produce different behavioral physiological and cognitive changes

Heavy metals: Metals like arsenic, mercury, lead, aluminum and cadmium, which are prevalent in many areas of our environment, can accumulate in soft tissues of the body.
Risks: Cancer, neurological disorders, Alzheimer's disease, foggy head, fatigue, nausea and vomiting, decreased production of red and white blood cells, abnormal heart rhythm, damage to blood vessels

Major sources: Drinking water, fish, vaccines, pesticides, preserved wood, antiperspirant, building material, dental amalgams, chlorine plants heavy metals

Chloroform: This colourless liquid has a pleasant, non-irritating odour and a slightly sweet taste, and is used to make other chemicals. It's also formed when chlorine is added to water.
Risks: Cancer, potential reproductive damage, birth defects, dizziness, fatigue, headache, liver and kidney damage.
Major sources: Air, drinking water and food can contain chloroform.

Chlorine: This highly toxic, yellow-green gas is one of the most heavily used chemical agents.
Risks: Sore throat, coughing, eye and skin irritation, rapid breathing, narrowing of the bronchii, wheezing, blue coloring of the skin, accumulation of fluid in the lungs, pain in the lung region, severe eye and skin burns, lung collapse, reactive airways dysfunction syndrome (RADS - a type of asthma)

Major sources: Household cleaners, drinking water (in small amounts), air when living near an industry (such as a paper plant) that uses chlorine in industrial processes.

Recommended steps for protection from toxins:

- Avoid exposure.
- Take quality multiple vitamin with extra antioxidants to decrease the potential of free-radical toxicity.
- Eat organic foods as much as possible.
- Adequate vitamin A enables healthy immune system and tissue protection.
- Beta carotene reduces the carcinogenicity of chemicals. Vitamin C protects cells and tissues against the effects of water-soluble chemicals such as carbon monoxide, metals such as cadmium, and metabolic by-products such as carcinogenic nitrosamines made from nitrites.
- Vitamin E and selenium (200 to 300 mcg) work together to protect cells from pollutants including ozone, nitrogen dioxide, nitrites and metals such as lead, mercury, silver and cadmium.
- Niacin helps detoxify fatty tissues.
- Minerals, especially zinc, help protect cells from toxins. Many detoxifying enzymes require zinc to work. When combined with copper and manganese, zinc also functions in the super-oxide dismutase system, detoxifying the oxygen-free radicals thought to be generated from ozone and smog. Calcium and magnesium also help neutralize some colon toxins and decrease heavy-metal absorption from the gastrointestinal tract.
- A, B vitamin complex formula with sufficient thiamine, pantothenic acid and niacinamide along with lipoic acid helps to protect the liver and mitigate the effects of radiation.
- The sulphur-containing amino acid N-Acetyl-Cysteine (NAC) helps neutralize heavy-metal toxins and toxic by-products of smoking, smog, alcohol and fats. N-Acetyl-Cysteine (NAC) helps produce glutathione, a tripeptide essential to several important enzymes, particularly glutathione peroxidase.
- Methionine, another sulphur-containing amino acid has mild detoxification and protective qualities.
- Insoluble fibres such as wheat bran and soluble fibre such as psyllium reduce metal absorption.
- Sodium alginate from seaweed decreases heavy and radioactive metal absorption.
- Chlorophyll-containing algae such as chlorella and spirulina enable a mild chelating effect.
- Apple pectin binds and clears intestinal metals and chemical toxins.
- Alfalfa , rich in chlorophylls, taken along with vitamin K, reduces tissue damage from radiation exposure.

Issues arising out of deliberate ingestion of poisons

The most common class of poisons ingested deliberately are pesticides. They are easily available and are extremely potent. Organo-phosphorus and carbamides are the two chemicals which are reported in most cases of deliberate intake. According to Dr. P.K Devadass, Professor and Head, Department of Forensic Medicine, Victoria Hospital and Medical College, Bangalore, there is a rise in the number of cases of death attributed to pesticides in the months of March, April, May and June. Up to 30 cases a month have been recorded each month during this period.

Among other classes of chemicals are the addictive drugs like cough syrups

General classification of toxicology:
Descriptive Toxicology - what
Mechanistic Toxicology - why
Analytical Toxicology - how Much

like Corex and Spasmoproxyvan. The use of these drugs among the student community is a factor for concern. Among street children, the addiction to inhaling correction fluids is prevalent. The liquid is poured on to a cloth and inhaled by them. Inhalation of this chemical can even cause death. Cocaine is the other addictive drug, the abuse of which is rampant.

Suggested first aid measures for preventing harm due to deliberate \accidental poison intake include:

1. Prevent / stop further exposure.

2. Removal of poison: This is the first step in this regard. On detection of ingestion, the person should be made to vomit. If conscious, the person can be made to do this by himself. Otherwise, this can be done by inserting the blunt end of a stick into the patient's mouth. The person should be given plenty of salt water and made to vomit.

3. This however will not remove the poison completely. In hospitals, doctors use equipment called gastric lavage or wash. The lavage is a special rubber tube with a funnel, a pump in the middle and a blunt end with perforations. This tube is first inserted into the person's stomach and water poured into it. This water is then extracted by suction. This procedure is done repeatedly until the wash does not have either the smell or color of the poison ingested.

4. Prevention of absorption: The next step is to prevent the absorption of poison as much as possible. One example, is the by the use of activated charcoal, which helps to trap the poison.

5. Use of specific antitoxins / antidotes: For a known poison, an antidote is a substance which neutralizes the effect of poison. They are of the following types:

   a) Mechanical: These form a barrier between the poison and the absorbing part of the stomach. Examples include activated charcoal, bulk food, demulcents like white of egg, milk, starch etc.
   b) Chemical antidotes: These oxidize the poison on contact. For example, salt decomposes silver nitrate, copper sulphate precipitates phosphorous, 4 per cent tannic acid can be used in case of cocaine, silver etc.
   c) Physiological antidotes: These are antidotes which work in an opposite manner to the poison. For example, atrophin in case of organo phosporus poisoning.
   d) Chelating agents: Like Ethylenediaminetetraacetic acid (EDTA) can be used for all metallic poisons.

There are several varieties of poisonous substances and it is difficult to identify quickly which poison has been consumed by the patient. Thus, if the material consumed is brought along with the patient, the task of identifying the poison becomes easy. If the poison is identified, then through the Poison Information Centres (PIC located in New Delhi and Kochi), the antidote and procedure of treatment can be established. The information is provided using the INTOX software. These centres also have laboratories to test for unknown poisons.

Another line of treatment is dialysis and increasing the rate of excretion by using machines. Despite all these treatments, the patient may still die owing to multiple complications.

Frequently asked questions

What are the different forms of toxic materials?

Toxic material can take the form of solids, liquids, gases, vapors, dust, fumes, fibres and mists. How a substance gets into the body and what damage it causes depend on the form or the physical properties of the substance.
A toxic material may take different forms under varying conditions and each form may present a different type of hazard. For example, lead solder in solid form is not hazardous because it is not likely to enter the body. Soldering, however, turns the lead into a liquid, which may spill or come into contact with skin. When the spilled liquid becomes solid again, it may be in the form of small particles (dust) that may be inhaled or ingested and absorbed. If lead is heated to a very high temperature such as when it is welded, fumes may be created consisting of very small particles which are

Natural healing

In order to minimize the ill effects of toxins and to boost natural immunity, fresh fruits and vegetables are the best option. Lets look at some of the vegetables and fruits that one can take to help body cleanse itself:

- Beetroot juice is rich in vitamins and minerals and also helps relieve constipation. It has a laxative effect and helps detoxify the body.
- Watermelon juice is a wonderful kidney cleanser. It promotes diuresis and prevents water retention.
- Similarly cabbage juice can help reduce acidity and is known to possess anti cancer properties.
- Eating celery sticks can help reduce uric acid levels and reduce symptoms of gout.
- Flaxseeds are good for the heart.

extremely hazardous as they are easily inhaled and absorbed. It is thus important to know what form or forms a given substance takes in the workplace.

> One of the earliest known instances of use of toxins is by certain tribes in South America, such as the Noanamá Chocó and Emberá Chocó Indians of western Colombia. They dip the tips of their hunting arrows or blowgun darts in a poison found on the skin of frogs like members of the Dendrobatidae family of frogs. The poison is generally collected by roasting the frogs over a fire. More than 100 toxins have been isolated by scientists from skin secretions of these frogs.

Are some people more affected by toxins than others?

Yes. People vary widely in their sensitivity to the effects of a chemical. Many things determine how an individual will react to a chemical. These include age, sex, inherited traits, diet, pregnancy, state of health and use of medication. Depending on these characteristics, some people will experience the toxic effects of a chemical at a lower (or higher) dose than other people.

People may also become allergic to a chemical. Such people have a different type of response than those who are not allergic. This response frequently occurs at a very low dose. Not all chemicals can cause allergic reactions. Substances that are known to cause allergies are called allergens, or sensitizers.

For example, formaldehyde gas is very irritating. Everyone will experience irritation of the eyes, nose, and throat, with tears in the eyes and a sore throat, at some level of exposure. All people will experience irritation if exposed to high enough levels. A person may be more sensitive to formaldehyde and have irritation at low levels of exposure. Formaldehyde also occasionally causes allergic reactions, such as allergic dermatitis. Some people may show allergic reaction at very low levels of exposure whereas others may not.

Are children more susceptible to the effects of toxins?

Yes! Children are uniquely vulnerable to environmental toxins. This heightened susceptibility stems from several sources. Children have greater exposure to environmental toxins than adults. Per kilogram of body weight, children drink more water, eat more food, and breathe more air than do adults. For example, children aged from one to five years eat three to four times more food per pound than the average adult. The air intake of a resting infant is twice that of an adult per pound of body weight. These patterns of increased consumption reflect the rapid metabolism of children and accidental exposure is common as the children are not aware of the toxicity of the substance.

This is the reason that doses for most pharmaceutical drugs for children are prescribed on the basis of the child's weight. (In addition, children may be more sensitive to some substances because their detoxifying mechanisms are not fully developed).

How can toxic substances harm the body?

When a toxic substance causes damage at the point where it first contacts the body, that damage is called a local effect (example acids). The most common points at which substances first contact the body are the skin, eyes, nose, throat and lungs. Toxic substances can also enter the body and travel in the bloodstream to internal organs. Effects that are produced this way are called systemic. The internal organs most commonly affected are the liver, kidneys, heart, nervous system (including the brain) and reproductive system. A toxic chemical may cause local effects, systemic effects, or both. For example, if ammonia gas is inhaled, it quickly irritates the lining of the respiratory tract (nose, throat and lungs). Almost no ammonia passes from the lungs into the blood. Since damage is caused only at the point of initial contact, ammonia is said to exert a local effect. An epoxy resin is an example of a substance with local effects on the skin. On the other hand, if liquid phenol contacts the skin, it irritates the skin at the point of contact (a local effect) and can also be absorbed through the skin, and may damage the liver and kidneys (systemic effects).

Sometimes, as with phenols, the local effects caused by a chemical provide a warning that exposure is occurring. You are then warned that the chemical may be entering your body and producing systemic effects which you can't yet see or feel.

Do all toxic chemicals cause cancer?

No. Cancer, the uncontrolled growth and spread of abnormal cells in the body, is caused by some chemicals but not all. It is not true that 'everything causes cancer' when taken in large enough doses. In fact, most substances do not cause cancer, no matter how high the dose. Only a relatively small number of the many thousands of chemicals in use today cause cancer. Chemicals that can cause cancer are called carcinogens and the ability to cause cancer is called carcinogenicity. Evidence for carcinogenicity comes from either human or animal studies. There is enough evidence for about 30 chemicals to be called carcinogenic in humans. About 200 other chemicals are known to cause cancer in laboratory animals and are, therefore, likely to be human carcinogens.

Determining the causes of cancer in humans is difficult. There is usually a long latency period (10 to 40 years) between the start of exposure to a carcinogen and the appearance of cancer. Thus, a substance must be used for many years before enough people will be exposed to it long enough for researchers to see a pattern of increased cancer cases. It is often difficult to determine if an increase in cancer in humans is due to exposure to a particular substance, since exposure may have occurred many years before, and people are exposed to many different substances.

How do I know if I have inhaled a chemical?

Watch out for these clues if you want to find out:

Odour: If you smell a chemical, you are inhaling it. However, some chemicals can be smelled at levels well below those that are harmful, so that detecting an odor does not mean that you are inhaling harmful amounts. On the other hand, if you cannot smell a chemical, it may still be present. Some chemicals cannot be smelled even at levels that are harmful. Though this is an indicator, don't depend on it completely as your sense of smell may be better or worse than average, that some very hazardous chemicals have no odor (carbon monoxide), some chemicals of low toxicity have very strong odors (mercaptans added to natural gas), and others produce olfactory fatigue.

Taste: If you inhale or ingest a chemical, it may leave a taste in your mouth. Some chemicals have a particular taste.

Particles in nose or mucous: If you cough up mucous (sputum or phlegm) with particles in it, or blow your nose and see particles on your handkerchief, then you have inhaled some chemical in particle form. Unfortunately, most particles which are inhaled into the lungs are too small to see.

Settled dust or mist: If chemical dust or mist is in the air, it will eventually settle on work surfaces or on your skin, hair and clothing. It is likely that you inhaled some of this chemical while it was in the air.

Are 'toxic' and 'hazardous' the same?

No. The toxicity of a substance is the potential of that substance to cause harm, and is only one factor in determining whether a hazard exists. The hazard of a chemical is the practical likelihood that the chemical will cause harm.

What is 'interaction of chemicals'?

Depending on the nature of exposure , one may be exposed to more than one chemical. If you are, you need to be aware of possible reactions and interactions between them. A reaction occurs when chemicals combine with one another to produce a new substance. The new substance may have properties different from those of the original substances, and it could be more hazardous, less hazardous or same.

An interaction occurs when exposure to more than one substance results in a health effect different from the effects of either one alone. One kind of interaction is called synergism, a process in which two or more chemicals produce an effect that is greater than the sum of their individual effects. For instance, carbon tetrachloride and ethanol (drinking alcohol) are both toxic to the liver. If you are overexposed to carbon tetrachloride and drink alcohol excessively, the damage to your liver may be much greater than the effects of the two chemicals added together. Another interaction is potentiation, which occurs when an effect of one substance is increased by exposure to a second substance which would not cause that effect by itself. For example, although acetone does not damage the liver by itself, it can increase carbon tetrachloride's ability to damage the liver.

Unfortunately, very few chemicals have been tested to determine if interactions with other chemicals occur.

Technical inputs:
Dr. P.K. Devadass, Professor and Head, Department of Forensic Medicine, Victoria Hospital and Medical College, Bangalore.

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