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Introduction

Cancer is a disorder of cells in the body. It begins with a group of cells that fail to respond to the normal control mechanism and continue to divide without need. The new growths are called tumours or neoplasia and may be either "benign" or "malignant". A "benign" tumour is one that remains localised whereas "malignant" tumours invade neighbouring tissues, enter blood vessels, lymphatic vessels and other spaces and can be carried to other areas of the body to form new tumours called "secondaries" or "metastases".

Cancer carries with it a high risk of premature death.

Cancer may arise from various causes, one of which is the adverse effects of certain substances on the cells of the body either directly or via their metabolites. Linking eventual cancers to chemical exposure is very difficult because of e.g. long delays between exposure and effect, the historical lack of recording of exposure and the variability of life style of victims. However, it has been estimated that between 2% and 6% of cancer deaths are due to occupational exposure and there exists evidence to firmly incriminate a number of chemical species with others under more or less strong suspicion. Several organisations and bodies provide lists of known or "suspect" **carcinogens**, classified into different categories according to the level of proof and some of these categories are described [here](#).

COSHH

Under the UK Control of Substances Hazardous to Health (COSHH) Regulations, a **carcinogen** is defined as:

- Any substance or preparation which if classified under the CHIP Regulations, would be required to be labelled with the Risk Phrases R45 "may cause cancer" or R49 "may cause cancer by inhalation".

CHIP itself divided carcinogens into three categories:

Category 1 - substances known to be carcinogenic to humans. There is sufficient evidence to establish a causal association between human exposure to the substance and the development of cancer.

Category 2 - substances that should be regarded as if they are carcinogenic to humans, for which there is sufficient evidence, based on long-term animal studies and other relevant information, to provide a strong presumption that human exposure may result in the development of cancer.

Category 3 - substances that cause concern owing to possible carcinogenic effects but for which available information is not adequate to make satisfactory assessments.

Categories 1 and 2, if purchased from a supplier will carry the "toxic" (T) symbol and the Risk Phrase R45 (May cause cancer) or R49 (May cause cancer by inhalation).

Category 3, if purchased from a supplier carries the "harmful" (Xn) symbol and the Risk Phrase R40 (Limited evidence of carcinogenic effect)

Mutagens and Substances Toxic to Reproduction similarly are classified in Categories 1 to 3.

- Category 1 and 2 **mutagens** carry the Risk Phrase R46 "**May cause heritable genetic damage**" and **substances toxic to reproduction** carry the Phrase R60 "**May impair fertility**" or R61 "**May cause harm to the unborn child**".
- Category 3 **mutagens** have the Risk Phrase "**Possible risk of irreversible effects**" and Category 3 **substances toxic to reproduction** are classified by R62 "**Possible risk of impaired fertility**" or R63 "**Possible risk of harm to the unborn child**".

Some lists may be found [here](#).

Notes

- **Mutagens** are substances that cause heritable genetic changes (mutations). Most mutations are harmful and most mutagens are carcinogens and vice versa.
- Substances that are known to impair fertility or to cause developmental toxicity in humans are defined as **toxic to reproduction**. This definition covers a broader range of health effects than the earlier "**teratogenic**" which applied only to substances that adversely affected the developing foetus.
- For some carcinogens there is no threshold level of exposure i.e. no level below which the majority of the population can be exposed with no risk to health and it is wise to assume that this is the case for **all** carcinogens, mutagens or substances toxic to reproduction until there is evidence to the contrary.
- Whilst a single exposure to a carcinogen is unlikely to be problematical, carcinogens are most dangerous through repeated exposure even at very low levels.
- Unforeseen but potent synergies may arise between two or more carcinogens greatly increasing the danger to e.g. tobacco smokers.
- Because of the danger to fertility, women of child-bearing age are especially advised to avoid working with substances which are carcinogens, mutagens or substances toxic to reproduction.
- It should be noted that the group of carcinogens, Category 3, contains a number of substances in common use e.g. chloroform and dichloromethane.