

A large industrial facility with multiple smokestacks emitting thick white smoke into a hazy, grey sky. In the foreground, a person wearing a full-body white hazmat suit and a hood stands with their back to the camera, looking towards the facility. The ground is wet and reflects the scene.

HOW DANGEROUS IS EXPOSURE TO TOXIC CHEMICALS?

Why are toxic chemicals more problematic than most workplace hazards?

The problem with toxic (as opposed to corrosive) chemicals is that dermal contact may have no immediate effects, so contamination might go unnoticed. The health consequences may not emerge for years... even decades, yet can be catastrophic for the worker involved and their families. Cancers, damage to organs, adverse effects on fertility, are common results.

And whilst understanding of the health consequences of many chemicals is at best limited and at worst unknown, where it is understood, it is clear that they can be toxic in very small quantities, especially with regular repeat of low-level contamination. Identifying direct causal relationships is difficult, but many chemicals can dramatically increase the probability of developing serious illnesses.

So, protection against toxic chemicals is more problematic than most hazards, and the commonly referenced "normalised breakthrough time" is inadequate to indicate that a suit is safe to wear.

How much do we know about chemical toxicity?

[The Directory of Chemical Producers](#) suggests there are over 21,000 different chemical products manufactured in over 20,000 chemical sites in more than 90 countries.

Many are toxic, but in many cases the toxicity is simply unknown. Even where some knowledge exists it may be uncertain; safety data sheets often state "may cause cancer" or "may damage the unborn child",

suggesting that whilst suspected there simply is not the data to confirm it one way or another. Since effects can take decades to emerge, empirical or statistical testing to prove a link, is problematic to say the least.

But with more than 20,000 chemicals in production somewhere in the world, the real question is, "how many of those have long term adverse health effects that are simply unknown?"

What are the statistics for deaths, injuries or illnesses caused by exposure to workplace chemicals?

The problem with establishing statistics lies in the chronic nature of the hazard. Assessing workplace burns is easy, as most accidents are registered at the time they occur. But if a worker is unknowingly contaminated, then develops cancer during retirement twenty years later, would the link even be recognised – especially if the toxicity of the chemical remains unknown?

So, there is a great deal of uncertainty about related statistics, if anything they are likely to be under-stated. But below are just some of the more reputable ones available:

The WHO's Data Addendum for the 2019 report on the public health impact of chemicals (knowns and unknowns) includes the following data:

- "More than 160 million chemicals are known to humans. About 40 000 to 60 000 of them can be found in commerce; 6000 of these account for more than 99% of the total volume of chemicals in commerce globally. In 2017, the chemical industry was the second largest manufacturing industry in the world and the trend is going upwards - chemicals sales are projected to almost double from 2017 to 2030".
- "unintentional occupational poisonings" involving chemicals resulted in 8,608 deaths and 407,082 DALYs (Disability Life Adjusted Years*)
- A range of occupational carcinogens including benzene, formaldehyde, sulphuric acid and trichloroethylene caused over 350,000 cancers and almost 7,700,00 Disability Adjusted Life Years (DALYs)
- Occupations particulates (dusts, fumes, gases) resulted in over 524,000 deaths and almost 12,000,000 DALYs.

The International Labour Organisation, a division of the UN, in 2021 produced a global review of hazardous chemical exposure in the workplace, suggesting that:

"Workers around the world are facing a global health crisis due to occupational exposure to toxic chemicals".

And that:

"Cancer is the main cause of work-related death, and more than 200 different substances have been identified as known or probable human carcinogens, with many of these exposures occurring in the workplace"

The US Occupational Safety & Health Administration (OSHA) estimate that:

"...workers suffer more than 190,000 illnesses and 50,000 deaths annually related to chemical exposures" in the USA alone.

They point out that of thousands of chemical hazards found in workplaces,

"While many of these chemicals are suspected of being harmful, only a small number are regulated in the workplace"

The World Health Organisation (WHO) estimate that:

"Globally, 2 million lives and 53 million disability-adjusted life years (DALYs) were lost in 2019 exposure to selected chemicals",

though this figure does not exclusively relate to exposure to chemicals in workplaces.

Note: A DALY or "Disability Adjusted Life Year" is defined as: "One DALY represents the loss of the equivalent of one year of full health".

What are the costs?

Leaving aside the human cost to the victims and their families, there is a huge financial cost both to the businesses involved, in the form of investigations, pay compensations and major legal costs, and to society as a result of the costs of medical treatment and care, not to mention the indirect opportunity costs related to how those resources could otherwise have addressed other issues.

The long-term consequences of toxic chemical contamination of workers are far from insignificant. And yet, the costs, both human and financial, are entirely preventable with a more effective program to select and manage chemical protective PPE