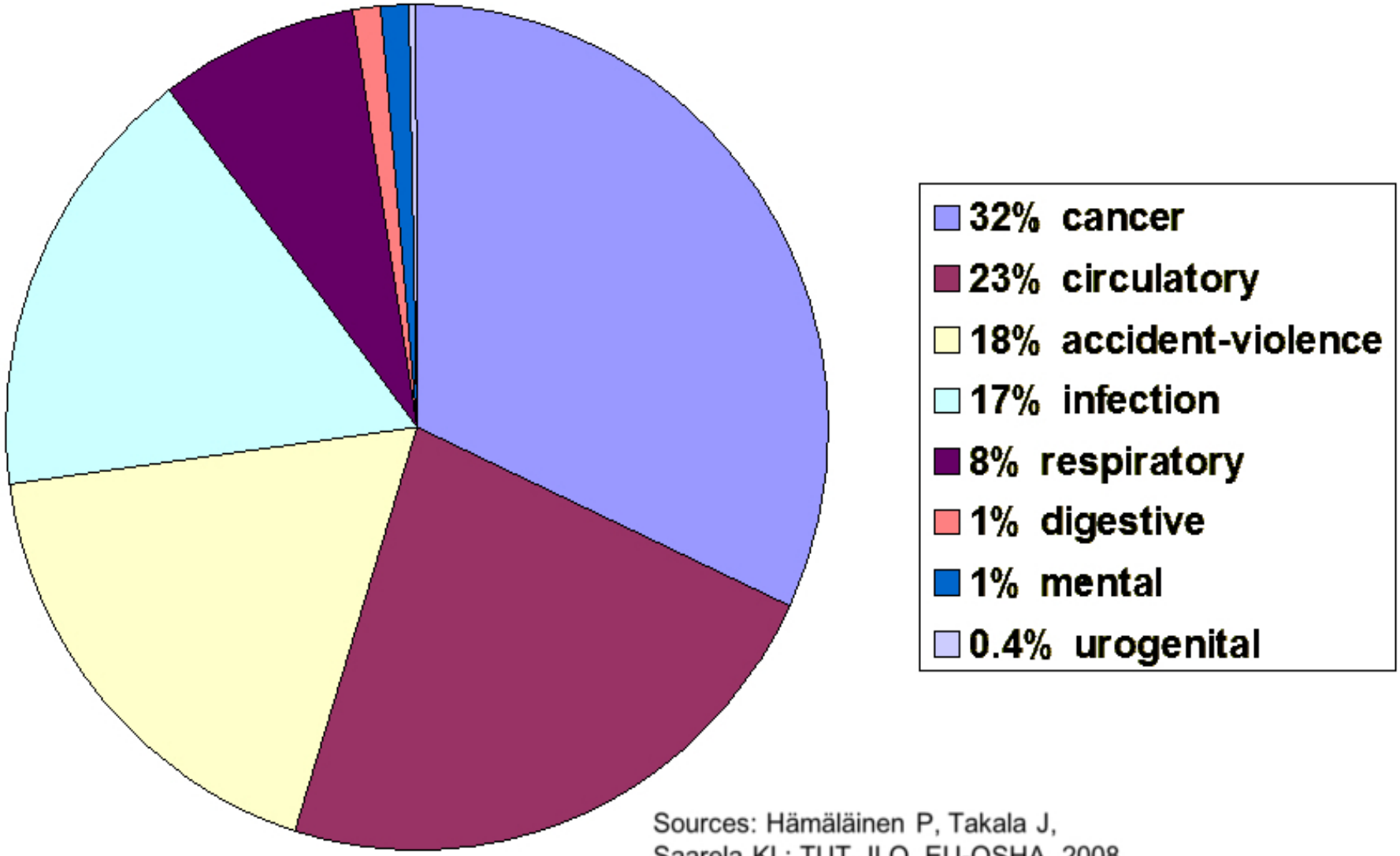
IndustriALL Global Union

Identifying Workplace Carcinogens

World Occupational Deaths: 2.3 million per year



Sources: Hämäläinen P, Takala J, Saarela KL; TUT, ILO, EU-OSHA, 2008

Work-related diseases worldwide, estimated: 198–242 million work-related illnesses

Cancer alone:

region	total cancer deaths		occupation related		occupational cancer deaths		
	men	women	men	women	men	women	total
EU 27	623,709	481,307	13.6%	2.1%	85,106	10,177	95,581
world	3,872,766	3,062,008	9.6%				665,738

Source: presentation by Takala J, ILO, 2008

Underestimates

These statistics, shocking as they are, are gross underestimates:

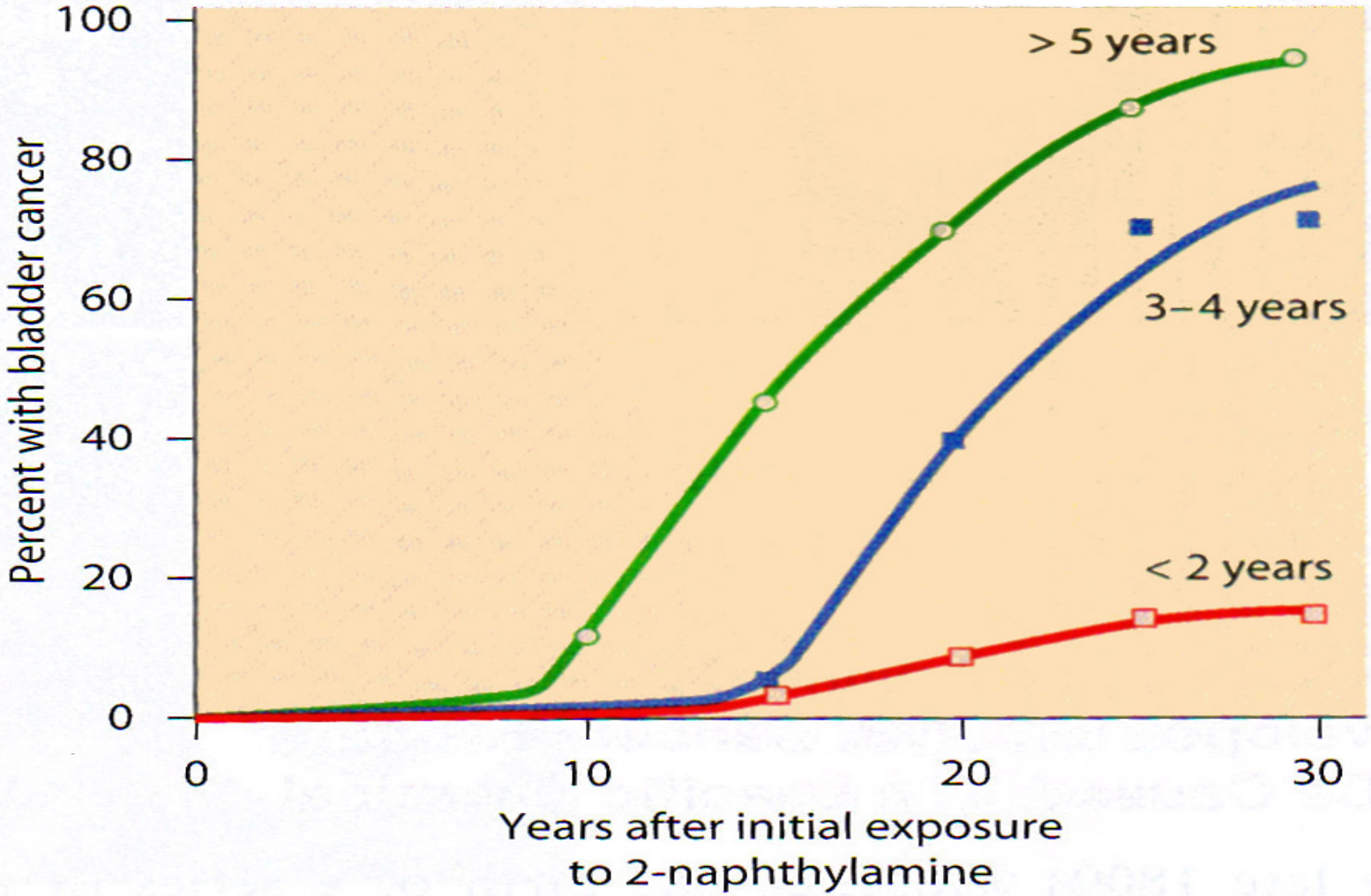
- record only nationally accepted statistics, usually from workers' compensation
- occupational diseases under-diagnosed
- widespread suppression of accident reporting, or outright concealment

Chemicals and Toxicology

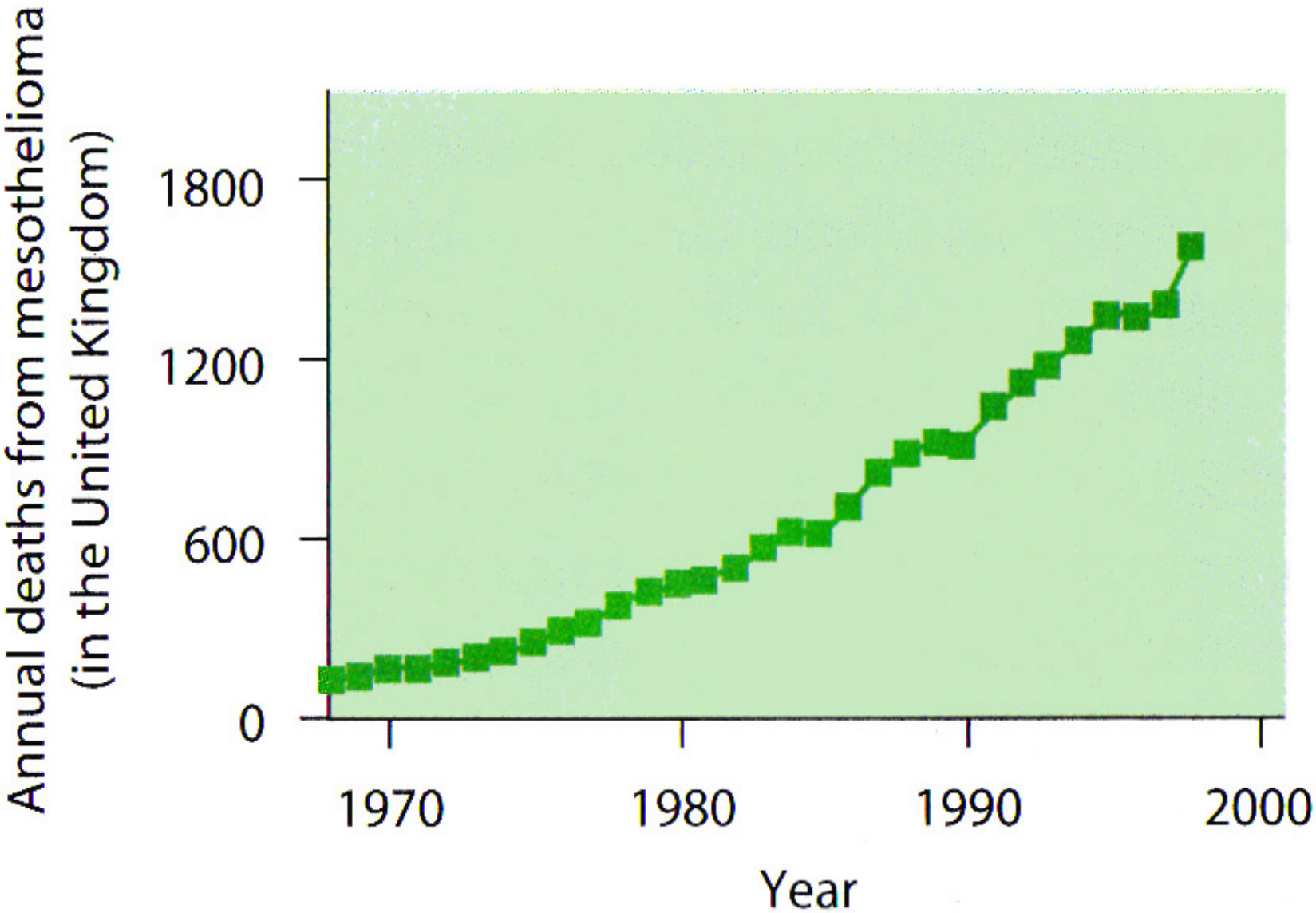
- Few of the hundreds of thousands of chemicals in use have been adequately characterized for their human health effects – even fewer for their environmental effects.
- REACH intended to partially address this.
- Increasing interest in immunotoxicology; neurotoxicology; endocrine disruptors; nanomaterials; carcinogens; etc.

Cancer and Carcinogens

- The rate at which we identify and classify carcinogens is simply inadequate.
- Three principle ways of identifying: cell cultures; animal studies; epidemiology.



Example: *beta*-naphthylamine



Example: asbestos - mesothelioma

Table 5-1 Some Human Carcinogens for Which Exposure is Mainly Occupational

Carcinogen	Industry	Type of Cancer
4-Aminobiphenyl	Rubber	Bladder
Arsenic	Glass, metals, pesticides	Lung, skin
Asbestos	Insulation, construction	Lung, pleura
Benzene	Solvent, fuel	Leukemia
Benzidine	Dye	Bladder
Bis(chloromethyl) ether*	Chemical	Lung
Chloromethyl methyl ether*	Chemical	Lung
Cadmium	Pigment, battery	Lung
Chromium	Metal plating, dye	Nasal cavity, lung
Coal-tar pitches	Construction, electrodes	Skin, lung, bladder
Coal-tars	Fuel	Skin, lung
Ethylene oxide	Chemical, sterilant	Leukemia
Mineral oils	Lubricant	Skin
Mustard gas*	Chemical weapon	Pharynx, lung
2-Naphthylamine*	Dye	Bladder
Silica	Construction, mining	Lung
Soots	Dye	Skin, lung
Sulfuric acid mist	Chemical	Larynx, lung
Talc	Paper, paint	Lung
Vinyl chloride	Plastic	Liver

*Mainly of historical interest.

Mechanisms of Chemical Carcinogenesis

Categories of Human Carcinogens

- Main classes of carcinogenic chemicals
  - Polycyclic aromatic hydrocarbons
  - Aromatic amines
  - N-nitroso compounds
  - Alkylating agents
  - Natural products
- Inorganic substances

Polycyclic aromatic hydrocarbons

- Natural components of coal tars, soots, and oils
- Producing also from incomplete combustion of coal, oil, tobacco, meat, and organic material (during burned)
- From weak to potent carcinogens

Aromatic amines

- Often dyestuffs
- benzidine; 2-naphthylamine; 2-acetylaminofluorence; 4-aminobiphenyl
- aminoazo dyes: 4-dimethylaminoazobenzene; o-aminoazotoluene
- 2-naphthylamine and 4-aminobiphenyl are also compounds of tobacco smoke

Alkylating agents

- Defined by chemical reactivity (ability to join an alkyl group another molecule)
- e.g. n-nitroso compounds; vinyl chloride, ethylene oxide, sulfur mustard

Natural products

- Producing mainly from microorganisms and plants:
  - Aflatoxin
  - Safrole
  - Pyrrolizidine alkaloids

Inorganic substances

- May be carcinogenic due to chemical or structural properties, or particle size, or a combination
- Metals: nickel, cadmium, chromium
- Asbestos
- Silica

Carcinogenesis: a Multistep Process

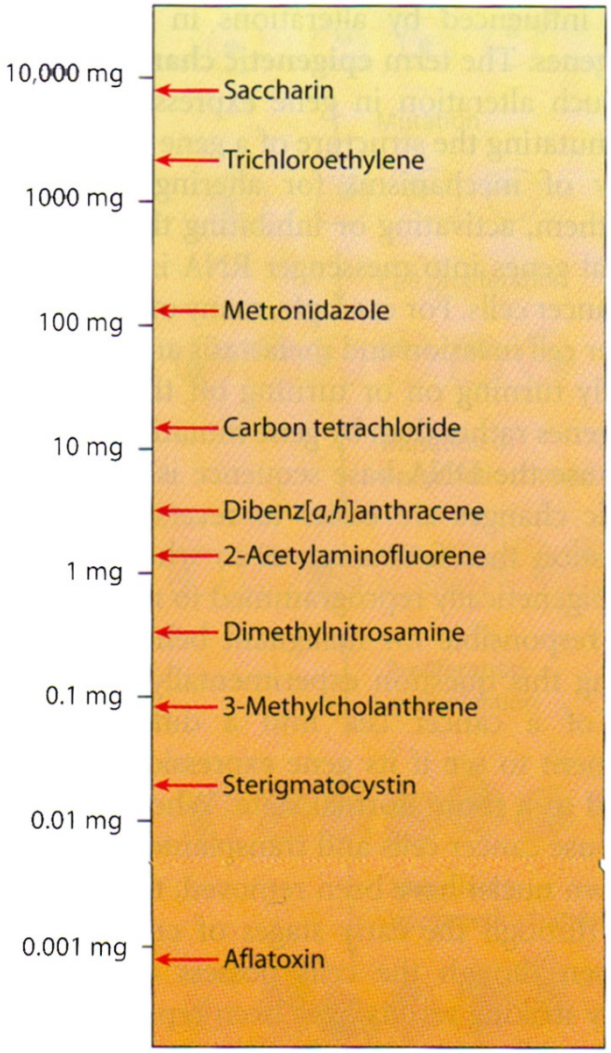
- Initiation (change to DNA: many chemical carcinogens react directly with DNA)
- Promotion (activation/expression of DNA)

Progression Towards Cancer

An eventual tumour or cancer results from repeated cycles of rapid growth and favourable opportunities

Should distinguish between a cancer initiator (usually genotoxic) and a cancer promotor (anything that creates a favourable circumstance for a cancer gene to be expressed and cancer cells to proliferate).

Potency of Some Chemical Carcinogens



An "initiated" cell has the potential to become a cancer due to changes in the cell's genetic information. It and its daughters through cell division can remain in the initiated stage for a lifetime, or it may self-repair, die, spontaneously promote, or be "promoted" by another agent to active cancer.

The cell may then among other changes, begin to divide and grow aggressively while losing at least some of the characteristics that identify it as being from a particular organ or type of tissue. This results in a cancer or a tumour. There is a strong element of chance involved in all of these steps.

These steps and changes and the chances of any of them occurring at a particular time explain why there is usually a "latency period" between the time of exposure to a carcinogen and the appearance of cancer. It also explains why it is impossible to predict exactly how long the latency period for a particular person will be, although we can talk about average latency periods for types of cancer and groups of people.

WCBs have treated latency as a fixed constant - when it is a statistical effect!

Many carcinogens target particular organs or cause certain types of cancer more frequently than others, but can often cause cancers at different sites in the body as well. Therefore more than one agent may cause similar cancers, or the same agent may cause different cancers in different people.

For these and other reasons, an observed association between exposure and cancer is not proof of the cancer having been caused by the exposure.

The basic steps involved are:

(1) gathering information;

(2) analyzing the information;

(3) reaching a conclusion

EXPOSURES - A complete list of the chemical, biological and physical agents in use in your workplace will be needed. Obtain a list of known carcinogens for the types of cancer you are investigating, and ask the workers about potential exposure to any of them. Ask them if they are suspicious of any other substances they have worked with that are not already recognized as carcinogens.

Body Mapping and **Workplace Mapping** techniques can be helpful.

Occupational diseases and deaths

You need to know if present and former workers are dying or getting ill at an abnormal rate. You need to connect, if possible, deaths and illnesses to past work activities and exposures. How many deaths and suspicious illnesses have occurred in active and retired workers in the past five years? Don't overlook those that had a possible occupational disease but died of another cause, like a car accident.

ANALYZING THE INFORMATION

Once you have gathered a lot of information, you have to figure out what it means. The data on workers usually must be compared to similar data for an appropriate "control" group. It is not always obvious how this should be interpreted. Avoid jumping to conclusions, even if you think you see a trend. Ask for help.

PITFALLS

Beware of incomplete data. If people know you are looking for cancer, they will remember cancer cases and tell you about them. They may not mention deaths from other causes like heart disease. If this happens, the percentage of deaths due to cancer may be made to appear artificially high.

Beware of non-occupational risks. It has been an unfair tactic to trivialize occupational causes of cancer by blaming "lifestyle" choices such as smoking and eating, but we cannot deny that these have a large impact and we have to at least anticipate the argument.

For example, if the plant group has a high level of lung cancer, try to decide whether smoking rates are higher among your workers than in the community at large.

Beware of "healthy worker syndrome"

People who work for a living tend to be healthier than those who do not. The working population excludes those too old, ill, frail, young, disabled etc. to work. There are also demonstrated psychological, social and physiological benefits to work.

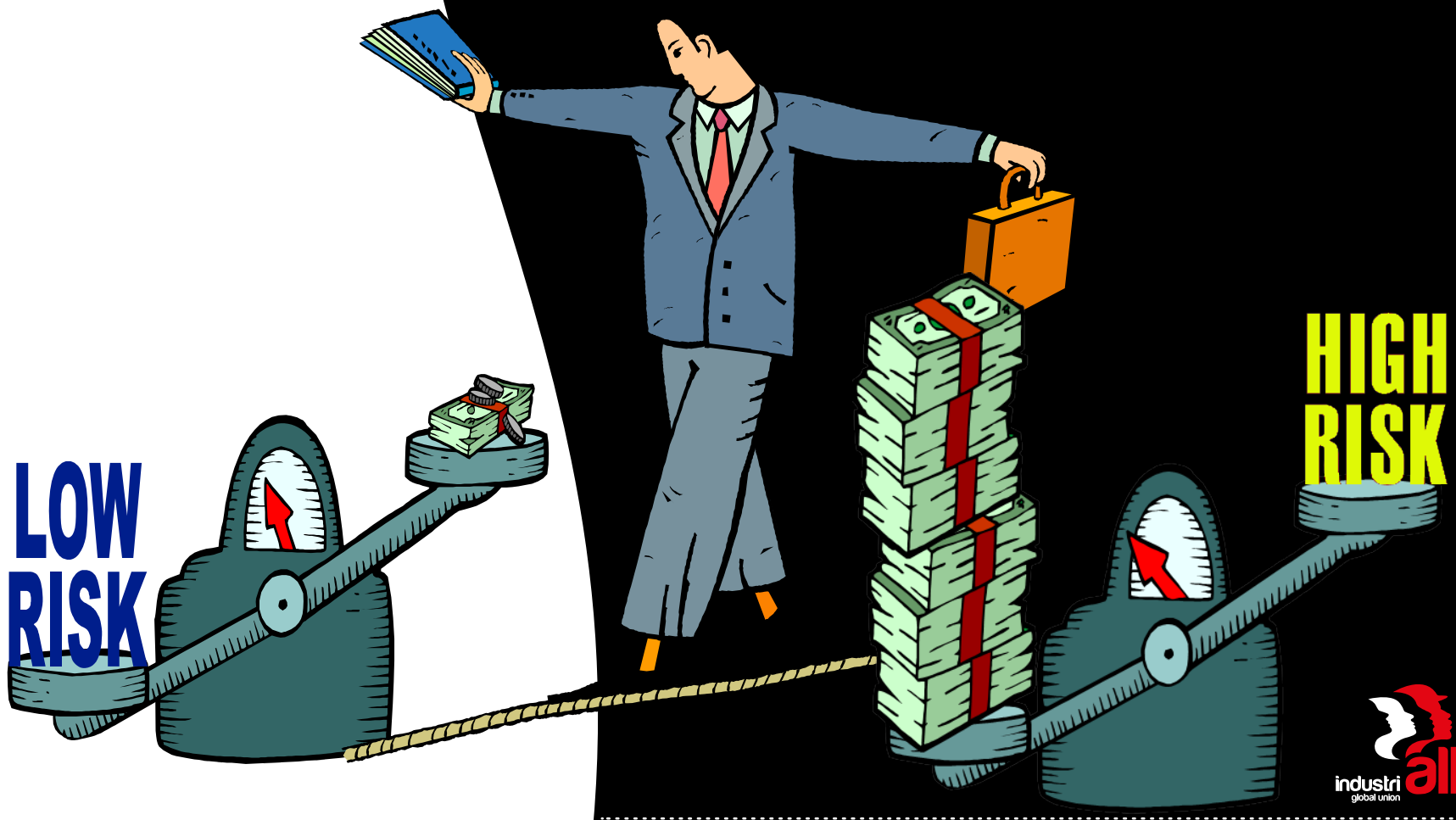
Healthy worker syndrome is the reason why some studies have shown that e.g. oil refinery and chemical plant workers have a lower death rate due to cancer (and other causes) than the general population. Refineries and chemical plants have many carcinogens and toxins, but the workers are an exceptionally healthy group to begin with. It is important to only compare their health with a comparable, employed group.

Watch for latency periods. Many cancers only develop years after initial exposure to the carcinogen. This latency period may be ten years to forty years. Because of latency, it is important to get as much data as possible on former workers such as retirees.

REACHING A CONCLUSION

You may need to do further work. In some cases, a few deaths or illnesses might be selected for more detailed job history analysis. In other cases, the "control" group selected for statistical comparison might turn out to be unsuitable for various reasons and a different comparison will have to be made. Remember, even if you do detect an association, it is only a first step. It may not be taken as proof that cancer is being caused in your workplace.

Problem: management culture historically rewards risk-taking!



Risk Assessment / Acceptable Risk?

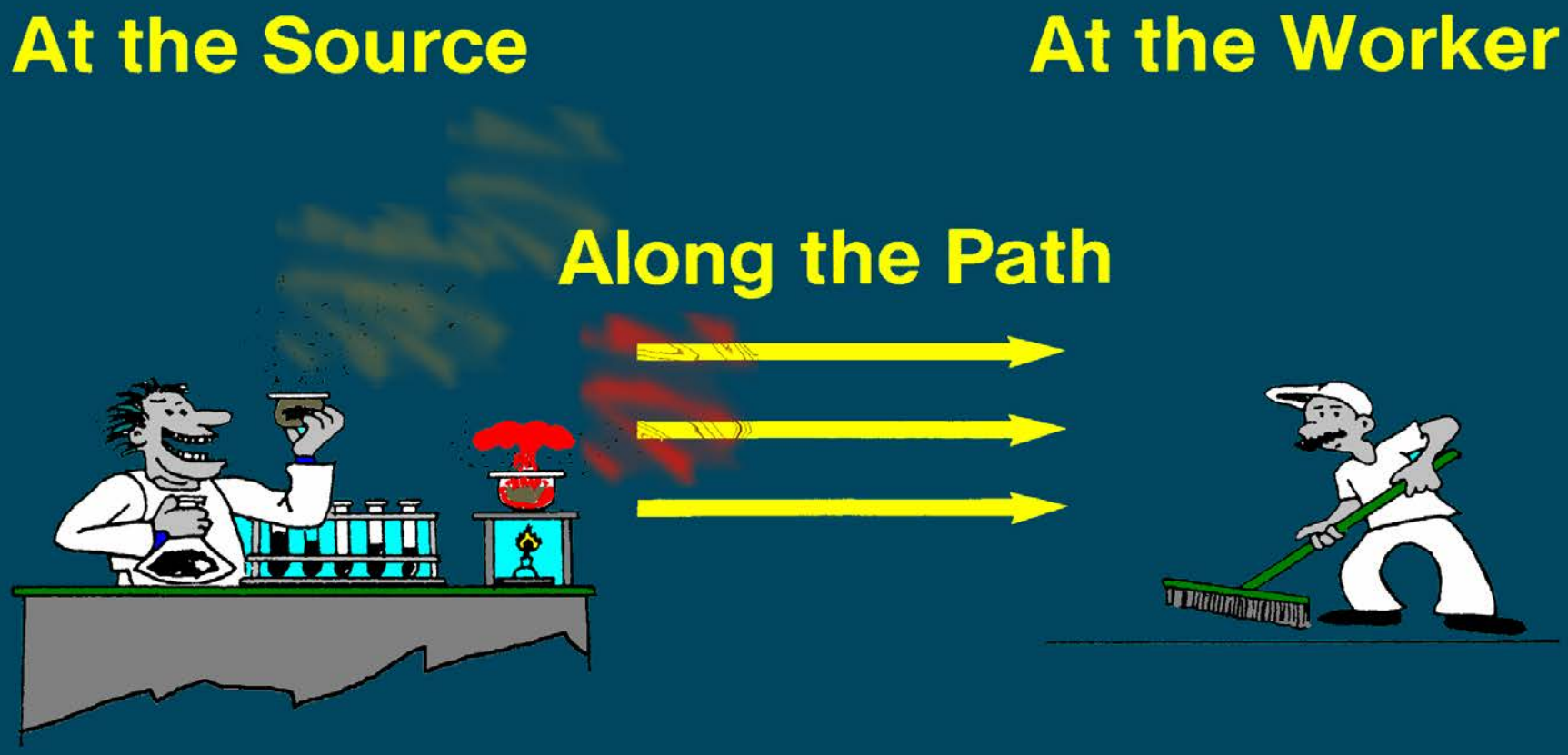
- **Acceptable: low likelihood and low consequence**
- **Intolerable: high likelihood and high consequence - risk cannot be justified**
- **ALARA: tolerable depending on perspective, resources, cost benefit, and recipient**
- **MORAL AUTHORITY: only those who must ultimately face the risk, have the moral authority to assess it !**
- **We demand that “risk assessment” be done WITH us, not TO us !**

Risk Assessment and Management

- **Legitimate Use: To identify potential problems, prioritize them, decide the best control actions, and assign resources.**

- **NOT Legitimate Use: To justify decisions already made, or create a false impression of certainty where none really exists.**

- **Can only be used where reasonably good data exists. In the absence of good data, a precautionary approach is preferred.**



Industrial Hygiene Approach

Thank you!

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