Preventing Occupational Cancer

Norwich & District Safety Group

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Andy Gillies
Gillies Associates Limited

Summary of Presentation

♦ What is cancer?
♦ Causes of cancer:
  • Environmental
  • Occupational
  • Genetic
♦ Legal requirements when working with chemical carcinogens
♦ Can (occupational) cancer be prevented?
♦ Specific examples
♦ Useful sources of information
A brief introduction to BOHS

- A multidisciplinary, learned and professional society established since 1953
- The voice of the occupational hygiene community in the UK
- An unrivalled source of information and expertise for members and non-members alike
- An examining board, through the Faculty of Occupational Hygiene, awarding qualifications in occupational hygiene and allied subjects
- For anyone with an interest in occupational hygiene, or a need for our services
The BOHS

The Society’s aim is simple:

To help to reduce work-related ill-health

The result is dramatic:

A healthy worker in a healthy working environment

www.bohs.org
BOHS in East Anglia

- Organises meetings, network events
- Previous meetings have covered COSHH, Noise at Work, REACH, LEV, Asbestos...
- Links with local H&S groups (e.g. N&DSG, IOSH, FISHnet, OHPAG)
- Small steering team
- Regional Organiser – Andy Marshall (Bayer Crop Science, Norwich)
What is cancer?

♦ **Cancer** – a range of diseases all involving **unregulated cell growth** to form malignant tumours

♦ Cancer cells...
  - grow very fast
  - can spread into and destroy neighbouring tissues
  - and if not treated they can spread through the blood or lymph systems to other parts of the body (“metastasis”)

♦ Over 200 different types of cancer in humans

"Taken from CancerHelp UK, the patient information website of Cancer Research UK: http://cancerhelp.cancerresearchuk.org".
Symptoms and Effects

- Symptoms generally non-specific in early stages
- Most cancers carry a high risk of premature death
- Commonly a long delay ("latent period") between first exposure and occurrence of cancer
- Often very painful; treatment can produce tough side-effects
- A feared disease – causes great emotional & spiritual distress

"Taken from CancerHelp UK, the patient information website of Cancer Research UK: http://cancerhelp.cancerresearchuk.org"
Main types of cancer

GLOBOCAN 2008
UK DATA

- IARC/WHO data for estimated age-standardised incidence rates for UK (both sexes)
- Lung (22.2%), Bowel (10.3%), Breast - women (7.8%), and Prostate - men (6.5%) accounted for nearly half of all 2008 cancer deaths in the UK.
The causes of cancer

♦ ENVIRONMENT – the majority of cancers are due to lifestyle and environmental factors

♦ OCCUPATION – exposure to carcinogens in the workplace accounts for 5.3% of all cancers in the UK in 2005 (8% men, 1.5% women) *

♦ GENETIC – most cancers are non-hereditary, but 5-10% are caused by an inherited genetic defect (e.g. breast cancer)

CARCINOGENS

IARC review of carcinogens (2010) identified more than 400 substances/mixtures/exposure circumstances that may be carcinogenic to man, and many of them are found in the workplace:

- 107 Group 1 (proven human carcinogens)
- 58 Group 2A (probable human carcinogens)
- 249 Group 2B (possible human carcinogens)

First recorded case of cancer caused by work was by Percival Pott in 1775 – scrotal cancer in chimney sweeps

“It is a disease which always makes its first attack on, and its first appearance in, the inferior part of the scrotum”
Genotoxic carcinogens

- *Genotoxic carcinogens* induce tumour incidence, increase malignancy, or shorten latency through mutagenic action (effect on gene structure); it is assumed that genotoxicity is a key event in the development of the tumour.

- Often cannot identify a biological threshold of effect (“one fibre can kill”)

"Taken from CancerHelp UK, the patient information website of Cancer Research UK: [http://cancerhelp.cancerresearchuk.org](http://cancerhelp.cancerresearchuk.org)"
Cancer risk factors

- No single cause for any one cancer – many risk factors

% cancer cases in the UK in 2010

- Tobacco
- Diet
- Overweight & obesity
- Alcohol
- Radiation - UV
- Occupation
- Radiation - ionising
- Infections
- Physical exercise
- Reproduction (breast feeding)
- Post-menopausal hormones

Classification of carcinogens under CLP

- **Cat. 1A** - known or presumed human carcinogens (largely based on human evidence)
- **Cat. 1B** - known or presumed human carcinogens (largely based on animal evidence)
- **Cat. 2** - suspected human carcinogens

<table>
<thead>
<tr>
<th>CLP pictogram</th>
<th>Signal word</th>
<th>Hazard class + category</th>
<th>Hazard statement</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Pictogram" /></td>
<td><strong>DANGER</strong></td>
<td>Carcinogenicity Category 1A</td>
<td>H350: May cause cancer (route of exposure, if applicable)</td>
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<tr>
<td><img src="image" alt="Pictogram" /></td>
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<td>Carcinogenicity Category 1B</td>
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<td><img src="image" alt="Pictogram" /></td>
<td><strong>WARNING</strong></td>
<td>Carcinogenicity Category 2</td>
<td>H351: Suspected of causing cancer (route of exposure if applicable)</td>
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</tbody>
</table>

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BE CAREFUL: DSD/DPD and CLP use “Category 2” to mean different things!!
HSE cancer statistics

~8000 occupational cancer deaths/year in UK
(compared with ~3000 RTA fatalities, and 171 deaths from accidents at work)
- ~50% due to Asbestos (mesothelioma [2321 cases] + lung cancer)
- Other significant causes include crystalline silica, mineral oils, diesel engine exhausts (DEEs), shift work, solar radiation

Current deaths reflect historic exposures. Estimates of future cancer burden are needed to set priorities for action today to reduce exposure.

(Source: HSE Statistics 2010/11)
COSH and Carcinogens (Appendix 1)

- Precautionary policy of prevention and control of exposure
- Control **ALARP**:
  - Engineering containment (full enclosure)
  - Plant, processes and systems of work designed to minimise exposure (partial enclosures, LEV)
- Prevent spread of contamination
- Store and label clearly
- PPE as secondary protection
- Exposure monitoring is normally necessary
- Health surveillance is usually appropriate
- Information, instruction & training is essential
ALARP – reduce exposure as Low as is Reasonably Practicable.

Control exposure to sufficiently low level so that although there may still be a cancer risk, that risk is acceptably low.

Implies a very high level of containment.

Feasible for large companies, but impractical for some processes and too costly for SME’s.
Carcinogens (class 1 and 2) are defined as “Substances of Very High Concern” (SVHC) under REACH, and are subject to Authorisation.

The aim of Authorisation is to ensure that risks are properly controlled, and that these substances are progressively replaced by suitable alternative substances or technologies where these are economically and technically viable.

- Invest in research to identify suitable alternatives
- Develop a substitution plan
- Continuing duty to improve controls
Can occupational cancer be prevented?

♦ Is it possible?

No, but…

…it is realistic to aim at reducing exposure to chemical carcinogens at work to such low levels that the risk of developing cancer would become negligible.

“BOHS believes that with appropriate focused efforts almost all occupational cancers could ultimately be prevented”

(Press Release, 7/12/2011)
Control strategy options

- **Prohibition** – complete ban on import and use
- **Substitution** – use less hazardous alternative
- **Re-design process** – control at source
- **Engineering containment** – physical enclosure
- **Minimise quantity** – use less of the substance
- **Minimise no. exposed** – restrict access
- **LEV** – local extraction
- **PPE** – only in conjunction with other measures
Examples of risk reduction measures

ASBESTOS

♦ Fibrous silicate dust
♦ Causes mesothelioma and lung cancer (also other sites)
♦ Biggest cause of work-related deaths in UK

♦ Import and new use banned since 1999 (1985 for blue/brown)
♦ Legacy of wide use in buildings (industrial, commercial, domestic)
♦ Major HSE campaign (“Hidden Killer”) aimed particularly at tradesmen - plumbers, electricians, joiners, etc.
Examples of risk reduction measures

**VINYL CHLORIDE MONOMER (VCM)**

- Flammable gas used as building block in PVC manufacture
- Causes angiosarcoma - rare cancer of the liver
- Process re-design - Closed loop polymerisation
- TLV reduced from >100ppm TWA to (now) 3ppm TWA
Examples of risk reduction measures

ENVIRONMENTAL TOBACCO SMOKE

♦ Passive smoking causes lung cancer
♦ ETS at work estimated to cause lung cancer in 284 non-smokers in UK in 2004
♦ Smoking ban introduced in public places in England & Wales in 2008
Current top 10 occupational carcinogens in UK

- Asbestos
- Shift work (including flight personnel)
  - Mineral oils
  - Solar radiation
  - Silica
- Diesel Engine Exhaust
- PAHs from coal tars and pitches
  - Painters
- TCDD (dioxins)
- Environmental tobacco smoke (non-smokers)

Based on no. of cancer registrations in 2004

Priorities for future cancer risk reduction

- Long latency intervals of many carcinogens means that current cancer cases are based on past exposures, which were generally much higher than today’s.

- **Risk reduction strategies should focus on the projected future burden from current and future exposures to carcinogens at work.**

- “Attributable Fraction” is the proportion of cases that would not have occurred in the absence of an occupational exposure. To establish AF you need to know (1) risk of disease developing at a particular exposure, (2) an estimate of the exposure, and (3) the proportion of the target population who were exposed.

- Hutchings and Rushton have proposed a method to estimate AF for future cancer risk given past and projected exposure trends.
Priority carcinogens – future burden

- **Asbestos** – construction industry, maintenance & demolition
- **Diesel Engine Exhausts (DEE)** – drivers, mechanics, car park attendants
- **Crystalline silica** – construction work, brick making, foundries
- **Mineral oils** – metal workers, engineering, printing
- **Painters** – commercial & industrial painters, artisans
- **Welders** – engineering, fabrication
- **Solar radiation** – outdoor work (NMSC)
- **Radon** – naturally occurring radioactive gas
- **Shift work** – nurses, flight attendants, marine telephone operators
Key industry sectors – future burden

- **Construction** – asbestos, DEE, silica, solar radiation
- **Personal & Household services** (incl. repair trades, laundries, dry cleaning, domestic services, hairdressing, beauty services) – asbestos, (ETS), DEE, soots, perchloroethylene
- **Land transport** (railways, roads, pipelines) – DEE, asbestos
- **Mining** – silica, asbestos, DEE, solar radiation
- **Public administration & defence** – (ETS), solar radiation
- **Wholesale & retail trades** (incl. restaurants, hotels) – (ETS), asbestos, radon
- **Farming** – dioxins, non-arsenical pesticides, solar radiation
Asbestos

- Comprehensive regulatory framework for all work with asbestos (N.B. revised Control of Asbestos Regulations due in 2012).
- HSE long-term focus on reducing risk of asbestos disease amongst tradesmen (industrial use now much reduced).
- Risks are now well known and recognised, with many freely available sources of information.
- Many partnership initiatives (e.g. Asbestos Training Pledge).
- Deaths from mesothelioma in UK expected to peak at 2100 cases in males in 2016.
- **Exposure reduction through education and enforcement of regulations and licencing controls**
Diesel engine exhaust emissions are a complex mixture of many components. Respirable elemental carbon is a proxy used to quantify exposure.


Wide use of diesel engines at work. Exposure greatest in enclosed workplaces, especially underground mines.

Exposure reduction through separation, use of air-conditioned cabs, low emission diesel engines...

More exposure data to quantify the risk

Improved education and awareness of risk
Respirable Crystalline Silica

- Exposure to crystalline silica in respirable size range may cause lung cancer after heavy and prolonged exposure.
- Silicosis and COPD are also significant health risks.
- Widespread exposure - quarries, mines, stonemasons, foundries, block cutting, construction/demolition, brick making, pottery, steel and glass manufacture...
- Estimated >100,000 workers exposed to RCS.
- WEL reduced to 0.1 mg/m³ in 2006.
- “Silica Essentials” guidance sheets published by HSE.
- **Exposure reduction through automation, choice of process parameters (e.g. cut speed), (partial) enclosures and LEV, wet suppression, etc.**
Painting was classified by IARC as a Group 1 carcinogenic circumstance in 2008. Linked to bladder, lung and stomach cancer.

Paints are complex mixtures of pigments, solvents and other additives. No single substance in the paint identified as the cause of the observed cancers.

Exposure to paint ingredients may give rise to a variety of other health risks.

- **Exposure reduction through choice of coating technology, LEV (e.g. downdraft booths for spraying), brush application rather than spray, etc.**
- **Improved education and awareness of risk**
Welders

- Exposure to welding fumes and UV radiation is linked to lung cancer and eye melanoma.
- Significant safety and electrical risks.
- Welding fume components vary depending on process, consumables and work piece; can include known carcinogens such as Cr and Ni.
- Estimated >500,000 workers perform welding work in UK. Widespread use in most sectors of industry.
- “Welding essentials” guidance sheets published by HSE
- Exposure reduction through alternative jointing methods, choice of welding process, automation, use of LEV...
Exposure reduction

Elements needed for effective exposure reduction to carcinogens:

- Recognition of the cancer risk
- A good understanding of the main risk factors for development of the disease
- Better knowledge of exposure and dose-response relationships
- Established and validated control measures
- Effective enforcement

- A determination to ELIMINATE WORK-RELATED CANCER
In summary

♦ No “one size fits all” solutions
♦ Good control measures already exist
♦ Need to increase awareness of cancer risks at work
♦ Reduce exposures \textit{today} to prevent cancer in 20 years time

"Taken from CancerHelp UK, the patient information website of Cancer Research UK: http://cancerhelp.cancerresearchuk.org".
Useful information sources on occupational cancer

Handy websites:

Cancer Research UK  http://cancerhelp.cancerresearchuk.org/
IARC  http://www.iarc.fr/
DoH – Cancer  http://www.dh.gov.uk/health/category/policy-areas/nhs/cancer/

British Occupational Hygiene Society  www.bohs.org
(professional body with comprehensive information on occupational hygiene)
Gillies Associates Limited  www.gilliesassociates.co.uk