EXPOSURE

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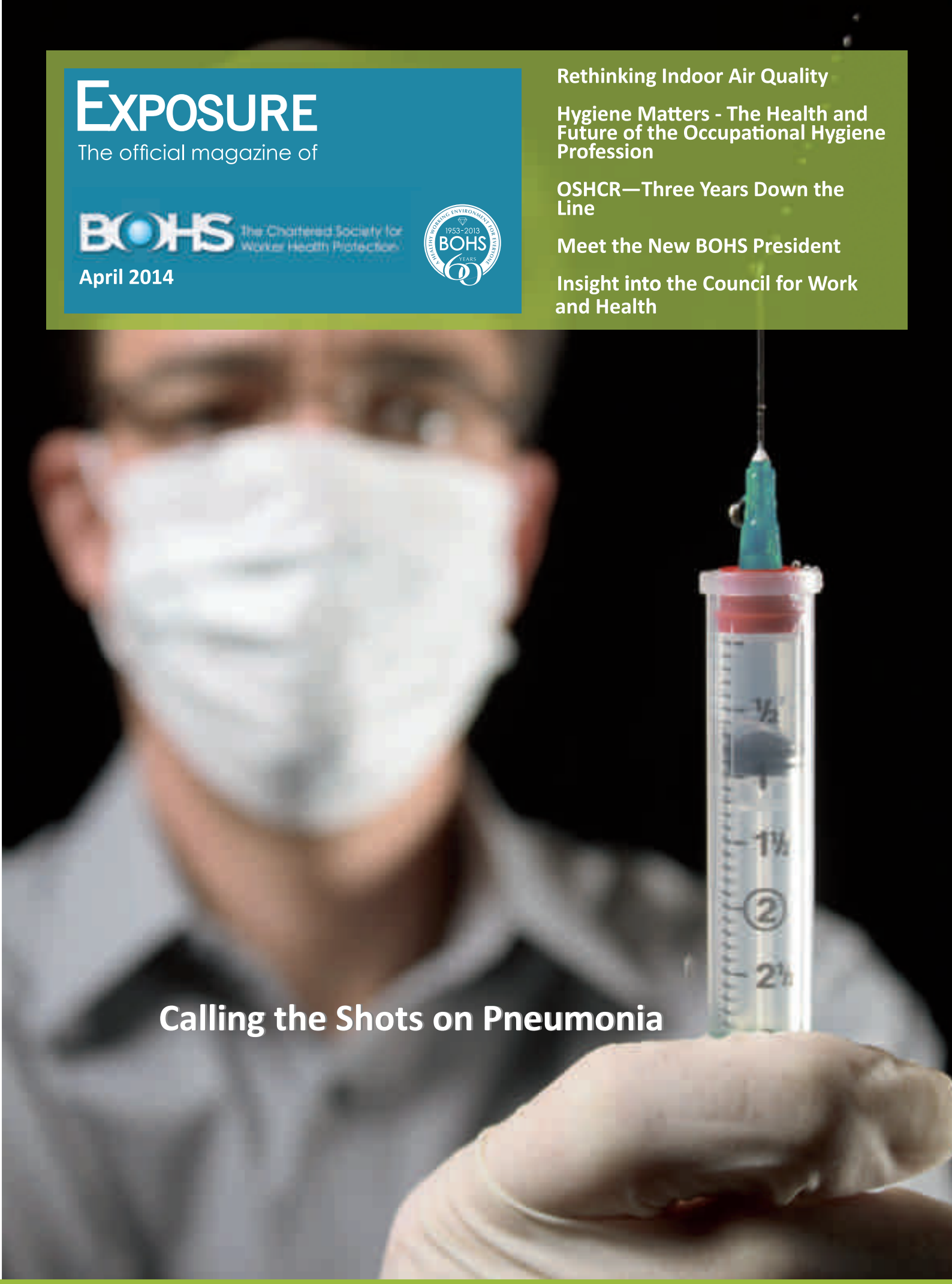
Rethinking Indoor Air Quality

Hygiene Matters - The Health and Future of the Occupational Hygiene Profession

OSHCR—Three Years Down the Line

Meet the New BOHS President

Insight into the Council for Work and Health



Calling the Shots on Pneumonia

"A HEALTHY WORKING ENVIRONMENT FOR ALL"

atmosphere was monitored using a gas detector until a zero gas reading was given.

Despite his concerns, the worker used a disc cutter, brought by Mr Greenland for this specific task, to cut the tank into sections so it could be removed more easily from the site. However, shortly after he started to cut the petrol end of the tank, an explosion occurred. As well as injuring the worker, a number of nearby properties and vehicles were damaged by flying debris.

HSE discovered a number of safety failings:

- The safety assessment carried out before the work started was inadequate and there was no safe system of work in place;
- The gas detector used to monitor the atmosphere had not been suitably calibrated and may have given false readings;
- The tank had not been properly cleaned and flammable residues remained;
- Although it would not have completely eliminated the risk of explosion, cold cutting techniques should have been used rather than a disc cutter, which generated heat and sparks, thus igniting the vapour when the tank was pieced.

Laurence Greenland, of Forest Side Gardens, Ringwood, Hampshire, pleaded guilty to breaching Section 3(1) of the Health and Safety at Work etc. Act 1974 and Regulation 6(3)(a) of the Dangerous Substances and Explosive Atmosphere Regulations 2002. He was fined £4,000 and ordered to pay £1,000 in costs.

And finally…

The Health and Safety Executive (HSE) has published its sixth annual Science Report highlighting the year's achievements in science and engineering research. The report reveals the breadth of work undertaken by the Health and Safety Laboratory, HSE's principle provider of forensic support, and HSE's own analysts and contractors – more than 500 projects in total. Highlights this year include:

- A survey of pesticide usage – an ongoing piece of research that will monitor the long -term health of people who work with pesticides.
- The causation, exposure and impact of chronic obstructive pulmonary disease on workers – the first study of its kind on occupational lung disease, working with the University of California that has led to HSL researchers being recognised as international experts on this issue.

Rethinking Indoor Air Quality

Julie Riggs

There are moments in your career when you will reflect on something that will resonate with you, perhaps motivate your intrinsic driver, inspiring the reasons for your daily professional dedication. Rachel Carson was my epiphany; the marine biologist, who inspired the environmental movement with her authentic and insightful books about how humans interact with our environment. In her 1962 book called Silent Spring, she predicted the plight of humans in this world. 'A catastrophe may already have occurred - the future may be foreclosed by what we have already done. We all live under the haunting fear that something may corrupt the environment to the point where man joins the dinosaurs as an obsolete way of life... our fate could perhaps be sealed twenty or more years before the development of symptoms.'

Rachel Carson

Her astute views provoked a consciousness to reflect on my own professional practice legacy. As a health and safety practitioner with an active passion for raising the indoor air quality agenda (IAQ), the passage stimulates the thought that it is not enough for us to know and practise our profession, for we should be changing our world for the better. We need to consider our world and some of the basic fundamentals of human necessities. The expectations that the food we eat, the air we breathe and the water we drink should be uncontaminated and safe. And yet, despite these fundamentals we continue to pollute our environment and bodies with an unknown certainty of risks.

Every breath you take

Consider the basics of your indoor air environment and the quality of the air you breathe. If you replace the contents of a five gallon bottle that sits aloft a water cooler, substituting water with air, you will breathe an equivalent of 600 bottles every day, taking approximately 20,000 breaths. It is often an unconscious action and you probably do not consider the quality of air that travels along dusty ventilation ducting or exhaled by adjoining occupants, which passes through our nose and mouth and into our lungs.

The air consists of oxygen (21%) with nitrogen (78%) and the remaining is small amounts of argon, carbon dioxide and other gases and water vapour (1%). The composition of inhaled air remains relatively constant although earth is a leaky vessel with small quantities of the atmosphere escaping into space every year, the loss rate is currently tiny, only about three kilograms of hydrogen and 50 grams of helium per second. With the knowledge that oxygen is too heavy to leave the atmosphere, we do not need to worry about wearing oxygen packs yet. Within the air, dusts, chemical components and biological agents will be present; these variables can affect our health, both physiologically and psychologically. They can affect our perception of our environment, determining whether our surroundings are conducive and comfortable.

Individually and collectively, we take the air we breathe for granted and yet every breath is vital for sustaining our lives, supplying our blood with oxygen and removing metabolic waste in the form of carbon dioxide. Unconscious breathing is regulated by neural

signals in our brain, the medulla (regulates the rhythm of inhalation and exhalation) and pons (controls the speed of inhalation and exhalation).

Each inhalation takes approximately 1 second, exhalation follows immediately, which takes slightly longer. A pause of a second or two between the end of exhalation and the beginning of the next inhalation occurs as the CO2 content of the blood increases to the point where it triggers the next cycle to start. Normally the rate of respiration at rest is between 12 to 15 breaths per minute. The rate and depth of breathing depend on the body's needs; it is a rising concentration of carbon dioxide, not a declining concentration of oxygen that stimulates the ventilation of the lungs.

"Information obtained from laboratory and epidemiological studies suggest that indoor air pollutants are an important cause of avoidable morbidity and mortality in the UK's life expectancy"

As most individuals spend approximately 80-90% of their time indoors, they are therefore exposed to the indoor environment to a much greater extent than the outdoor. Information obtained from laboratory and epidemiological studies suggest that indoor air pollutants are an important cause of avoidable morbidity and mortality in the UK's life expectancy.

With hundreds of varied compounds, typical immediate health effects can include eye, nose and throat irritation, headaches, migraines, nausea, fatigue and the feeling of dizziness. Such immediate effects are usually short-term and treatable. Sometimes the treatment is simply eliminating the person's exposure to the source of the pollution, if it can be identified. Reaction to indoor air pollutants can be individually determined by factors such as gender, age, activity within exposed area, individual sensitivity, repetitive exposure and/or pre-existing conditions.

Other health effects may show up years after exposure has occurred or only after long or repeated periods of exposure. These effects, which include respiratory diseases, heart disorders and cancer, can be severely debilitating or fatal. Mental health conditions, reduction in productivity and comfort have also been linked to changes in air quality.

The inside story

The physical, chemical, and biological characteristics of air in the indoor environment and how it relates to the occupant's physiological and psychological health, comfort and productivity is not a new concept, we can trace transcripts of text discussing the impacts of indoor air within biblical scripts. However, there have been four fundamental developments which have occurred in the last 45 years:

- The increase of time spent within indoor environments;
- The increased dependency on artificial products;
- The increased occupancy density (open plan offices, reduction of working space);
- Advancements of energy conservation techniques (air tight buildings, re-circulated air).

A growing body of scientific evidence has indicated that the air within buildings can be more seriously polluted than the outdoor air in even the largest and most industrialized cities. The US's Toxic Substances Strategy Committee stated that the majority of cancers (80-90%) are triggered by exposure to substances in the environment.

According to a five-year-study carried out by the US Environmental Protection Agency, peak concentrations of 20 toxic compounds, some linked with cancer and birth defects, were 200-500 times higher inside than outdoors.

During the past forty-five years, more soft furnishings and carpets are being used within buildings, resulting in a greater emission of a variety of substances into the indoor environment. At the beginning of the 20th Century around 50 materials were used in buildings; there are now around 55,000 building materials available and over half are man-made. The HSE claim 30–50% of new and refurbished buildings could be classified as 'sick'.

As the range of building materials and products grow, there is a need to balance such risks with understanding IAQ and the impact of such rapid changes. The Chemical Abstracts Service, a division of the American Chemical Society, is the global comprehensive source for chemical information since 1907. The daily inclusion of 36,000 new chemicals added to the CAS register contributed, in 2009, to their 50 millionth compound, thus demonstrating the increase use of chemicals within our society. As is the case with many chemicals found in the indoor environment, there is often scientific uncertainty over the risks posed to humans. This is due to the large number of chemicals currently presented in the indoor environment. Of the 75,000 chemicals in common commercial use, only 3% have been tested for carcinogens.

"the HSE claim 30–50% of new and refurbished buildings could be classified as 'sick'"

Our world is complex with a diversity of exposures. It is estimated that an individual carries a body burden of approximately 700 contaminants. Because many chemicals have the ability to attach to dust particles and/or catch air and water currents and travel far from where they are produced or used, the globe is bathed in a chemical soup. Our bodies have no alternative but to absorb these chemicals and sometimes store them for long periods of time. Due to the latent and uncertainty effects of chemical combinations, body burden indicators are often difficult to extrapolate quantitative risks, which challenges our traditional view of the scientist's cause and effect approach.

Historically, science has often focused on one common denominator as a cause and effect, which influences public health regulations and theoretical risk calculations according to known levels of substances in the air, such as the EH40. Air masses always contain many pollutants in differing amounts, depending on the types of source and atmospheric conditions, therefore occupants are simultaneously exposed to a complex mixture of air pollutants. Thus, multi-pollutant assessment approaches are desirable, but challenging. Demonstrating a relationship between single and combined components and the impact on occupants is vague. Whilst we continue to research silo contaminants, and regulate exposure limits based on single pollutants, the cost model for controlling and managing IAQ will be limited. The complexities of combined contaminants, the reaction from different individuals, the perception of risk against actual and the variations during exposure, such as ventilation rates, temperature, and occupant density, can add further permutations. Bio-monitoring will enable a clearer understanding of physiological, psychological and perception impacts, providing a clear evaluation of actual interactions from a mixture of pollutants.

The lack of data or ability to demonstrate associated costs and contributing factors to health risks can reduce their visibility in society and relegate Government policy

decisions; high-risk perception of the public can also influence such decisions. As an example, the Environmental Protection Agency considers industrial waste sites as medium to low risk and indoor air quality as medium to high risk; however, the public perception is reversed and therefore more funding and policy decisions will be spent on hazardous waste sites.

Conducting research with health, safety and facility practitioners, little has changed in how people feel about their environment within the past 10 years; with a consistent 69% feeling dissatisfied with their indoor air, 78% believing indoor air problems are belittled, and 92% of occupants having no access to IAQ resources. Only 3.6% of Local Authorities have an IAQ policy, despite 96% valuing clear guidance, education and IAQ investigation kits.

There is a gap between the needs of our occupants and the role of influencing change and access to resources. Solutions to indoor air problems are not solely achieved by technical knowledge, but also by the management of social interaction and cooperation.

As an example, if you take a known hazard, such as smoking; Cancer Research UK

claims that 3% of lung cancer cases in the UK are caused by air pollution compared with smoking that causes up to 90%. This means that smoking causes nearly 30 times more lung cancer cases than air pollution. Although smoking has been addressed within public spaces, Cancer Research UK indicates that 40% of children are still exposed to second-hand smoke. This suggests that although the Government have legislated against public spaces, they have had limited impact on society's personal actions and behaviours. The Government spend for their Smokefree campaign in 2006 is attributed at £43 million. Many of the publications regarding the effects of the Smokefree initiatives have reported on the short term quit rate using access responses to smoking cessation packs provided by the Government; reporting that 8.6% of smokers in 2007 and 5.7% in 2008 attempted to quit, there are no figures regarding long term attempts.

This creates an interesting perception, that although we know the dangers of smoking and that the government has invested in this area to reduce smoking activities, people still choose to smoke. Thus publicizing a hazard to people does not necessarily make them change a habit, stimulating the debate that change is dynamic and promoting IAQ needs to be more sophisticated than just discussing the hazards and health concerns.

The perception of a risk by an occupant can also affect their comfort and productivity. When an occupant is unable to control local temperatures by opening windows or altering the thermostat, they will perceive air quality as poor; 73% of facility managers have admitted to installing fake thermostats to rectify this problem. Perception is multifaceted and can be further complicated when we take a pollutant that has a pleasant attraction, such as perfume.

Branding the sweet smell of success

The use of artificial scents and branding within our homes and workplaces has become a powerful tool in a visually and audibly competitive sales market. With 75% of the emotions we generate on a daily basis affected by smell, companies will continue to look to increase the cocktail of fragrances into our deteriorating and fragile air quality environment.

A perfume consists of volatile chemical compounds, their composition is usually complex; it involves numerous natural and synthetic sweet-smelling constituents, more than 5,000 of which are known. 95% of the chemicals used in fragrances today are synthetic compounds derived from petroleum and include benzene, aldehydes and many other known toxins and sensitizers which are capable of causing allergic respiratory disorders. 84% of these ingredients have never been tested for human toxicity, or have been tested only minimally. Studies show that fragrance chemicals can cause health effects, with some data suggesting that as many as 75% of known asthmatics have asthma attacks that are triggered by perfumes. Fragrances are capable of causing cancer, birth defects, central nervous system disorders, allergic respiratory reactions, skin and eye irritations as well as neurological and cutaneous disorders. Yet fragrance formulas are considered trade secrets and manufacturers do not need to disclose details. Even fragrance free or unscented does not guarantee they do not contain fragrance chemicals, they imply they have no perceptible odour.

As the International Fragrance Association continues to campaign for protection of creative rights, occupants are encouraged by powerful advertising to envelop ourselves every day with this pollutant that has similar chemicals to cigarettes, such as benzene, formaldehyde and toluene. Merely the influence that fragrances have a pleasant aroma ensures tolerance from exposed occupants; thus creating a challenge with regards to the risk perception and social acceptance of improving indoor air quality.

Canada and the US have recognised the impact of scents within an enclosed environment. Canadian safety authorities have been driving a 'no scent, make sense' campaign. The issue of fragrance may be as controversial as today's tobacco smoke issue. The debate over people's right to smoke versus others' right to breathe clean air could also be applied to fragrances.

Awake the giant

Compared with industrial spaces, most of the toxins in low risk workplaces and residential properties are at low levels, but should not be disregarded as harmless; an accumulative effect within the body must be considered.

Despite health being an important issue in people's lives, people remain unaware and often apathetic of the health risks posed from indoor air. It has become clear that the plethora of data and research has not been transferred effectively into society. We are not managing indoor air quality proactively. Therefore to raise the agenda, we need to bridge the gap between our academic knowledge, our professional practice and society's risk perception using tangible, story telling topics that make IAQ accessible.

We often refer to environmental concerns as a sleeping giant, fearful of the unreleased power of disturbing the balance of nature; however, we can look within ourselves to stimulate our own sleeping giant to make a change. Part of our role is to educate and stimulate debate with policy makers and society to discuss the risks faced, empowering individuals to demand change, supporting the vital work of BOHS practitioners, before our legacy echoes the plight depicted by Rachel Carson.

'Then a strange blight crept over the area and everything began to change. Some evil spell had settled on the community…. no witchcraft, no enemy action had silenced the rebirth of new life in this stricken world. The people had done it themselves'. (Carson, 2002, p2-3).

Reference:

Carson, R. (2002). 'Silent Spring' Publisher: Mariner Books. ISBN-10: 0618249060.