Introduction

At the fourth World Health Organization (WHO) ministerial conference on environment and health held in 2004 in Budapest, Hungary, ministers from all 53 countries across the WHO European Region, including the UK, agreed to the development of a Children’s Environment and Health Action Plan for Europe (CEHAPE).1 This plan commits countries to the development of national Children’s Environment and Health Action Plans to protect the health of children and young people from environmental hazards. CEHAPE sets down four Regional Priority Goals covering:

- water, sanitation and health
- accidents, injuries, obesity and physical activity
- respiratory health, indoor and outdoor air pollution
- chemical, physical and biological hazards

In the last edition of the Environmental Public Health Quarterly Bulletin we looked at the approach taken by the WHO European Region to children’s health and the environment, the development of the action plan for Europe1, and the proposals in the strategy document for the UK2 with special emphasis on the first two regional priority goals.

In this edition we are looking at the third and fourth regional priority goals which relate to respiratory health, indoor and outdoor air pollution, and chemical, physical and biological hazards and the way that these international and national initiatives might impinge on programmes here in the North West over the next few years. Please note that “regional goals” in this context relate to the WHO European Region, rather than the North West Region of England.
The United Kingdom Government, through its Interdepartmental Steering Group on Environment and Health via the Department of Health, has commissioned the Health Protection Agency (HPA) to evaluate children’s environmental health in the UK and develop recommendations as to how we can best meet our commitments under CEHAPE and further protect children’s health.

A Children’s Environment and Health Strategy for the UK was published on 24 March 2009. The Strategy provides a brief overview of children’s health in relation to their environment in the UK and recommends areas that should be taken forward in order to protect and promote children’s health and to meet the UK’s commitment to CEHAPE.

Regional Priority Goal III addresses indoor and outdoor air pollution (see box, right).

### Indoor air pollution

Children and young people can be more susceptible to the effects of poor air quality, both indoors and outdoors, as their lungs are still developing and they take in proportionately more air than adults. Although the actual health impacts are difficult to quantify, indoor and outdoor air pollution can adversely affect children’s health in a number of ways. Indoor air pollution (e.g. from fossil fuel appliances and environmental tobacco smoke) has been linked with increases in lower respiratory tract infections, rhinitis, cough, exacerbation of wheeze and asthma, and effects on the foetus.

The smoking ban, introduced in Scotland in 2006 and in England, Northern Ireland and Wales in 2007, prohibits smoking in any public building, workplace, vehicle or other enclosed structure other than an individual’s own home or car. Compliance with the ban has been generally good and the latest report for the first half of 2009 shows that compliance in the north west region is only slightly worse than the

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Regional Priority Goal III

Prevent and reduce respiratory disease due to outdoor and indoor air pollution, thereby contributing to a reduction in the frequency of asthmatic attacks, in order to ensure that children can live in an environment with clean air. This is to be achieved through:

(a) developing indoor air quality strategies that take into account the specific needs of children,

(b) implementing the Framework Convention on Tobacco Control and setting up health promotion programmes that will reduce smoking prevalence and the exposure of pregnant women and children to environmental tobacco smoke,

(c) improving access of households to healthier and safer heating and cooking systems as well as cleaner fuel,

(d) applying and enforcing regulations to improve indoor air quality, especially in housing, childcare centres and schools, with particular reference to construction and furnishing materials, and

(e) reducing emissions of outdoor air pollutants from transport-related, industrial and other sources through appropriate legislation and regulatory measures which ensure that air quality standards such as those developed under EU legislation take into account the values set by the WHO Air Quality Guidelines for Europe.

(INTERNATIONAL EXPERT GROUP, 2004)
average for all of England: 98.4% versus 98.7% of premises inspected.\textsuperscript{5}

Chronic carbon monoxide exposure can lead to behavioural deficits in children and harm the unborn child; also children can be particularly susceptible as they may suffer health effects in a shorter period of time than an adult breathing in the same concentration of carbon monoxide.\textsuperscript{6}

Exposure to high levels of carbon monoxide can be fatal.

In November 2008, the Health Protection Agency North West held a one day workshop in Preston “Carbon Monoxide Poisoning – Whose problem is it?” aimed at improving multi-agency response in the north west region.\textsuperscript{7}

**HPA Recommendations: Indoor air pollution**

Provision of a coordinated policy approach, action plan and improving public information on indoor air quality would be beneficial. There may also be benefits in preparing an action plan to address indoor air quality. In particular, more work may be needed to increase public awareness of the risks associated with carbon monoxide exposure and the importance of properly maintained fossil-fuel appliances.

Further research to quantify the incidence and impact of chronic carbon monoxide poisoning may be beneficial. This should consider whether children are more severely affected than adults and, if necessary, identify ways to prevent such exposures.

Continued efforts should be made to educate adults as to the effects of smoking on children's health and encourage them to continue to minimise children’s exposure.

As socioeconomic status is one of the primary determinants of children’s exposure to environmental tobacco smoke, it is important to focus efforts towards the most vulnerable groups.

**Outdoor air pollution**

Outdoor air pollution (e.g. from vehicle exhausts, industry and the products of combustion) has been associated with a range of respiratory effects in children. For example, high levels of outdoor air pollution have been linked with exacerbation of asthma and respiratory tract infections., and there is increasing evidence on the health effects linked to living in proximity to major roads and traffic.\textsuperscript{8}

Whilst not a cause, air pollution can exacerbate asthma; an estimated 30% of the acute exacerbations of asthma in children are related to outdoor air pollution.\textsuperscript{9} Deaths from asthma in the UK are rare, but amongst children and young people, asthma is a major reason for general practitioner (GP) consultations and hospital admissions. Between 1955 and 2004 the prevalence of asthma increased in children two- to three-fold, but has flattened or may even have fallen recently.\textsuperscript{10} However, GP consultations for asthma amongst children and young people have been declining since the mid-1990s. In 2005 GP consultations for asthma in England and Wales were 275 and 462 per 10,000 amongst 1–4 and 5–14 year olds, respectively.\textsuperscript{11} Emergency hospital admissions for asthma in 2006 were 45 and 22 per 10,000 for 0–4 and 5–14 years olds, respectively, in the UK.\textsuperscript{12} In 2005 the north west region recorded the highest rates of admission in all age groups when compared with other regions of England and Wales: 15 per 10,000 in males and 17 in females.
HPA Recommendations: outdoor air pollution

Guidance on local air quality action plans should be extended to include measures which can be taken to reduce the exposure of susceptible groups, including children. Action plans developed by local authorities should prioritise more susceptible groups, including children, within the general population, and guidance should be provided on what actions are practical and effective.

Evidence on the health effects linked to proximity to major roads and traffic is increasing and may have implications beyond childhood into adult life. There is a need to improve understanding in this area and this requires a review of the available literature and evidence in order to determine the best course of action.

Regional Priority Goal IV addresses chemical, physical and biological exposures. (see box, below and right).

Regional Priority Goal IV

Reduce the risk of disease and disability arising from exposure to hazardous chemicals (such as heavy metals), physical agents (e.g. excessive noise) and biological agents and to hazardous working environments during pregnancy, childhood and adolescence.

Reduce the proportion of children with birth defects, mental retardation and developmental disorders, and decrease the incidence of melanoma and non-melanoma skin cancer in later life and other childhood cancers by:

(a) passing and enforcing legislation and regulations and implementing national and international conventions and programmes to:

• reduce exposure of children and pregnant women to hazardous chemical, physical and biological agents to levels that do not produce harmful effects on children's health
• protect children from exposure to harmful noise (such as aircraft noise) at home and at school
• ensure appropriate information on and/or testing for effects on the health of developing organisms of chemicals, products and technologies before their marketing and release into the environment
• ensure the safe collection, storage, transportation, recovery, disposal and destruction of non-hazardous and hazardous waste, with particular attention to toxic waste
• monitor in a harmonised way the exposure of children, as well as men and women of reproductive age, to hazardous chemical, physical and biological agents
• ensure that international agreements on the control of chemical pollutants and hazardous waste are applied

(b) implementing policies to raise awareness and endeavour to ensure reduction of exposure to ultraviolet radiation, particularly in children and adolescents, and

(c) promoting programmes including those for the adequate dissemination of information to the public that will prevent and minimise the consequences of natural disasters and major industrial and nuclear accidents and take into consideration the needs of children and people of reproductive age.

(WHO, 2004)
Children in the UK are exposed to a range of chemical, physical and biological hazards, some with chronic or cumulative exposure, that have effects on their health and well-being. The impacts of many of these are difficult to quantify as available data are limited.

**Lead**

We have known for many years that lead poses a risk to children as it can affect the development of the nervous system. In the last 20–30 years legislation and other actions have been put in place to control lead in the environment and protect children’s health. These have included banning the use of lead additives in petrol, restricting the use of leaded paint and the use of lead in toys, controlling lead in food and controlling emissions of lead from industrial processes. It is now common practice for the water industry to adjust the pH and add phosphate based corrosion inhibitors to drinking water to minimise the dissolution of lead from older pipes and water fittings. As a result, there has been a substantial reduction in blood lead levels in children, so that median blood lead levels in the 1990s (1–3 \( \mu g/dL \)) had declined approximately ten-fold compared with levels in the 1960s (23 \( \mu g/dL \)).

Unfortunately, there is now emerging evidence that lead is harmful to young children even at concentrations in blood that were previously thought safe. The current blood lead concentration that triggers further investigation (10\( \mu g/dL \)) therefore may not offer adequate protection.\(^\text{13}\)

The north west region has a diversity of environments including old and new industrial areas and extensive and complex tracts of contaminated land. In addition, the north west has some of the highest levels of deprivation and health inequalities in the country. Across the north west there are five nuclear sites, many large chemical industry manufacturing sites and nearly 60 top-tier COMAH (Control of Major Accident Hazards Regulations) sites.\(^\text{14}\)

**Microbial hazards**

Agriculture in many parts of the north west region is dominated by livestock rearing and many children are given the opportunity to visit farms as part of their schools’ enrichment programme. Unless appropriate hygiene precautions are taken there may be a risk of gastrointestinal infection and there have been several large outbreaks in the north west and elsewhere in recent years. In May 2007 a cluster of cases of cryptosporidiosis was identified particularly affecting young adults in Bolton. Cryptosporidium is a parasite associated with farm animals which causes a diarrhoeal illness. It is found in lakes, streams and rivers, untreated water and sometimes in swimming pools, as well as in the faeces of infected animals and humans. Of the six cases, five had visited an open farm. An incident team was called and an Environmental Health Officer visited the farm to assess hygiene procedures, especially access to handwashing facilities. These were reported to be acceptable and with no obvious breaches found. As most of the cases were adults it was hypothesised that they may have paid inadequate attention to their own hand hygiene after assisting children with theirs.\(^\text{15}\)

In April 2009, a large outbreak of cryptosporidiosis (at least 155 suspected cases, including 41 confirmed) was linked to a visit by 382 children from 8 local primary schools to a dairy farm in Carlisle. The children had visited various work stations on the farm. They came into direct contact with a cow (which they milked), four calves (some had previously had diarrhoea), a nanny goat and four baby kids, and they walked through a cow cubicle house. The children were provided with alcoholic hand gel (which is not
effective against cryptosporidium) before receiving refreshments in the farm office. Positive faecal samples from 3 of 7 calves and 7 of 20 goats were all identified by PCR-RFLP as *Cryptosporidium parvum* at VLA Weybridge, and gp60 sequencing showed that the calf samples were of the same subtype as detected in human cases by the National Cryptosporidium Reference Unit in Swansea. This suggested that the calves may have been the source of the outbreak; however a preliminary epidemiological analysis showed that petting and feeding goats was the greatest exposure risk.\(^{16}\)

In June this year, two young children developed *Escherichia coli* O157 infection after visiting an open farm at Burscough, West Lancashire. Infection was transmitted to six family members with three cases complicated by haemolytic uraemic syndrome. A joint investigation by the Health Protection Agency, Environmental Health Department, Hospital Microbiology Departments and the Veterinary Laboratories Agency identified faecal contamination of the public areas at the farm and close contact with goats as the likely cause of the outbreak.\(^{16}\)

Farmers do not require a licence to open their farms to the public although they have responsibility to visitors under the Health & Safety at Work etc. Act. Hygiene advice for farm visits is available from the HSE on their dedicated agriculture website, including the recently revised information sheet on avoiding ill health at open farms.\(^{17}\)

The importance of washing hands with soap and water is emphasised, and it states that using cleansing gels or wipes is not a substitute. This information sheet particularly emphasises the risks from vero cytotoxin-producing *E. coli* (VTEC) but there is also an information sheet dealing with a wider range of zoonotic risks including cryptosporidium, leptospirosis, bovine TB, orf and ringworm.\(^{18}\)

**HPA recommendations:**

**Chemicals**

Ways to further reduce the number of deaths and hospital admissions of children from accidental poisoning need to be identified. A better understanding of the current trends and patterns of poisonings would help identify interventions and areas that would benefit from further research.

There is still much to learn about children’s exposure to single chemicals and chemical mixtures in the UK, including a better understanding about where children are exposed (e.g. in the home, schools and outdoor environment). The UK should develop a robust human biomonitoring programme to monitor exposures and evaluate interventions (e.g. legislation) to reduce exposure.

Further research is required to understand better the health effects of chemical exposures and, particularly, harm during embryonic development. Further work is needed on the transgenerational effects of *in utero* chemical exposure as well as neurological developmental toxicology and other lifelong effects potentially resulting from exposures early in life.

A strategic review of systems for surveillance of congenital abnormalities would be timely with a view to making recommendations to improve upon the current surveillance systems in the UK.

**Ionising and non-ionising radiation**

Householders in radon-affected areas should continue to be encouraged to participate in radon testing and to reduce radon levels in houses which are above the action level. Whilst there have been several campaigns, the proportion of householders installing remedial measures to reduce radon in homes is still relatively...
Encouraging householders to consider radon mitigation should continue. Landlords and employers in radon-affected areas should be encouraged to participate in radon testing and to reduce levels in buildings which are above the action level. In particular, all schools and childcare settings in radon affected areas should be tested for radon and, if above the action level, should take measures to reduce the exposure of pupils and staff.

COMARE (the Committee on Medical Aspects of Radiation in the Environment) has recommended that schools should be treated the same as homes for the purposes of radon protection. This would mean that the current radon action level in homes of 200 Bq/m$^3$ should be applied to schools and other childcare environments.

Good sun protection behaviour should be encouraged in children and young people. Campaigns across the UK should be coordinated and evaluated. There have been a number of north west initiatives related to exposure to UV radiation such as Sefton’s Sunwise campaign, including the Living Shade Project, and Blackpool’s Shun the Sun campaign.

The use of sunbeds and tanning parlours by children and young people should be prevented or reduced and means to do this need to be explored further and implemented across the UK. Measures could include restricting the use of commercial sunbeds and tanning parlours to those over a specified age (e.g. 18 years) and ensuring that information about health risks is provided with retail sunbeds.

COMARE has also recently recommended that the commercial use of sunbeds by the under-18s is prohibited in England and Wales.\textsuperscript{19} This is in line with the Public Health etc. (Scotland) Act 2008. In order to support this, COMARE also recommended the prohibition of unsupervised use and/or self-determined operation of sunbeds in commercial outlets.

Further research is needed to improve the understanding of possible health effects of electromagnetic field exposures (e.g. from mobile phones, base stations, electrical wiring and appliances, and overhead power lines) in children, young people, pregnant women and foetuses.

**Noise**

Children and young people are affected by noise and their education can suffer directly. Noise maps, which are currently being produced for major roads, railways and cities, could be used to identify schools likely to be affected by noise and identify where noise interventions may be most useful.

Further research is needed as to improve understanding of the non-auditory effects of background noise, high frequency noise devices and personal music players on children and young people. Further investigation is also needed into the use of personal music players and their impact on the hearing of children and young people.

**Biological hazards**

Schools should continue to teach and encourage food hygiene to establish good habits at an early age. The surveillance system for food-borne diseases is an important way to identify health effects of biological hazards; however, this could be strengthened.

**Emergency preparedness**

Children and young people should be routinely considered and, where appropriate, included in emergency preparedness exercises in order to understand and take better account of their needs.
References:


(3) HPA. A Children’s Environment and Health Strategy for the UK, Health Protection Agency, Chilton; 2009. Available at: http://www.hpa.org.uk/cehape


(16) HPA. Zoonoses Network Newsletter. 2009; No.5. Available at: http://www.hpa.org.uk


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