Methods: Short courses, each lasting one to two weeks, are offered to mining engineers and individuals responsible for environmental and occupational health. Each course focuses on health assessment approaches and both occupational and public health interventions to limit morbidity and mortality from mining and related activities. Injury prevention and field research methods are emphasized and the uses of monitoring instruments are incorporated in the courses.
Results: Based on experience from our courses conducted to-date, it has been realized that blended (computer-based and face-to-face) learning has proven more efficient and economically effective than stand-alone, face-to-face course delivery. Course participants begin by going through self-study material on computers using CD-ROMs for about two weeks. This is followed by a 2-day face-to-face session primarily targeting unclear areas in the self-study material as well as practicals.
A subsequent survey of the existing computer/internet environment showed that many companies and individual participants do not have the necessary funds or time to participate in out-of-station courses, due to limited resources in most of Southern Africa.
Discussion: With this realization, the self-study material has been further developed for online delivery so that less time can be expended on face-to-face course sessions, enabling participants to benefit more from the free and vast amount of information existing in eLibraries and websites. In addition, training of eLearning Tutors has also been undertaken to develop, conduct and manage eLearning courses.

ISEE-48

HEALTH AND ECONOMIC CONSEQUENCES OF PESTICIDE USE: THE EXPERIENCE OF THE HEED PROGRAMME ON PESTICIDES IN SOUTHERN AFRICA

London L,* Ngowi AVN,† Perry M,‡ Rother HA,* Cairncross E,§ Solomon A,§ Du Toit A,¶ Hall R,¶ Ajayi O.‖ **Occupational and Environmental Health Research Unit, University of Cape Town, Cape Town, South Africa; †Tropical Pesticides Research Institute, Arusha, Tanzania; ‡Harvard Occupational Health Program, Harvard University, USA; §Cape Peninsula University of Technology; Cape Town, South Africa; ¶Programme for Land and Agrarian Studies, University of the Western Cape, South Africa; ‖World Agroforestry Center, Chipata, Zambia.*

Introduction: International environmental law has increasingly focused attention on issues of environmental sustainability. Yet, particularly in developing countries, there is a perception of a potential contradiction between economic development and environmental protection. For example, policies for environmental sustainability may be seen as holding back job creation, or economic development. Pesticides are an example of a technology used widely in agriculture to promote food production, and in public health for vector control. Yet the costs of pesticide usage in social and economic terms is poorly characterised. Externalisation of the costs of the consequences of pesticide usage frequently invalidates cost-benefit estimates required for appropriate policy development. Pesticides may also be the cause of significant adverse health impacts, including both acute poisoning, and chronic health impacts, which may, in turn, impact on agricultural productivity. Therefore, if policy is to be based on sound data, careful study of the health burden and economic costs associated with pesticides are needed.
Aims: (1) To document international and national trends in agricultural policy and in pesticide use and exposure. (2) To develop methodologies to characterise: potential human and environmental exposures; risk-perceptions and decision-making processes of small farmers using pesticides; and health consequences of pesticide exposure for farmers and their families. (3) To develop tools to measure the costs of pesticide usage.
Methods: A set of linked sub-studies using quantitative and qualitative methods, both social science and epidemiological, are under way in study sites in South Africa and Tanzania, supported by the National Institutes of Environmental Health Sciences under its HEED programme.
Results: Preliminary findings indicate widespread use of pesticides in ways that are neither safe for human health, nor protective of the environment. Policies that have increased access to, and use of, pesticides in both South Africa and Tanzania are outlined. Pilot studies have confirmed underreporting of acute poisoning, and have shown that methods to assess childhood developmental and adult neurobehavioural impacts of pesticides are feasible in the two countries. Tools to measure the direct and indirect costs of pesticide usage have been field tested. Preliminary results with biomarker studies have identified training and capacity development needs in collaborating institutions. Key capacity building steps in generating these data are outlined.
Conclusion: In environmental health, important policy choices need to be based on a full consideration of the health and economic consequences of a particular technology. In particular, vulnerable groups such as women, or new entrants to farming, need to be protected from policy pressures to use pesticides in unsafe ways. The project's results will be used as the basis for a larger grant application to undertake a full-scale investigation of the costs associated with adverse impacts of pesticides on human health.

ISEE-49

ACTION ON PESTICIDES - HEALTH AND ECONOMIC CONSEQUENCES OF PESTICIDE USE: THE EXPERIENCE OF RESEARCH COLLABORATION ON PESTICIDES IN SOUTHERN AFRICA

London L,* Ngowi AVN,† Perry M,‡ Rother HA,* Cairncross E,§ Muangirwa C. **Occupational and Environmental Health Research Unit, University of Cape Town, Cape Town, South Africa; †Tropical Pesticides Research Institute, Arusha, Tanzania; ‡Harvard Occupational Health Program, Harvard University, USA; §Cape Peninsula University of Technology, Cape Town, South Africa.*

Introduction: Pesticides pose an important environmental health hazard for rural populations in many developing countries. Accordingly, research into the health and economic consequences of pesticide use, and action to control pesticide hazards offers a significant opportunity to enhance local capacity to manage the problem.
Methods: The experience of collaboration developed between partners in South Africa, Tanzania and the US over the past three years, funded through US and Swedish agencies is described, with a view to identifying important lessons for international research collaboration, particularly from a South-South perspective.
Results: The Health, Environment and Economic Development (HEED) programme of the National Institute of Environmental Health Sciences (NIEHS) funded a planning grant to support collaboration in Tanzania and South Africa to undertake a mix of social science and epidemiological research into pesticide hazards, so as to inform policy. This has been recently strengthened by a biregional programme to enhance occupational health capacity in the SADC region, funded by the Swedish International Development Agency, in which Action on Pesticides is a key sub-project. Central to both programmes are strategies that seek to build capacity in the region on pesticide research. Key gaps/obstacles in local capacity identified early on included: lack of laboratory analytical skills and equipment; telecommunications obstacles; lack of reliable email connectivity between SADC centres; ambivalence expressed by industry; and inadequate conditions of service for local researchers. Strengths identified included: strong track record of participating institutions in pesticides research; high levels of motivation; availability of training

opportunities and their utilisation for project staff; diversity of agricultural settings enabling comparison of methods and data; use of multidisciplinary approaches in the team; tapping of complementary research funding and training opportunities; and strong institutional support locally, regionally and internationally. The collaboration has successfully linked in with other regional initiative on bioethics training and capacity building through the FIC, as well as drawing more widely on international experiences of collaborative initiatives within developing countries.

Conclusion: A long-term vision over the next decade has the potential to significantly build local capacity in a sustainable manner, whilst impacting on policy and programmes related to pesticides, trade, health and economic development. Successful collaboration between scientists in developing countries of the south is key to this process, as is the support of international agencies.

ISEE-50

"AN EXCESS OF ZEROS" PROBLEM IN THE RELATIONSHIP BETWEEN CANCER MORTALITY AND MATERIAL DEPRIVATION BY CENSUS TRACTS IN THE CITIES OF BARCELONA, GIRONA, LLEIDA AND TARRAGONA, SPAIN, 1994-2000

Saez M.,* Saurina C.;* Lertxundi-Manterola A,* Barceló Maria A.,* ña-Riola R.† **Research Group on Statistics, Applied Economics and Health (GRECS), University of Girona, Spain †Escuela Andaluza de Salud Pública , Spain*

Introduction: The estimation of the relationship between cancer mortality and material deprivation with lattice spatial data is often over dispersed relative to the Poisson distribution, even when both, the uncorrelated and, above all, the spatially correlated extra variability had been controlled for. Although part of the over dispersion is a consequence of misspecification errors, uncontrolled confounding above all, it is also possible that occurs the 'excess zero' problem, that is the incidence of zero counts is greater than expected for the Poisson distribution. In fact, there are some areas with no observed cases of the disease of interest, specifically when, as with census tracts, the size of the areas under study is relatively small. As a consequence, the observed counts do not actually follow a Poisson distribution. If one uses standard models, like that proposed by Besag, York and Mollie (BYM), the estimates will be inconsistent.

Methods: As a solution, finite mixture models are proposed. In particular, an extreme form where the response variable is a mixture of a Bernouilli and a Poisson distributions, known as Zero-inflated Poisson (ZIP) models. The problem is that these models assume that a proportion of the counts are 'structural' zeros, i.e. inevitable. In epidemiology, however, there are not free risk areas and the zeros are, in fact, 'sampling' zeros, that is, which occur by chance. We propose here to use, as an alternative, 'hurdle' models. Using cancer mortality data (lung, breast, bladder, laryngeal, stomach, colon and rectum, and prostate) of the census tracts of the cities of Barcelona, Girona, Lleida and Tarragona, Spain, during the period 1994–2000; as well as an 'ad hoc' material deprivation index based in the Townsend index; we estimate the relationship between cancer mortality and material deprivation, stratifying by gender, using the BYM and the hurdle model.

Results: After comparing the results of the estimations of the BYM and the hurdle model using graphical and statistical methods, we will give evidence of a better behaviour of the hurdle models in the estimation of the risk in spatial epidemiology analysis.

ISEE-52

OCCUPATIONAL EXPOSURE TO ETHYLENE OXIDE DURING PREGNANCY AND ASSOCIATION WITH ADVERSE REPRODUCTIVE OUTCOMES

Gresie-Brusin, D.;* Kielkowski, D.;† Baker, A.;† Rees, D. **University of the Witwatersrand – Faculty of Health Sciences, Johannesburg, South Africa; †National Institute for Occupational Health - National Health Laboratory Service, Johannesburg, South Africa.*

Aim: To investigate the association between exposure to ethylene oxide during pregnancy and adverse reproductive outcome in women working in sterilising units using ethylene oxide in Gauteng province, South Africa.

Methods: We analysed singleton pregnancies that: 1) occurred in women currently working in sterilising units using ethylene oxide in Gauteng, South Africa; 2) were the last recognised pregnancy occurring in these women after 1st January 1992; 3) occurred while the mother was employed. Adverse reproductive outcome was defined as the occurrence of spontaneous abortion, still birth, pregnancy loss, low birth weight or combined adverse reproductive outcome. Information on pregnancies' evolution and outcome was gathered from mothers using a questionnaire. Information on exposure to ethylene oxide during pregnancy was obtained from three sources: walk-through survey, questionnaire-collected data and measurements of the levels of ethylene oxide in sterilising units at the time of the study (personal and static sampling).

Results: The study enrolled 68.8% of the medical facilities in Gauteng using ethylene oxide to sterilise medical equipment. The participation rate for the women employed in these sterilising units was 96.5%. The study population consisted of 98 singleton pregnancies. Measurements of ethylene oxide levels showed that exposure still occurred and the employees most exposed were operators. There was a significantly increased risk of spontaneous abortion (RR=16.6; 95%CI=2.0–140.4; p=0.004) and pregnancy loss (RR=6.2; 95%CI=2.0–19.9; p=0.003) amongst pregnancies exposed to ethylene oxide compared to unexposed. No associations were found between exposure to ethylene oxide and stillbirth (RR=3.5; 95%CI=0.6–19.0; p=0.18), low birth weight (RR=0.6; 95%CI=0.1–4.3; p=0.51), and combined adverse reproductive outcome (RR=2.1; 95%CI=1.0–4.4, p=0.06).

Conclusion: An increased risk of spontaneous abortion and pregnancy loss was found to be associated with work as an operator in ethylene oxide sterilising units during pregnancy. These results are consistent with the findings of previous studies addressing this issue.

ISEE-53

OXIDATIVE DNA DAMAGE DUE TO TRAFFIC EXHAUSTS EXPOSURE MODULATED BY INDIVIDUAL SUSCEPTIBILITY

Chuang, C.Y. *Laboratory for Molecular Biomedicine and Ecogenetics, Department of Atomic Science, National Tsing-Hua University, Hsinchu, Taiwan.*

Introduction: The atmosphere in urban areas is polluted by a number of combustion sources including automobile exhaust, industrial emissions, and residential heating. Drivers may be exposed to potentially carcinogenic combustion and pyrolysis products during the course of their work. The present studies on professional drivers have observed the health effects of air pollution including excess mortality from lung cancer, bladder cancer, leukaemia and other lymphatic cancers.

Aim: This study was to estimate urinary 8-hydroxydeoxyguanosine (8-OHdG) as an effective biomarker on DNA oxidative damage for taxi drivers due to the exposure from traffic exhaust.

Methods: With subject consents, the levels of urinary 8-OHdG were determined for 95 male taxi drivers and 75 male community residents, as the reference group. In addition, the polymorphisms in individuals