

Environmental Health Research Network First Workshop on 17 August 2009

Workshop Report 20 August 2009

1. Introduction

The first workshop for the newly established Environmental Health Research Network (EHRN) was held on the 17 August 2009 as a video conference across four venues in South Africa: CSIR Pretoria, CSIR Durban, CSIR Port Elizabeth and CSIR Stellenbosch. The workshop was attended by 56 individuals representing 29 institutions, organisations, agencies and government departments. The list of attendees is included in Appendix 1.

This report summarises the events of the day and collates feedback from workshop attendees obtained during the breakaway sessions.

2. Agenda

The agenda for this workshop is attached in Appendix 2 and comprised six slots:

- The welcome
- Four introductory presentations focussed on environmental health research
- A breakaway session to share and collect information
- Breakaway session information consolidated by the facilitators and presented in a short feedback session
- Lastly, an open discussion and final workshop closing

3. Presentations

Four short introductory presentations were made as an introduction to the workshop and to spark ideas and thoughts to share during the breakaway sessions. These presentations are attached as Appendices 3-5 and summarised below.

3.1 Introduction and background to the Environmental Health Research Network and workshop

The first introductory presentation presented an introduction and background to the EHRN and workshop. The purpose of the workshop was to talk about environmental health research in South Africa. Besides researchers, several sectors of society with an interest in environmental health research are represented. This strengthens the ultimate goal of the EHRN and workshop, to identify the gaps in environmental health research in South Africa through a collaborative network of sharing ideas.

In January 2009, the CSIR Environmental Health Research Group was tasked to answer the question, what are the important environmental health research questions in South Africa, and what research should we, as part of the research community, be doing to help answer these questions? It was then that the CSIR realised the need to bring together environmental health researchers to create a EHRN to answer these questions and better direct environmental health research in South Africa for meaningful impact. The CSIR set

about creating a database of institutions, organisations and so on, which fulfil environmental health objectives. Individuals from these organisations were invited to meet at a workshop using an email network structure which has the potential for longevity as a list-serve. It is hoped that the email network will continue as an on-going virtual network for environmental health researchers to connect, collaborate, debate, share ideas and more.

As of the 11 August, the EHRN comprises approximately 85 individuals from around 55 institutions or organisations from at least 6 different countries including Australia, Mauritius, Botswana, the United States, and Canada, where researchers' environmental health research objectives are varied and diverse.

Why a workshop? It is an exciting time for environmental health, in general, in South Africa. Much work is being done by the National Department of Health and the South African Institute of Environmental Health. Concurrently, South Africa is faced with an environmental health conundrum: how do we alleviate poor environmental health conditions and associated diseases while planning for the potential adverse impacts of climate change. Through the EHRN we aim to meet one another, to identify gaps in environmental health research in South Africa and to plan for action. The Workshop also provides us with the opportunity to strengthen relationships for the future and ultimately, to do impactful environmental health research for South Africa.

3.2 What is environmental health research?

Environmental health is an integral part of primary health care and strives to promote wellness and prevent disease with specific emphasis on controlling environmental factors that negatively impact upon human health. According to the World Health Organization, environmental health comprises those aspects of human health and disease that are determined by factors in the environment. It also refers to the theory and practice of assessing, correcting and controlling factors in the environment that can potentially affect health. Several definitions are available; however, the WHO definition is possibly the most consistently applied.

To get a better feel for what constitutes environmental health, and from a South African perspective, a roadmap of ideas around environmental health is considered. One might say there are seven facets to environmental health: health itself; basic needs or environmental factors; governance; research; risk assessment; prevention and control; and training and education. Ideas have been put into boxes but this does not mean that they do not fit in other boxes, and of course, there is overlap between one box of ideas and another. For example, knowing something about the state of environmental health will inform the work carried out in the research box. One may define research as a systematic investigation to extend knowledge and help humanity. This second comment is of utmost importance to South Africa.

Environmental health looks at ways to improve and control environmental factors impacting upon human health; understanding the epidemiology of environmental diseases; and monitoring and evaluating the environmental health status of a population. From previous research findings, one might suggest that the link between environmental health and disease is fairly well established. Ill health may be related to environmental hygiene and improvements in environmental hygiene contribute to better health. However, it is

probably less complicated to attempt to improve the environment than it is to change people's behaviour.

To get a better idea of what environmental health research is, the 'headlines' of recent environmental health research journals were reviewed. In the UK, the Chartered Institute of Environmental Health publishes their journal entitled *The Journal of Environmental Health Research*. Their scope of articles published is diverse and includes environmental protection, health promotion, housing and health, environmental health education and so on. The article titles listed in the most recent *International Journal of Environmental Health Research* cover topics such as sewage effluent, housing and damp, mercury exposure and rodent infestation control. The esteemed *Environmental Health Perspectives* August 2009 volume focuses on two key interests: the future of toxicity testing and ethics in observational research. *The Journal of Environmental Health*, dedicated to the advancement of the environmental health professional, features articles on public health policy in relation to swimming prohibitions, damp and mould growth, and associated self-reported leisure time physical inactivity and PM_{2.5} air pollution exposure. Evidently, a diverse range of environmental health interests are covered here.

The 'headlines', so to speak, of the recent South African Medical Journal are:

- Community-based care of stroke patients in a rural African setting
- Hospital and community isolates of uropathogens at a tertiary hospital in South Africa
- Fifty years of thoracic surgical research in South Africa

Changing gears and looking to the news in South Africa to get a feel for what is happening on the ground in terms of environmental health research, this presentation would not be complete without the topic raised in the following article 'Measures to contain swine flu in place'. One week of local newspapers' content was searched for articles related to environmental health and especially, environmental health research. Here are the results:

- A school feeding programme being supported through new partnerships and funding.
- Eating your crusts may protect you against developing bowel cancer.

These articles were the only articles found with an environmental health component. However, on the health pages of the newspapers, the more commonly found headlines included the following:

- Now even electronic cigarettes are revealed as toxic cancer time bombs
- How divorce can harm your life
- Trainee medics save student after heart attack
- Tiny tumours lurk for years, the kill
- Jogging has its risks but it can also clear your head and lift your mood

None of these headlines really relate to environmental health, or to environmental health research.

To synthesis these findings, it is clear that environmental health research journals cover a diverse range of topics. Many of these journals aim to serve as a communication link between practitioners, communities and researchers. Secondly, environmental health research does not feature regularly in the news, neither good nor bad news, that is. Journals and newspapers are two prime means to sharing environmental health research ideas, outcomes and impacts, yet it is difficult to find environmental health in South African media. So, the question remains, 'How can we change this, and do we think we should?'

3.3 What do we know about environmental health research in South Africa?

This short presentation aimed to elicit ideas for the afternoon's breakaway session by considering what is known about environmental health research in South Africa. The South African Health Review, published by the Health Systems Trust has a chapter dedicated to 'developments in environmental health'. In the chapter's introduction, it reads that South Africa needs to address traditional, modern and emerging environmental health issues. Traditional issues relate to basic needs, modern issues arise from modernisation and industrialisation, such as air and water pollution, and emerging issues tend to focus on climate change and sustainability, but are not limited to these. Concerns raised include rapid urbanisation, climate change, globalisation, air pollution, poverty, food insecurity and inequity. The chapter is divided into three parts: 1-Focus on developments in environmental health services, 2-Review of main environmental health components, and 3-Human resources in environmental health. The review of main environmental health components looks at three issues only: water and sanitation, food control, and malaria control. Of course, in a developing country such as South Africa, other issues are also important and deserve prioritisation.

The review states that, in general, access to basic water infrastructure coverage has improved from 59% in 1994 to 94% in 2007; however, there is concern about the quality of the water provided. According to the 2001 White paper on basic household sanitation, community participation is essential. It is unknown whether this has been successfully achieved, but on the whole, there have been slow improvements in sanitation service provision, and hygiene awareness among South Africans remains low.

According to the review, there has been a sustained decrease in the number of nationally reported malaria cases and deaths between 2001 and 2007. Historically, the areas of concern were Mpumalanga and Northern KZN. Today, these are mainly in the low altitude border areas of Limpopo, Mpumalanga and North-East KZN. The case fatality rate in 2007 was 0.9% (where the target was set at 0.5%). Success to date is mainly the result of effective vector control, good case management and sustained political and financial support. Further control will only be achieved through inter-country collaboration.

A quick look at who is involved in environmental health research in South Africa, and by no means a complete list, hence the reason for having this workshop, includes the Medical Research Council Environment and Health Research Unit, the National Institute for Occupational Health, several groups at the CSIR, the Human Science Research Council and many University departments.

Regarding environmental health research in South Africa, work has been done in water and human health, to look at water quality, detection methods and situation analyses to assess pathogen presence in water for drinking, irrigation and recreation use, and human health risk assessments for microbes, chemicals and endocrine disruptors. Also, studies have looked at lead poisoning, exposure to persistent toxic substances, chemicals in the environment, for example, mercury exposure and community nutrition. The Medical Research Council / World Health Organisation 'Health, Environment and Development' (HEAD) study monitors change in housing conditions and health status in Johannesburg settlements.

To summarise and suggest some conclusions, much research has been done in environmental health in South Africa; however, it is difficult to know what work has been done. The issues of concern raised in the South African Health Review may not be all inclusive of the fundamental issues in South Africa requiring research attention. We do not know what research we should be doing because, for example, we do not know what the baseline is. This is only one area of concern for environmental health research in South Africa.

3.4 What is the purpose of the Environmental Health Research Network and workshop?

This final presentation summarised what is purpose of the EHRN and workshop. There are three key reasons to have the EHRN, whether a stand alone network, or facilitated through the well established South African Institute of Environmental Health:

- To strengthen environmental health research in South Africa.
- To encourage collaboration and idea sharing to augment results for meaningful impact.
- To gain a better understanding of the environmental health baseline of South Africa.

A tentative overall goal for the EHRN might be to identify the gaps in environmental health research in South Africa through a collaborative network of sharing ideas. But this is open for discussion by the EHRN members.

Besides sharing information through answering several specific questions relating to our roles in environmental health research, the purpose of this workshop is to bring together researchers in environmental health, to meet face-to-face and get to know one another. Also, to foster relationships for possible future collaborations, and to see who you can perhaps talk to when next you are grappling with an environmental health research-related issue. The environmental health research community, as a single entity, is relatively small. While environmental health is part of other research domains, few researchers focus on it in its purest, holistic form. We should, therefore, use this as our strength.

The objective of the breakaway session this afternoon is for information sharing. We hope to consolidate, for everyone's benefit, information on environmental health and our research roles, research prioritizations, research-related concerns, research collaborations and interactions.

4. Feedback from breakaway sessions

Six breakaway sessions were held across the four venues to gather information from workshop attendees to answer six specific questions:

- Your research role in environmental health
- Your concerns regarding environmental health research in South Africa
- What areas of environmental research in South Africa would you consider require prioritization?
- Who do you collaborate with in undertaking environmental health-related research?
- Do you interact (and in what ways) with Environmental Health Practitioners?
- What are your thoughts about and expectations of the proposed EHRN and how would you want to benefit from being involved in such the EHRN?

Feedback was consolidated by a group facilitator and relayed back to the workshop delegation via video conferencing. Here, feedback has been further summarised by question for the three groups in Pretoria, one group in Durban, one group in Port Elizabeth and one group in Stellenbosch.

4.1 Roles in environmental health research

The roles in environmental research of workshop attendees were diverse and are summarised in Table 1 below.

Table 1. Roles and research in environmental health

<p>Air / Atmosphere</p>	<p>Water quality management: toxicology, radioactivity, research on capacity, particularly on implementers Radiation (ionising and non-ionising radiation specifically in terms of Disaster Management) Air pollution – providing a platform and promoting it (Brown haze) Cape Peninsula – unique for air pollution Khayalitsha – Cairncross (modeling parameters) Volatile Organic Compounds (pilot study) – fuel stations Non-ionising radiation (COST BM0704 – signed agreement between Department of Science and Technology and other countries – launch 8 September 2009 (Pretoria) http://www.cost.esf.org/ Air Quality monitoring data Air pollution in densely populated areas Indoor air quality guidelines Hydrogen sulphide testing</p>
<p>Water / sanitation</p>	<p>Food safety – reviews, recommendations, implementation of policies Water quality monitoring downstream of dense settlements Sanitation behaviors of these settlements Agricultural water quality monitoring in Berg River Transfer of pathogens from polluted irrigation water to produce (export fruit and vegetables) Impact of low cost housing on sanitation and environmental pollution (impact on health from backyard shacks) Impact of low cost housing on sanitation and environmental pollution (impact on health from backyard shacks) Grey water impact study (desktop) Prevention water –borne infectious diseases Risk assessment Water and HIV/AIDS Cholera Water quality and aquatic resources Base line studies for example the prevalence of particular diseases in the region such as gastro intestinal diseases. Diarrhoea Surface water and pesticides (persistent organic pollutants)</p>

	Microbial adaptation bacteria resistant to sanitisers Drinking water standards
Solids / soil / food	Food security (availability, sustainability) – food and feeding schemes Waste management, solid waste, landfills related to food industry Research in food health and safety Food – from farm to process to consumer
Occupational Health and safety	Occupational health and safety
Governance	Department of Health fund projects of applied research (type B) to assist in policy development – service providers Directorate for research within the Department, but not specifically on environmental health Environmental practitioner training
Climate change	Climate changes – heat waves – link to health data Climate change and impact on health in Cape Winelands District Municipality
General	Vulnerability Interventions and implementation at municipal level Animal keeping in informal settlements and impacts on environment Focus on communities TUT thinking of starting a small journal where there students can publish their research Sustainable livelihoods Nanotoxicology and human health Environmental chemistry Environmental consulting Study to look at who is using public health information? Study to look at how many people, excluding academics, are doing environmental health research in South Africa? Environmental monitoring National Toxicity Monitoring Programme

4.2 Collaborations

Workshop attendees discussed who they work alongside with in carrying out environmental health research or research-related work. The entities with which collaborations exist are included in Table 2.

Table 2. Collaborations in environmental health research in South Africa

Government	Government Departments – into setting research strategies City Councils and Municipalities Department of Health, Department of Environmental Affairs, Department of Water Affairs, also input from Department of Education, Department of Mineral and Energy
Education	Educational institutions Academia – Central University of Technology, Tshwane University of Technology, University of Pretoria, University of KwaZulu-Natal,

	University of Stellenbosch, University of the Western Cape, University of Johannesburg etc
Parastatals	Rand Water Medical Research Council Eskom Transnet Agricultural Research Council Water Resource Council Council for Scientific and Industrial Research (CSIR) Resource Quality Services Health Information Systems Programme Human Science Research Council South African Local Government Association South African National Nuclear Regulator
Communities	Target groups, e.g. rural and urban, vulnerable groups
Other	South African Development Community, New Partnerships for Africa's Development, international role players and funders World Health Organisation European Commission European Union Private firms / consultants International academia and research institutes Environmental Protection Agency World Meteorological Organisation Focus groups Consultants Gates Foundation
Industry	Industries particularly with large internationally driven companies, harder to get involvement and buy in from smaller companies.

4.3 Concerns regarding environmental health research in South Africa

The concerns that were raised by workshop attendees were varied but, interestingly, all groups identified funding and data as critical areas of concern. All reported concerns regarding environmental health research in South Africa are provided in Table 3.

Table 3. Concerns around environmental health research in South Africa

Economic	Where to find the funding Funding is slow - impacts on many things but especially on capacity building Would having an environmental health equivalent of the WRC help?
Governance / training	Scope of practice of environmental health practitioners – lacking recognition of indigenous knowledge Education and marketability of environmental health practitioners profession Education at different levels – different types of eh research We have the acts, the mandate etc – but no implementation policies

	<p>Students finish studies and then go to industry – do not further their studies</p> <p>Relationship between the policymaker and the researcher needs consideration</p>
Data	<p>Data availability, sharing, access</p> <p>Data is a huge concern (lack of and/or the quality of data)</p> <p>Data sits in silos, difficult to know where to look for it</p> <p>Scope of data centres for ease of access, quality control etc</p> <p>Data needs to be packaged better</p>
Management	<p>Are we getting the basics right?</p> <p>Do we implement effectively? Who should implement?</p> <p>How do we relate to them?</p> <p>Duplication of efforts – without a journal for environmental health research in South Africa, one cannot know what work is being carried out</p> <p>Lack of collaboration – research and publications</p> <p>Lack of speciality within organisations</p> <p>Little advertising of positions available for qualified people</p>
Communication	<p>Do we communicate research effectively?</p> <p>Public awareness, e.g. hygiene issues</p> <p>Poor connections / links made between environmental information and health</p>
Research	<p>All topics not covered properly (holistically not addressed and also not geographically (not all over country))</p> <p>Burden of Disease report do not focus on linking geographical and environmental priorities</p> <p>Early warning system not available and no link between curative health and research or monitoring results</p> <p>Use available research results – collate and add meaning</p> <p>How is research helping communities?</p> <p>How is research communicated to decision makers?</p> <p>Research not always solution driven</p> <p>Academics evaluation sometimes on number of students and publications – no focus on implementation of research</p> <p>Lack of supervisors (number and skills)</p> <p>Internal policies – press for higher qualifications – compromise research</p> <p>Cannot supervise if you have a Masters degree</p> <p>Research degree-based</p> <p>National Research Foundation dictates what research, because they have the funding (student funded degrees) - not necessarily what is needed (supervisor projects)</p> <p>People do not finish post graduate studies</p>

	<p>Staff turnover increasing the potential for duplication of research</p> <p>Need more qualitative research</p> <p>Human behaviour very important in terms of attitudes, training, methods and procedures</p> <p>Environmental health research done to date requires consolidation and communication</p> <p>Changes in multiple stressors</p> <p>Trust between researchers is an important consideration</p> <p>Science is always evolving, how to make sense of it for the policymaker</p> <p>Translations of research into policy briefs</p> <p>Much research is being done but is it too thin to properly answer the questions?</p>
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4.4 Areas of environmental research in South Africa that require prioritization

Issues that arose as concerns were usually also raised as priority areas for research in South Africa. They are arranged in five categories in Table 4 below.

A general comment about prioritization was that it would appear that much research in environmental health has been done but it has not been synthesized and made accessible to the broader research community.

Table 4. Areas of environmental research in South Africa requiring prioritization

<p>The basics / environmental factors</p>	<p>Water and sanitation</p> <p>Air quality – outdoor and indoor</p> <p>Waste management</p> <p>Soil pollution</p> <p>Food safety</p> <p>Integrated water resource management</p> <p>Storm water being the regular or back-up as sewer</p> <p>Storm water under Roads and storm water – only care about volume (not what it contains)</p> <p>Volatile organic compounds (contribution air craft traffic)</p> <p>Coastal and inland water quality (recreation)</p> <p>Solid waste management (mercury) and new energy saving bulbs and cadmium in batteries</p> <p>Impact of application of treated sludge and waste water in agriculture</p> <p>Food fortification and the impact</p> <p>False sense of security in terms of organic produce</p> <p>Water quality monitoring especially groundwater, parasites, microbial, chemicals</p> <p>Why are pathogens re-emerging in for ex developed countries?</p> <p>Environmental factors that drive outbreaks such as cholera outbreaks in the United States?</p> <p>Waste disposal and the chemical pollution that goes with that in terms of water and air</p>
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	Pesticides and endocrine disruptors
Health and people	<p>Lifestyle diseases Communicable diseases Rodents (vector control) Unregulated slaughtering in informal settlements and environmental pollution and human health impacts due to affected meat Unpasteurised milk (fermentation) What are people exposed to and how much are they exposed to Issues of coping, behavioural change Vulnerable communities need to be supported Communicable diseases need to be the most important priority TB, acute respiratory tract infections Chemical poisoning Medical waste and integrated waste management systems</p>
Climate change	<p>Climate change and related diseases Climate and water ecosystem health Alien and invasive species and climate change Disaster management Coping Adaptation to climate change Government needs scientifically based input to policies re Climate change and biofuels</p>
Interventions	<p>Interventions Coping and adaptation Cooperative governance Application of pesticides in agriculture Household pesticide use Status of services rendered</p>
General	<p>Core research skills across media – risk assessment, environmental pathways, prevention/control Very large research area, equally personal interests in multiple aspects – dilution of research capacity across priority research areas (potential risk for impact) Careful that research is needed and that it is not a question of implementation of what has already been researched Prioritize research needs, starting with local level Monitoring programmes Networking</p>

4.5 Interactions with Environmental Health Practitioners

Individuals working in environmental health research or related areas agreed that there are interactions with Environmental Health Practitioners, but at varying levels and degrees of involvement.

Some researchers have interactions with Environmental Health Practitioners during field work, sampling, data requirements, and area identification stages of the research process. These researchers lobby that it is crucial to interact with Environmental Health

Practitioners to get access to research platform. The concern is how to make them partners in research rather than researcher asking them for information and assistance.

Other researchers have interacted with Environmental Health Practitioners through learning programmes and skills transfer, guest lecturing and identifying research priorities. A question is what is the role of research in supporting Environmental Health Practitioners? Does a gap exist here, and what is the researcher's role to help close this gap? For example, the role of research in supporting Environmental Health Practitioners and how to communicate science – to use collaboration, science communication and science filtering.

4.6 Thoughts about and expectations of the proposed Environmental Health Research Network and how one would want to benefit from being involved in this initiative

There was consensus between all workshop attendees that there is a place for the proposed virtual EHRN. Specific expectations and concerns are expanded upon in the table below.

Table 5. Expectations of the proposed Environmental Health Research Network

General	<ul style="list-style-type: none"> Be a potential research warehouse Facility for knowledge management and dissemination Gives opportunities to collaborate/network -- around science transfer and uptake Source of advice Communities will benefit
Expectations	<ul style="list-style-type: none"> Could help identify potential collaborators Can provide solutions to my problems Could identify research topics from needs in environmental health Get contacts Good database Can contribute with capacity building Role for networking (researchers); advice (government departments); motivate students (keep in sector) Expertise register to EHRN with relevant individual or institution
Structure	<ul style="list-style-type: none"> EHRN should be broad enough to include all necessary and relevant disciplines Experts for recognising, evaluating, control and monitoring Must be formalised body and have constitution to ensure sustainability Ability to join from student level Quality research (methodology) – epidemiology – include expertise on research design (to advise on quality) Support function (mentoring) Motivate post grads that there is a place where they can go to for advice
Meetings	<ul style="list-style-type: none"> Have periodic meetings/conferences Add EHRN meeting to another environmental health-related conference in South Africa
Applications	<ul style="list-style-type: none"> Strengthens research capacity and be able to respond to calls for

	funding
Concerns	Funding formula from Education – in terms of funding being divided between number of authors or collaborators on papers – working against collaborating Still unsure how this will pan out in future Costs could be high to individuals – giving a lot of personal time and energy WHO guidelines on “how to establish such a network” Distance between funders and researchers (unbiased research) – honest broker How to ensure research results in action – organisation versus individual pressure (organisation should provide pressure to publish or get message out there etc and should not leave it to individual researcher to their work in media and to general public) IP could be a problem but there is a need for a network Anything worthy of communicating should be sent to the right people and/or departments Make information available through such a network, but organisations participating should transfer information to their constituents so as not to duplicate information/communication

5. Comments from general discussion

Could the EHRN, as an entity, lobby with greater degrees of success for access to data compared to an individual from a singular institution?

It is imperative that the EHRN has close ties with the well established South African Institute for Environmental Health and Environmental Health Practitioners.

The proposed EHRN should look closely at the European Union ‘Health and the Environment’ network.

Advice should also be sought from those who established the ‘Network of Young Scientists’.

How does one subscribe to the environmental health journals? Each journal has a website and one may subscribe as an individual by becoming an individual member or through their institution as an institution member.

There is a need to strengthen environmental health within Integrated Development Plans.

The EHRN should include other stakeholders such as department of agriculture, department of mining, trade and industry, department of science and technology, Water Research Council and Agricultural Research Council as well as collaboration with National Research Foundation.

Environmental health research is supposed to answer questions of environmental health. The research needs to enter the profession and assist the public and it needs to filter down to the grass roots level.

6. Conclusions

In conclusion, much was discussed and many fruitful initial relationships were forged at the first workshop of the proposed EHRN. This report serves to collate discussions across four venues in Pretoria. Some members of the EHRN were unable to attend the workshop and their comments, thoughts and ideas are welcomed. These will be compiled in an additional Appendix. Workshop attendees are also more than welcome to comment and initiate conversations around the report content.

In the near future, the EHRN will launch its website and list serve software will be employed to properly begin the virtual networking envisioned for the EHRN.

With the support of several well established institutions and organisations, the EHRN is sure to succeed and serve its members well.

7. Appendices

- 1 - Workshop Agenda
- 2 - List of workshop attendees
- 3 - Workshop presentations

Appendix 1 - List of workshop attendees

	Name	Institution
Pretoria		
1	Caradee Wright	CSIR NRE EHRG
2	Rietha Oosthuizen	CSIR NRE EHRG
3	Juanette John	CSIR NRE EHRG
4	Jino Mundackal	CSIR NRE EHRG
5	Linda Godfrey	CSIR NRE
6	Emma Archer	CSIR NRE
7	Brendon Barnes	University of the Witwatersrand
8	Olga de Smidt	Central University of Technology
9	Desmond Jacobs	TUT
10	Louisa Magabane	Gauteng Department of Health
11	Ingrid Mokgobu	TUT, Environmental Health Dept
12	Nosipho Molefe	DWAF Resource Quality Services
13	Jonathon Okonkwo	TUT
14	Jane Olwoch	University of Pretoria
15	Hester Roberts	Central University of Technology
16	Henry Roman	Metago
17	Andre Rose	University of the Witwatersrand
18	Gerhard Swanepoel	TUT
19	Melusi Thwale	DWAF Resource Quality Services
20	Cheledi Tshehla	South African Weather Service
21	Jongikhaya Witi	DEA
22	Gopaul Rangasamy	City of Tshwane Metro
23	Mariette Swart	Department of Water Affairs
24	Marna van der Merwe	CSIR
25	Wouter Le Roux	CSIR
26	Madikizela Bonani	WRC
27	Murdock Ramathuba	Department of Health
28	Norman Chambers	Innovation Hub
Durban		
29	Mamopeli Matoane	CSIR NRE EHRG
30	Tirusha Thambiran	CSIR NRE
31	Cassandra Abboy	Zanokuhle
32	Ana Bigara	Mangosuthu Uni Tech
33	Angela Brown	PCRM
34	Archie Buthelezi	Mangosuthu Uni Tech
35	Siva Chetty	Health Unit eThekweni
36	Paul Chelule	UKZN
37	Rico Euripidou	groundWork
38	Jafta Nokosana	UKZN
39	Jay Maniram	KZN Department of Health
40	Selva Mudaly	SAIEH
41	Nomcebo Mvelase	groundWork
42	Brent Newman	CSIR
Port Elizabeth		
43	Patricia Albers	CSIR
44	Roman Tandlich	Rhodes University
45	Nikite Muller	Rhodes University
46	Henry Maarschalk	Nelson Mandela Metropolitan University
47	Charles Qoto	Nelson Mandela Metropolitan University
48	Patrick Nodwele	Nelson Mandela Bay Metro
49	Wendy Dunywa	Nelson Mandela Bay Metro
50	Dirk	Nelson Mandela Bay Metro
Stellenbosch		
51	Maronel Steyn	CSIR

52	Bettina Genthe	CSIR
53	Jo Barnes	University of Stellenbosch
54	Thashlin Govender	University of Stellenbosch
55	Prof Barney de Villiers	University of Stellenbosch
56	Reinardt Avenant	City of Cape Town

Appendix 2 – Workshop Agenda

Appendix 3 - Workshop Presentations (PowerPoint files)