ENVIRONMENTAL HEALTH CURRICULUM

Bachelor of Science in Environmental Health
"Programme specific for the needs of Africa"

Revision 01
April 2010

Preface

As the Chairperson of the Africa Academy for Environmental Health (AAEH) it gives me great pleasure to introduce the first ever generic curriculum developed in environmental health training for Africa. As disease and pollution does not respect borders it is important that a common understanding of environmental health is necessary to ensure that environmental health stressors are managed in a co-ordinated approach. Africa is a unique continent with unique challenges as far as environmental health service delivery is concerned. Although environmental health training in Africa is to address the needs for Africa it is also important that it does not loose track of the global approach and perspectives.

A need was identified by the AAEH to develop such generic curriculum and through the financial assistance of the British Council (DelPHE grant) the development of a curriculum was one of the AAEH main objectives. The delivery of academic programmes however goes hand in hand with quality assurance and the AAEH developed a quality manual parallel to the curriculum development process. It needs to be emphasised that the main purpose of this curriculum is to impart and generate knowledge that pertains to effective recognition and response to environmental health problems. The curriculum is based on a specific cluster of related knowledge, skills and attitudes that are appropriate to the practise of environmental health in Africa.

A broad consultative process was followed that included the various stakeholders in environmental health. Workshops were held in South Africa, Malawi and Kenya and various drafts were circulated for comment and input. It needs to be put on record that without the input of various organisations, training institutions, government departments and professional organisations this document would have not been complete (see Addendum H for a list of contributors). Specific reference needs to be made to Me Jeannie Snyman, a curriculum development specialist of the Tshwane University of Technology in South Africa for the professional manner in which the various workshops and related activities were facilitated and comments and inputs judged and managed. The curriculum portfolio holders of the AAEH also need special mentioning for dedication in completing the curriculum.

The AAEH hopes that this curriculum will assist training Institutions to develop and improve the outcomes expected of programmes to render an effective environmental health service.

JC (Koos) ENGELBRECHT Dr
CHAIRPERSON: AFRICA ACADEMY FOR ENVIRONMENTAL HEALTH
30 April 2010

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List of Acronyms

AAEH	Africa Academy for Environmental Health
EH	Environmental Health
EHPs	Environmental Health Professionals
EHOs	Environmental Health Officers
IFEH	International Federation of Environmental Health
IFF	International Faculty Forum
HACCP	Hazard Analysis Critical Control Point
HD	Human Development
HIMS	Health Information Management System
MDGs	Millennium Development Goals
SADC	Southern African Development Community
SSA	Sub-Saharan Africa
WHO	World Health Organization
WIL	Work Integrated Learning

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Bachelor of Science in Environmental Health Programme specific for the needs of Africa

1.0 Preamble

1.1 Environmental Health

Environmental Health (EH) is the assessment and management of environmental influences (e.g. chemical, physical, biological, social and psychosocial factors) on human health (Figure 1). This entails the study of food safety and hygiene (including production, distribution and fitness for human consumption), occupational health and safety (including investigation and control of work-related ill health), community health (communicable and non-communicable disease control and prevention, disaster management, health promotion and education), the built environment (including homes, workplaces and public spaces) and pollution control (including the control of the air, land and water). EH is about taking a preventative approach to tackling disease and ill-health rather than a curative approach.

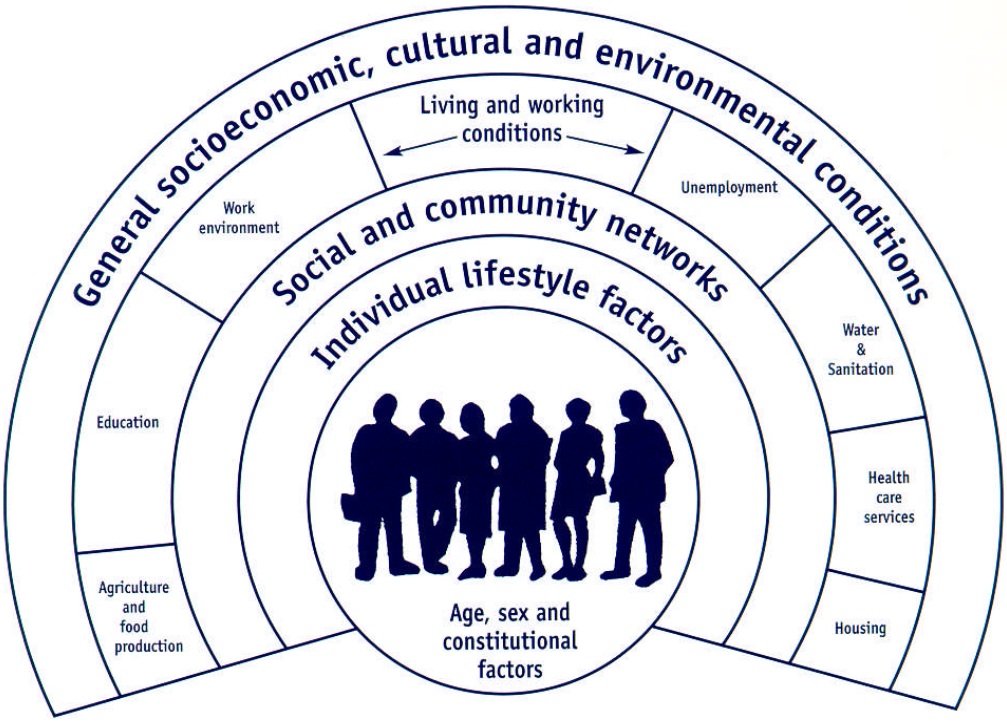


Figure 1: The Main Determinants of Health
(Adapted from Dahlgren & Whitehead, 1991)

Progress towards the key Millennium Development Goals (MDGs) can be accelerated through improved environmental health conditions, in particular the MDGs for child health, access to water and sanitation and environmental sustainability. While many other interventions may also accelerate progress, the multi-sectoral approach to environmental health offers cost effective and sustainable improvements. Environmental risk factors account for 21% of the overall burden of disease worldwide, and more in developing countries. Some 1.7 million young children die each year from diarrhoeal disease associated

with inadequate water supplies, sanitation and hygiene and a further 1.4 million child deaths from respiratory infections are attributable to indoor pollution. Environmental improvements are often more cost-effective as health measures than curative health services (Cairncross *et. al*., 2003).

Environmental health services are normally located within local authorities/councils/assemblies (acting under the directorship of Ministries of Health) and are managed by Environmental Health Professionals (EHPs) who are charged with implementing environmental health policies through monitoring and control activities. They also carry out that role by promoting the improvement of environmental parameters and by encouraging the use of environmentally friendly and healthy technologies and behaviours.

In Africa EHPs are normally graduates who have completed either a Bachelor's Degree in Environmental Health or a Diploma in Environmental/Public Health. EHPs implement the principles of risk assessment and management to address adverse environmental influences on health, improve the health of the community and contribute to sustainable development. They achieve this through professional practice by ascertaining, correcting, controlling, minimizing and preventing those factors in the environment that can potentially and adversely affect the health of present and future generations. The EHP is usually a member of a multi-disciplinary team of health-care professionals, and is able to communicate effectively, foster entrepreneurship, uphold professional and environmental health ethics and manage human, financial and physical resources within the scope of profession.

1.2 Context

The development and practice of Environmental Health in high human development (HD) countries has resulted in significant improvement to the environment and health of the population and people generally live a relatively healthy lifestyle with a life expectancy, on average, of more than 80 years. In contrast, the average life expectancy of someone coming from a low HD country in sub-Saharan Africa (SSA) is half of that (HDR, 2007). For the region as a whole life expectancy today is lower than it was three decades ago. Several countries in SSA have suffered catastrophic reversals: 20 years in Botswana, 16 in Swaziland and 13 years in Lesotho and Zambia (HDR, 2007). A report on children's environmental health conducted by the World Health Organization (WHO) Regional Office for Africa of 6 African countries (WHO 2005) concluded that the main environmental health factors causing morbidity and mortality are related to inadequate access to safe water supplies, inadequate sanitation, inadequate solid and hazardous waste management and disposal, inadequate vector control, inadequate housing/overcrowding, poor personal hygiene, air pollution, exposure to various non-communicable diseases etc. – all areas which have been successfully tackled and are properly regulated by environmental health authorities in most developed countries. Today 28 of the 31 low human development countries are in SSA (HDR, 2007).

Specific examples of differential HD indicators for developing countries in the Africa Southern African Development Community (SADC) and developed countries are outlined below (Adapted and modified from Chunga *et. al*., 2004).

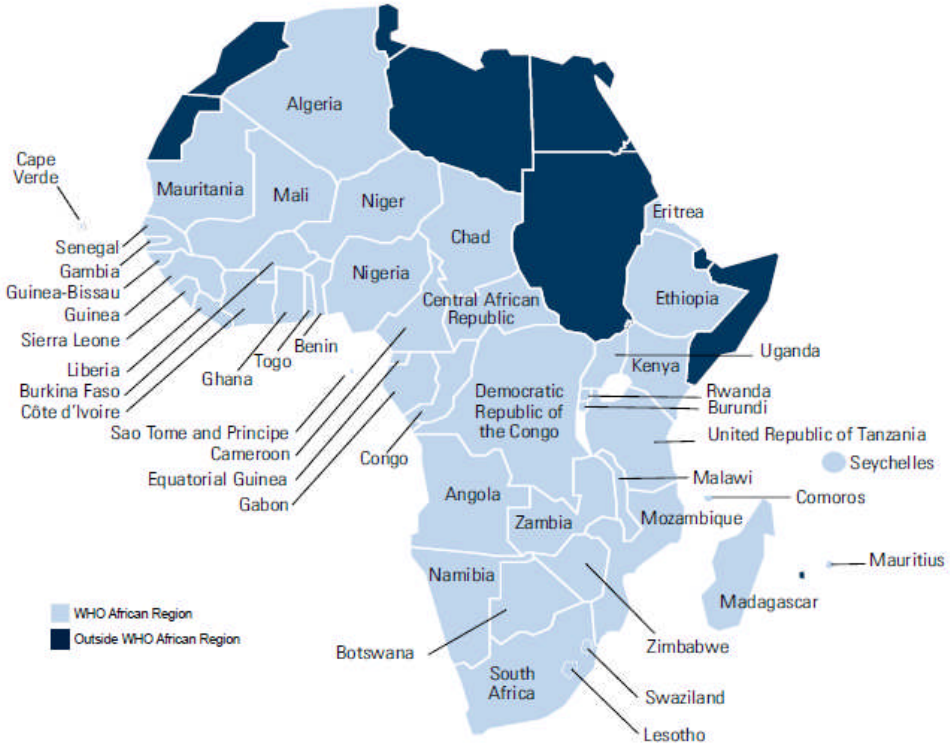
Table 1: Examples of differential HD indicators

Human Development Indicator (HDI)	Summary of HDI data for low income SADC and developing countries	Summary of HDI data for high income SADC and developed countries
Life expectancy	< 40 years	80+ years
U5 mortality	200+ / 1000	< 10 / 1000
Diarrhoeal related deaths in < 5's	20 - 30%	< 0.1%
HIV/AIDS prevalence	10% to 20%	< 0.2%
Malaria prevalence	25 - 40%	0%
TB prevalence	242 / 100,00	< 5 / 100,000

The SADC Health Protocol (1996), of which all the African participants of this project are members, emphasise the importance of improving environmental health conditions of communities especially in rural and under-developed areas.

1.3 Establishment of the Africa Academy for Environmental Health

The concept of an 'Africa Academy for Environmental Health' was first proposed by Dr. Koos Engelbrecht, from Tshwane University of Technology in South Africa at the International Faculty Forum (IFF) on Environmental Health Education (5th World Congress on Environmental Health, Stockholm) in 1998. At this meeting, the International Federation of Environmental Health (IFEH) endorsed this concept. The IFEH is a Federation of National Associations of professionals working within the field of environment and health protection (www.ifeh.org). The IFEH currently has full members in 39 countries and 28 Academic Associate members. Countries are spilt on a regional basis with the interests of African countries represented by the Africa Region Group (Figure 2).



Adapted from the African Regional Health Report 2006

Figure 2: Africa Region of the World Health Organization

At the first Africa conference on Environmental Health Education held at Bagomayo, Tanzania in October 2001 hosted by the Tanzanian Environmental Health Officers Association (CHAMATA), the above concept was moved forward. Participants from a number of African countries came together to discuss many environment and health issues that are specific to Africa. At this meeting, it was unanimously agreed that there was a need for a proactive communication system, using electronic media, to improve the exchange of information among lecturers, technicians and students within African academic institutions. Amongst the many resolutions tabled, the Africa Group of the IFEH gave a mandate to three Universities in Tanzania, Malawi and South Africa to collaborate and establish an

Africa Academy. At the 1st All Africa Congress on Environmental Health in Nairobi, Kenya (27th – 30th August 2007) the Academy was officially launched after more than 10 years of preparatory work. The Academy submitted an article to the International Federation of Environmental Health professional journal announcing this momentous achievement (Engelbrecht & Grimason, 2009) and similarly flagged up this development on the IFEH Africa Academy for Environmental Health (AAEH) website (http://www.ifeh.org/afa/index.html).

The long term goal of the partnership is to establish a body of African academic institutes under the auspices of the AAEH to instigate develop and advance training, science and the practice of environmental health within the SADC region, and throughout the continent. This should lead to a cadre of well qualified environmental health graduates and professionals in each country (Figure 2).

1.4 Justification for the development of the curriculum

In Africa it is recognised that there is a shortage of EHPs per head of population and national policies are currently directed at addressing this problem. A review of environmental health education in 6 African countries (Angola, Botswana, Cameroon, Kenya, Mali and Zambia) by the Africa Region of the WHO (2005) reported that few countries offered environmental health courses. Only Kenya had an adequate number of environmental health degree programmes in place producing the requisite number of graduates required for the size of the country. In the other five countries the approach to environmental health education and enforcement was fragmented and only specific areas covered through allied professionals (i.e. nurses, doctors) e.g. health education, community health or as a module in a Masters in Public Health course. It concluded that a more holistic and co-ordinated approach to environmental health practice was needed and that the academic sector could address this problem through the provision of appropriate courses but at the present time is completely under utilised. Even where degree programmes do exist concern has been expressed that the curriculum for training EHPs (in West Africa) lagged behind the skills required to cope with the challenge of environmental monitoring and control (Emeharole, 1993). Emeharole reviewed the existing curriculum for the training of EHPs at the diploma and degree levels in the sub-region and concluded that both curricula lack sufficient credit weight to impart the desired skills to perform the highly scientific task of environmental monitoring, which is a problem we envisage exists in other African countries. The lack of appropriately qualified professionals in this area inevitably leads to inadequate environmental health practice and enforcement, inappropriate environmental health policy and strategy for action, the lack of sound information for priority setting and planning, the absence of a suitable set of environment and health indicators, and the lack of an appropriate performance indicator system (Emeharole 1993; WHO 1998; Thomas *et. al*, 2002; Cairncross *et. al.*, 2003; WHO 2005).

In 1998, the African Region of the WHO announced that “it is indispensable to strengthen the capacities of the ministries of health to promote environmental health as a precondition for any sustainable human development”. In this respect, it called upon ministries of health to act as catalysts in directing, coordinating and promoting environmental health and hygiene activities, through: (i) the adoption and implementation of policies, strategies and plans of action on environmental health and hygiene and (ii) strengthening of inter-sectoral collaboration between all environmental health actors and stakeholders. It encouraged ministries of health to establish an appropriate legal framework for implementing environmental health activities, integrate environmental health into all local and national development programmes and projects, mobilise the resources needed to support and strengthen these activities, promote community-based local initiatives in the area of environmental health and coordinate interventions related to the management of environmental health activities (WHO 1998a). The SADC Health Protocol, of which all the African participants of this project are members reaffirms the importance of improving environmental health conditions of communities especially in rural and under-developed areas. The WHO has also committed itself to the Health for All in the 21st Century framework which makes explicit three goals (WHO 1998b): (i) an increase in life expectancy and improvement in the quality of life for all; (ii) improved equity in health between and within countries and (iii) access for all to sustainable health systems and services. While not encompassing all the actions, environmental health

falls clearly in the interface between health and development and is therefore critical to the goal of "making health central to human development." (Thomas *et. al*., 2002; Cairncross *et. al.*, 2003).

To achieve these goals in Africa, various Ministries of Health are (i) encouraging the establishment of environmental health degree programmes from scratch in higher education institutes where none currently exist; (ii) recruit appropriately qualified and research active academic staff to deliver the programme and undertake research; (iii) improve the professional capacity of academic staff to enable them to review and/or upgrade existing Diploma in Public Health programmes to Bachelor's in Environmental Health dgrees, (iv) ensure that such degrees are accredited and reviewed by appropriate professional bodies and (v) provide appropriately tailored continuous professional development courses for practising EHPs. The development of the proposed curricula for environmental health degrees in Africa is intended to ensure that irrespective of the location within Africa all environmental health professionals will be educated to the same core curriculum. This will ensure that cross-cultural insights have been shared and leads to the development of environmental health professionals who have common internationally recognized educational base. This will facilitate transportability of qualifications and mutual recognition of partners.

2.0 AAEH consultation process

A concept document entitled 'Developing an International Competence-Based Curriculum for Environmental Health' was developed by the University of Birmingham, Dublin Institute of Technology and Chartered Institute of Environmental Health to guide the development of an international curriculum in 2008 and was presented at the IFF prior to the World Congress on Environmental Health in Brisbane (Brennan *et. al*., 2008). The document emphasized the concept of core skills for Environmental Health Professionals and focused upon the need for the development of a curriculum that enhanced the knowledge, ability and skills that are uniquely possessed by environmental health professionals. Using this document as a template the AAEH held a workshop in Pretoria in March 2009 and produced a revised document that emphasized the development of an internationally portable curriculum aimed at (i) promoting environmental health articulation within various countries in Africa and (ii) which emphasised the importance of addressing environmental health problems specific to the African continent. Subsequent workshops held at Tshwane University of Technology in Pretoria (3rd – 5th March, 2009), University of Malawi in Blantyre (27th – 29th May 2009), Moi & Kenyatta Universities in Nairobi (17th - 20th August 2009) and the University of Johannesburg (22nd – 25th February 2010) have moved this process forward. The proposed curriculum is the result of the commitment and hard work of various environmental health academics and practising professionals from the higher education institutes and professional associations listed in Appendix 1. The curriculum will be officially launched at the 2nd IFEH Africa Group All Africa EH congress in May 2010 (24th – 27th May) and presented to the Chair of the Africa Group of the IFEH. Thereafter the document will be circulated to all member institutions of the AAEH and placed on the IFEH website for consultation (http://www.ifeh.org/afa/index.html).

3.0 Vision of the AAEH

To ensure a harmonized and portable EH curriculum throughout Africa.

4.0 Goals of the AAEH

1. Produce environmental health graduates who are competent to practice in Africa.
2. Harmonize the EH curriculum with the AAEH quality assurance framework and criteria.

5.0 Objectives of the AAEH

1. To impart and generate knowledge that pertains to effective recognition and response to environmental health problems among environmental health students, scholars, researchers, professionals and the community at large.

2. To enhance appropriate use of natural and human resources to promote good health and sustainable development.
3. To impart skills and relevant methods used in identification, diagnosis and management of environmental health hazards.
4. To guide higher education institutions in Africa in the delivery of environmental health programmes.

6.0 Recommended Entry Requirements

Students should comply with the relevant national and institutional policies which allow for vertical and horizontal articulation.

Both conventional (e.g. school leavers) and experiential (e.g. mature students with advanced prior learning) entrance routes should be considered for all potential scholars.

Students entering through the experiential/mature route must be able to demonstrate that they have acquired sufficient knowledge and/or qualification in the following areas

- Mathematics
- Core sciences
- Language competency

7.0 Recommended course duration and course requirements

7.1 Duration of the programme

The duration of a degree course of the programme would normally be 4 academic years. Diploma and certificated courses may be shorter. Minimum and maximum periods for completion of study should be in accordance with institutional and professional policies

7.2 Course requirements

All aspects of the curriculum must be achieved together with any integrated practical training modules, if appropriate, to attain competency.

The AAEH curriculum for the Bachelor's degree in EH stipulates the minimum competencies that a graduate should achieve to practice. These competencies consist of relevant knowledge, skills and attitude. These competencies can be achieved either through an integrated curriculum approach or postgraduate (i.e. upon graduation) practical training. These should include teaching strategies such as, laboratory practices, field trips, industrial attachments; work integrated learning, service learning as detailed in the curriculum outcomes.

7.3 AAEH teaching strategy

This curriculum supports and promotes a learner centred approach to achieve the competencies stated in section 11. The AAEH recognises that institutional policies will govern the teaching strategy used.
Teaching strategies should be a balance of theoretical, practical and experiential knowledge and skills. Lecturer-directed, peer-controlled and self-controlled strategies that are recommended are for example:

- Collaborative Learning
- Discussion Strategies
- Experiential Learning
- Games/ Experiments/ Simulations
- Inquiry-guided Learning
- Interdisciplinary Teaching
- Learner-centred Teaching
- Learning Communities
- Lecture Strategies
- Online/hybrid courses
- Problem-based Learning

- Service Learning
- Teaching with Cases
- Team-Based Learning
- Team Teaching
- Writing Assignments

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7.4 AAEH competency criteria

This curriculum is based on a specific cluster of related knowledge, skills and attitudes that are appropriate to the practice of EH in Africa and were compiled by the AAEH after the Pretoria workshop (March 2009) to develop and expand upon the recommendations of the IFF of the IFEH (Brennan *et. al*., 2008). These can be measured against accepted standards and norms, and can be enhanced through assimilated integrated professional training and development. This cluster of competencies is embedded in the curriculum.

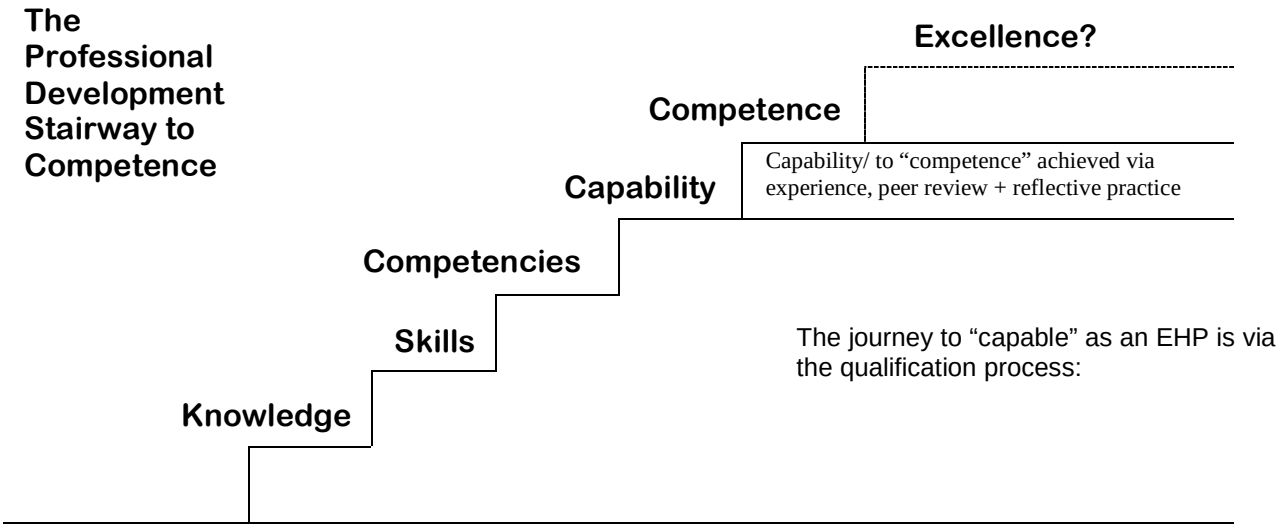

Figure 3: The Professional Development Stairway to Competence (Brennan & Lewis, 2008)

Table 2: Clusters of related knowledge, skills and attitudes appropriate to EH

Knowledge	• Risk assessment/management principles • Anatomy physiology, basic toxicology and infection • Environments of humans and its related ecologies (institutional, recreational, etc.) • Social, natural, health sciences, economic and engineering science • Epidemiology and disease control • Environmental Health protection measures and methods of control (food, water, land, pollution control, occupational health and safety) • Health education and promotion • Research methodology and biostatistics • Inequalities in health • Principles of sustainable development

	• Public health nuisances • Principles of management (including health management systems) • Pest control (health and nuisances) • Relevant legislation and codes of practice (National and international) and relevant legal Processes
Skills	• Determine and articulate the nature of a hazard and quantify the level of risk associated with that hazard • Determine appropriate courses of action to promote public health • Determine appropriate courses of action to • remedy environmental health problems • Interpret qualitative and quantitative data and develop appropriate action • Design a proposal, conduct research, interpret results, implement findings and evaluate the impact of interventions • Demonstrate interpersonal skills • Plan, execute and report on assessments, investigations and audits • Demonstrate effective communication skills • Enforce law • Obtain admissible evidence and apply due legal processes • Become a reflective practitioner by applying competencies and experiences • Ability to interact with and work within all relevant stakeholders (community partnerships) • Ability to contribute to the continual development of the profession (e.g. evidence based practice, dissemination of information) • Project management
Competence	• Risk management: Monitor, identify, evaluate, control, communicate, manage biological, chemical, physical, social and psychosocial stressors that may act upon and within the physical, social and human environment • Identify, communicate and engage with relevant stakeholders • Design and implement appropriate intervention strategies taking to account all available information e.g. economic, gender, political and ethical considerations
Work Integrated Learning/Placement	Work Integrated Learning / professional placement should be included in the syllabus and therefore guidelines for this learning opportunity must be established.

8.0 Assessment strategy

Assessment of competencies should be aligned with institutional, and where applicable, professional policies.

A combination of various assessment strategies should be utilized in order to ensure achievement of the stated competencies and assessment criteria. Therefore the theoretical, practical and reflexive aspect of the curriculum must be assessed.

In the assessment strategy as a whole, evidence must be demonstrated through a variety of options which can include case studies, problem solving assignments and strategies, portfolio of learning materials, projects, written and oral examinations, log books and practical exercises and demonstrations. Some strategies will be more suited to assess foundational competence while others are more suited to assess practical and reflexive competence. Practical, foundational and reflexive competences are defined as follow:

- Practical competence – the demonstrated ability to perform a set of tasks and actions in authentic contexts.
- Foundational competence – the demonstrated understanding of what we are doing and why we are doing it.
- Reflexive competence – the demonstrated ability to integrate our performances with our understanding so that we are able to adapt to changed circumstances and explain the reason behind these adaptations.

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All assessors must comply with relevant quality standards of the institution. A copy of the AAEH Quality Assurance manual can be found at AAEH IFEH website (http://www.ifeh.org/afa/index.html).

9.0 Credit transfer

The AAEH anticipate that credit transfer/exemption/waiver/progression will be accommodated between institutions where policy allows.

10.0 Certification

On successful completion of all requirements the degree that will be awarded is the Bachelor's degree in EH. Practical training and competence may be certified by professional bodies.

11.0 Curriculum

The curriculum of the Bachelor's degree in EH presented in this document reflects the intended learning outcomes or learning experiences that should be demonstrated by the graduate. Institutions should use this curriculum as a basis to develop *their own learning plan or program* that includes the selected, ordered learning experiences/outcomes and steps in providing the learning experiences/outcomes. The learning plan or program should reflect all the learning outcomes that would be acquired by students from teaching as well as the assessment strategies. (Johnson,1969:7). This process is elucidated in **figure 3: Components in the curriculum-learning program complex**.

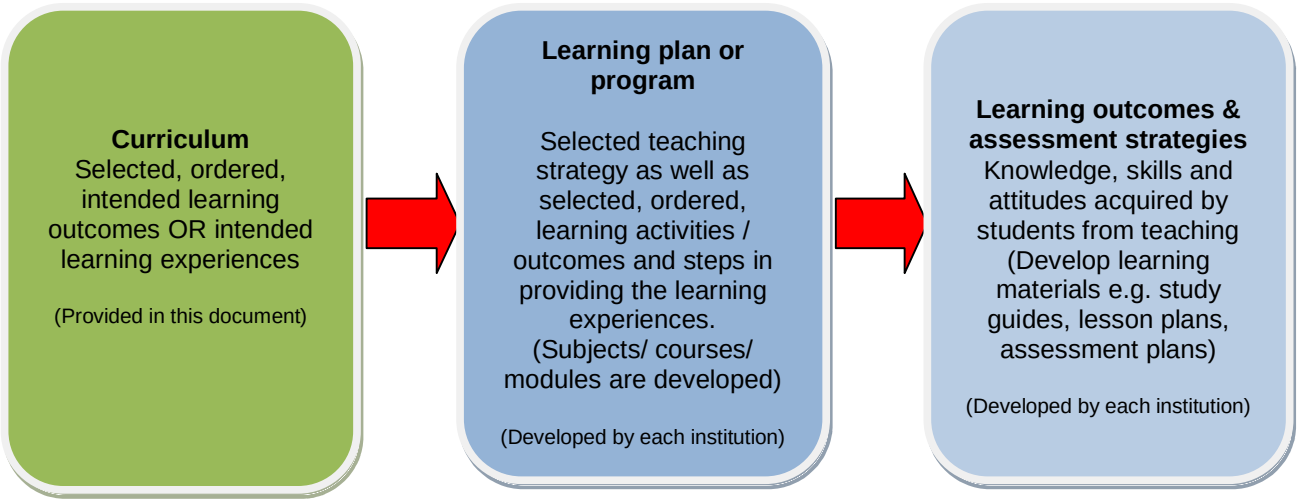

Figure 4: Components in the curriculum-learning program complex (Johnson,1969:7)

11.1 Development of learning plan or program

Depending on the institutional mission and vision, teaching and learning strategy (policy) and resources, a relevant mode of delivery (contact, distance or mixed mode) as well as an appropriate teaching strategy would be selected. (Examples of teaching strategies are listed under point 7.3).

The content of the learning plan or program would be divided into various subjects / courses/ modules. The structure of these subjects / courses/ modules would be influenced by the selected teaching strategy. The developed modules of a learning program following for example a Problem-based Learning approach would integrate the content of the curriculum whereas a Lecture Strategy might consist of subjects/ courses / modules that are more fragmented. Depending on the teaching strategy, a variety of learning activities (e.g. lectures, tutorials, syndicate groups, independent self-study, problem solving techniques, field trips, practicum and community oriented research projects) as well as assessment strategies (see item 8.0) would be selected to match the teaching strategy. Finally, the relevant learning materials would be developed e.g. study guides, WIL guides, practical guides, lesson plans, assessment plans etc.

11.2 Development of the curriculum

The core outcomes that informed the curriculum for the Bachelor's degree in Environmental Health are as follows:

- Manage environmental health risks within natural, socio-economic, build and working environments within the scope of profession
    - Identify current and potential health risks
    - Compile a comprehensive risk management plan
    - Apply various strategies to address current and potential risks
    - Monitor and review the effectiveness of the comprehensive risk management plan
    - Conduct public participation at all stages of the development and implementation of the risk management plan
    - Present a report in an acceptable format
    - Communicate outcomes to the relevant stakeholders
- Manage environmental health promotion programmes
    - Conduct a situation analysis in a community
    - Design sustainable health promotion programmes
    - Develop implementation strategies
    - Implement the health promotion programme
    - Monitor and evaluate the programme
    - Participate in multi-disciplinary promotion programmes
- Manage environmental health services
    - Apply administrative skills in context
    - Apply relevant policies and legislation for the provision of environmental health services
    - Develop policies and legislation for environmental health services
    - Apply set criteria for development control
    - Apply skills and techniques to manage human resource in an environmental health context
    - Manage financial matters and physical resources of an environmental health service
    - Demonstrate computer literacy skills
    - Apply project management principles
- Conduct and participate in environmental health research
    - Identify research need/ theme/ problem
    - Apply research principles in design and conduct of investigation
    - Manage research data in line with prescribed guidelines
    - Develop intervention measures
    - Implement and evaluate intervention measures
    - Communicate results in appropriate format
- Demonstrate interpersonal relations and professional behaviour in terms of the ethical code
    - Develop and manage communication strategies to improve environmental health services

- Communicate verbally, in writing and electronically according to requirements to all stakeholders
- Facilitate resolution of conflicts within the work environment
- Manage communication and marketing strategies that are related to environmental health
- Interpret and apply code of ethics in implementing the code of practice for environmental health practitioners

These core outcomes were broken down further into fundamental and core components of the curriculum (see **figure 5: Fundamental and Core Components of the curriculum**).

The fundamental components of the curriculum are those elements of learning which forms the grounding or basis needed to undertake the education, training or further learning required to obtain a qualification, for e.g. basic sciences, communication skills, information literacy skills and research skills.
The core components are all the elements which are compulsory learning required in situations contextually relevant to the particular qualification, for e.g. the five pillars of environmental health, which are: community health, pollution control, built environment, food and meat safety and occupational health and safety as well as all the relevant professional knowledge and skills.

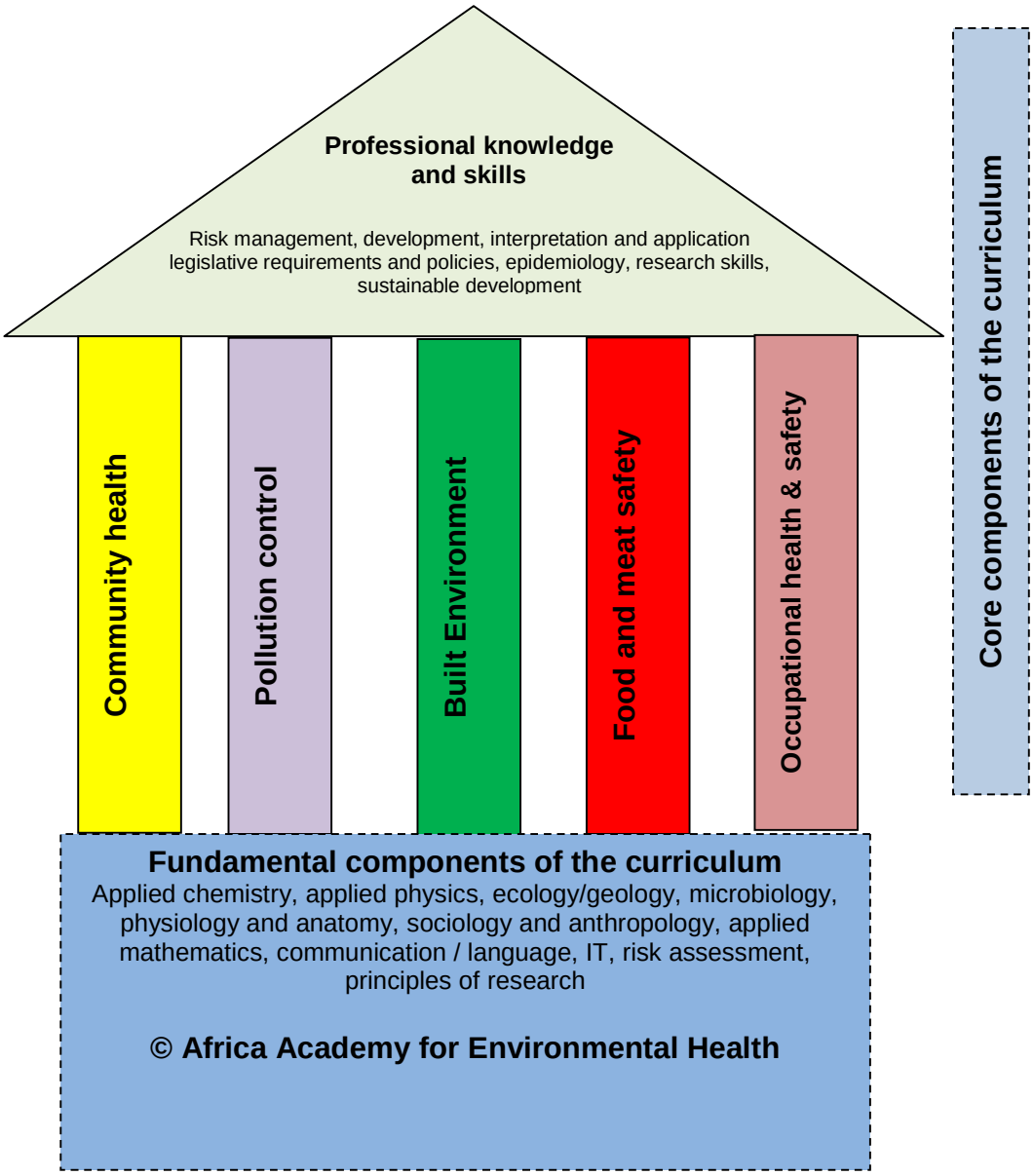

Figure 5: Fundamental and Core Components of the Curriculum

In **figure 5: Overview of the curriculum,** the fundamental and core components of the curriculum are further divided into four (4) levels. These levels **DO NOT** refer to academic years, i.e. year one (1), year two (2), year three (3) and year four (4), but to a *progressive introduction of concepts and frameworks to the student at increasingly complex levels*. Any one or more of these levels could be done in any one of the academic years, depending on the teaching strategy and the structure of the instructional plan or program. The Basic Sciences (addendum A) could for example be done in the first year as separate subjects / courses / modules, or it could be spread over the four years and the relevant outcomes could be integrated where applicable (just-in-time teaching) into various of the other subjects / courses / modules.

In Addendums B, C, D, E and F some of the intended learning outcomes or intended learning experiences are linked by means of numbers to specific components of the curriculum, which are:

1. Community Health
2. Food and Meat Safety
3. Occupational Health and Safety
4. Pollution control
5. Built Environment
6. Regulatory framework
7. Risk assessment
8. Communication and Information Technology
9. Research

This information can be used during the development of the instructional plan or program to develop integrated learning outcomes and assessment strategies.

Example: Addendum F (Built Environment):
Outcome: Assess the appropriateness of building services (e.g. water supply, heating systems, domestic electrical and fire protection services, etc.) (3; 4; 6)

This outcome links to *Occupational Health and Safety **(3)**; Pollution control **(4)** and Regulatory framework **(6).***
This implies that in the development of the learning plan / programme this outcome could be linked to various other subjects / courses / modules, depending on the teaching strategy and the design of the curriculum. These types of outcomes should preferably also be assessed in an integrated manner

Figure 5: Overview of the curriculum

	Food Safety 2	Community Health 1	Pollution Control 4	Occupational Health & Safety 3	Built Environment 5	Research 9	Risk Assessment 7	Regulatory Framework 6	Management & Administration	Communication & Information Technology 8	Laboratory work and field/ industry visits
Level 4 Apply theories, research methodologies, methods and techniques in a particular context.	**See addendum B**	**See addendum C**	**See addendum D**	**See addendum E**	**See addendum F**	Collect data using appropriate methods; Interpret data using appropriate statistical tools; Present relevant research findings.	Apply principles of risk assessment, auditing and inspection (INC. ISO)	Analyse and communicate outcomes in terms of the regulatory framework; Apply and execute administrative and legislative enforcement roles	Ability to manage adhering to all the principles of management (from planning to implementation, monitoring and evaluation	Apply verbal and non verbal communication skills; Describe and apply appropriate and innovative IT technologies (e.g. GIS, EPIINFO, SSPS, Autocad)	Select, apply or transfer appropriate standard procedures, processes or techniques to unfamiliar problems
Level 3 Apply and evaluate the key terms, concepts, facts, principles, rules and theories. Detailed knowledge of area of specialization and how that knowledge relate to other fields, disciplines or practices	**See addendum B**	**See addendum C**	**See addendum D**	**See addendum E**	**See addendum F**	Identify research problems; Apply appropriate quantitative, qualitative and statistical research methods; Develop a mini research proposal	Describe principles of inspection and auditing Apply monitoring and sampling principles and techniques	Apply the local, national and international regulatory frameworks which relate to EH; Apply local, national and international guidance and codes of practice	Apply the principles of management in terms of policy, planning, organisation, finance, HR, procedure and control	Apply verbal and non verbal communication skills; Describe and apply appropriate and innovative IT technologies (e.g. GIS, EPIINFO, SSPS, Autocad)	Apply a range of methods to resolve problems or introduce change within a practice
Level 2 Understand an apply key terms, concepts, facts, principles and rules and theories. Knowledge of area of specialization and how that knowledge relate to other fields, disciplines or practices	**See addendum B**	**See addendum C**	**See addendum D**	**See addendum E**	**See addendum F**	Apply the principles of general mathematics and statistics; Evaluate different sources of literature and select the information appropriate to the task	Describe the principles of risk assessment Describe the difference between a hazard and risk	Apply the local, national and international regulatory frameworks which relate to EH; Apply local, national and international guidance and codes of practice	Describe the principles of management in terms of policy, planning, organisation, finance, HR, procedure and control	Display professional conduct; Compile reports; Communicate in writing and verbally with the multidisciplinary health team	Evaluate, select, apply appropriate methods, procedures and/ or techniques in a defined context
Level 1 Understand key terms, concepts, facts, principles, rules and theories. Identify, evaluate and solve defined, routine and new problems in a familiar context.	Applied Chemistry, Microbiology, Applied Physics, Anatomy and Physiology, Applied Mathematics, Sociology and Anthropology, Ecology and Geology, Introduction to EH **See addendum A**					Gather information from electronic and written resources; Select information from resources in order to complete an assignment	Describe physical, chemical, biological and sociological hazards	Describe the principles of the regulatory framework Describe the role and function of agencies involved in all areas of EH	Manage self and time efficiently; Apply conflict management, negotiation, mediation and collaboration to facilitate resolution of problems	Apply computer skills within the EH context; Demonstrate verbal and non verbal skills in a professional environment	Select and apply standard methods, procedures and/ or techniques

ADDENDUM A – Basic Sciences

Level 1

Applied Chemistry

Describe, select and apply basic measurements and conversions

Describe basic principles of chemistry

Describe chemistry of air, water, soil and food

Describe the movement, storage and cycling of chemicals in the environment

Describe the impact of chemical pollution on the environment and health

Describe chemical occupational and environmental hazards

Describe the properties of building materials

Identify the advantages and limitations of instruments used for the analysis of samples which includes:

- Mass spectrometry
- Gas Chromatography
- Atomic Absorption Spectrometry
- High Pressure Liquid Chromatography

Explain the principles of detergents and disinfectants

Identify physical, biological and chemical hazards.

Identify the key food groups.

Describe the key principles of food chemistry

Select and apply standard methods to assess the chemical composition of foods

Organic chemistry

- Nomenclature
- Aliphatic
- Aromatic
- Basic mechanisms
- Functional groups

Physics

Explain physical environmental hazards

Describe the physical processes e.g. heat transfer, temperature and pressure in relation to atmospheric and water behaviour

Explain the physical properties of water, air and soil e.g. density, humidity and temperature

Describe the properties of building materials

Select and apply basic measurements and conversions

Discuss physical occupational and environmental hazards e.g.

- Thermodynamics
- Gas Laws
- Wave and wave theory

ADDENDUM A – Basic Sciences
Level 1
• Inverse square law • Ionizing and non ionizing radiation
Ecology/ Geology Describe the principles of ecology and geology and communicate in relation to human health and sustainable development Explain the environment as a complex of interacting biophysical, social, economic and political systems. Discuss the mineral formation of the following substances e.g. asbestos, silica, oil. Explain basic soil science in relation to migration of ground water and permeability of pollutants into various soil types. Explain the applicable building and materials and methods. Explain the mechanics related to soil structures. Describe the principles of ecology and geology and it's relation to the food chain and food security
Microbiology Describe the structure and function of potential pathogens in relation to air and water/soil quality Describe the range of microorganisms found in air, food, water and soil, their origins and mechanism for dispersion / transportation Describe biological hazards in the workplace Apply relevant and appropriate microscope techniques for water analysis, occupational health and safety and food safety Describe the role of micro-organisms in air, food, water and soil in relation to pollution and pollution control Describe the key terms and principles pertaining to the survival, growth and destruction of microorganisms Describe methods to limit the growth of microorganisms in food
Anatomy & Physiology Describe the normal human structure and function in a health context Describe the anatomy, pathology and physiology of humans, food animals and plants. Describe and communicate the structure and function of selected body and plant systems Describe the circulatory, nervous, respiratory, endocrine, digestive and urinary systems in relation to the impact of exposure and health effects of chemical, biological, physical and psychosocial stressors Explain the principles of biological monitoring
Sociology & anthropology Describe the basic social and psychological principles regarding public participation and consultation processes Describe and communicate human behaviour in terms of specific aspects of environmental health (environmental psychology e.g. stress, emotions etc) Describe and evaluate world views on culture regarding health promotion.

ADDENDUM A – Basic Sciences
Level 1
Describe the importance of indigenous knowledge systems Apply knowledge and discuss social groups and group dynamics (e.g. ethnocentrism) Describe the importance of culture and socialization in environmental health Describe human development through their lifespan Relate social impacts to the environmental impact assessment process Describe the social aspects of environmental planning Describe the role of environmental health in relation to wellbeing Describe the social, biological, chemical, build environment in relation to human health Identify and explain inequalities in health
Applied mathematics Apply working knowledge of the following areas: • Conversions • Metric system • Simple functions and graphs • Descriptive statistics • Arithmetic and calculus • Exponential laws and logarithms Apply calculus and conversion in air quality and water sampling, dispersion modelling, emission calculations, landfill lifespan and drinking and wastewater capacity calculation Apply relevant formulae to solve problems related to building and construction. Apply conversion, metric systems, sample functions and graphs Explain the meaning and importance of health measurement
Environmental biochemistry Describe the process of bio-degradation in the environment (air, water and land)
Historical and Social context of Occupational Health, Safety and Hygiene Describe the national structure for the control and promotion of occupational health and safety and the relationship to international structures. Provide an explanation of the origin of occupational health and safety.

ADDENDUM B – Food and Meat Safety		
Level 2	**Level 3**	**Level 4**
Food Safety and Hygiene Describe the principles behind the following key areas: • National and international legal framework for food safety and hygiene (6) • Cleaning and disinfection • Personal hygiene practices (1) • Pest control (1) • Cross contamination • Temperature control • Food preservation • Design, construction and equipment (3,5) • Training • Staff facilities • Food standards • Port health/importation (1) • Risk assessment (7) Identify and evaluate hazards associated with food production (7) Describe minimum standards for informal traders (6) Describe the role and function of other agencies involved with food safety and hygiene (6)	**Food Safety and Hygiene** Apply the local, national and international legal framework for food safety and hygiene. (6) Apply local, national and international guidance and codes of practice (6) Apply the principles of HACCP and other risk assessment methods in practice (7) Develop and communicate IEC messages pertaining to food safety and hygiene.(1) • Evaluate and validate the practices in the following areas: • Cleaning and disinfection • Personal hygiene practices (1) • Pest control (1) • Cross contamination • Temperature control • Food preservation • Design, construction and equipment (3,5) • Training • Staff facilities • Food standards • Port health and importation (1) • Risk assessment (7) Describe the principles of inspection and auditing and differentiate between them (6 – 7)	**Food Safety and Hygiene** Analyse and apply the appropriate local, national and international frameworks pertaining to food safety and hygiene (6). Analyse and apply the national and international guidance and codes of practice (6) Develop and apply the effective auditing and inspection plans for food safety and hygiene (6 – 9)
Food technology and processing Describe the principles of food preservation using chemicals, temperature, dehydration, irradiation and traditional methods Describe the national and international legal framework for food technology and processing (6)	**Food technology and processing** Apply the local, national and international legal framework for food technology and processing (6) Describe the principles of the main technologies in food processing.	**Food technology and processing** Apply the principles of risk assessment, auditing and inspection (INC. ISO) to various food processes both traditional and novel (7)
Meat pathology and Diseases Differentiate between relevant anatomical features of different slaughtered animals	**Meat pathology and Diseases** Describe (including sampling and analysis) the physiological and pathological conditions, disease	**Meat pathology and Diseases** Identify, evaluate and communicate (including sampling and analysis) the

ADDENDUM B – Food and Meat Safety		
Level 2	**Level 3**	**Level 4**
Describe the national and international framework for zoonotic and notifiable diseases (1; 6)	and parasitology in bovine, porcine, equine poultry, game and fish (6 – 9) Describe the national and international legal framework for zoonotic and notifiable diseases (1; 6)	physiological and pathological conditions, disease and parasitology in bovine, porcine, equine poultry, game and fish (6 – 9) Critically analyse and apply the national and international legal framework for zoonotic and notifiable diseases (1; 6)
Meat inspection and slaughter management Describe the role and function of other agencies involved with meat inspection, slaughter management and food animal husbandry and welfare (1, 6) Describe the principles of good practice in an abattoir (3) Describe and apply abattoir planning, construction and management in terms of standard regulations and guidelines (5 – 6)	**Meat inspection and slaughter management** Explain and recognise the requirements and needs for food animal husbandry (1; 6 – 7) Apply the principles of risk assessment to meat inspection and slaughter management (7)	**Meat inspection and slaughter management** Practical training in meat inspection at an abattoir Identify factors in abattoir practice and legislation that determine the hygiene and quality of meat (6 – 7) Perform, recognise and describe hygiene and procedures involving food animal slaughter in line with regulations (6 – 7)
Food Security and Nutrition Describe the importance of a sustainable food supply and the socio economic, and cultural effects on this (1; 4; 6). Describe the principles of nutrition and nutritional assessment (1) Describe management of nutritional deficiencies (1) Describe the role and function of other agencies involved with food security and nutrition (6)	**Food Security and Nutrition** Present and communicate effective IEC messages on nutrition and food security (1; 8) Apply principles of nutrition and food security to determine effective action plans (1; 7 – 9) Develop, analyse and interpret nutritional profiles for communities in collaboration with other agencies (1; 7 – 9)	**Food Security and Nutrition** Instigate appropriate mitigation and management of nutritional deficiencies (1; 7 – 9)
	Outbreak management Describe terms and definitions relevant to the investigation of food poisoning outbreaks (1; 3) Describe the principles and procedures of an outbreak investigation and outbreak management (1; 3)	**Outbreak management** Apply the principles and procedures of an outbreak investigation (1,3) Apply the principles of the international sanitary regulations (6)

ADDENDUM C – Community Health		
Level 2	**Level 3**	**Level 4**
Communicable and non Communicable diseases Identify communicable and non-communicable diseases and their modes of transmission Describe the pathogenesis of various micro-organisms Identify risk groups Describe the health effects of chemical incidents (3; 4)	**Communicable and non Communicable diseases** Explain emerging, re-emerging and neglected tropical diseases Implement control programmes for communicable and non communicable diseases (3) Monitor and evaluate the toxicological aspects of non-communicable diseases (3) Describe terms and definitions relevant to the investigation of food poisoning and disease outbreaks	**Communicable and non Communicable diseases** Critically analyse case control studies of communicable and non-communicable diseases (6) Management and control of outbreaks associated with recreational (indoor and surface) waters (3; 4)
Biostatistics and research methodology Apply general principles of statistics within the health service management systems	**Biostatistics research methodology** Develop research protocols and tools for data collection (9) Review scientific research reports in EH (9) Conduct community needs assessment and present it to relevant stakeholders (9)	**Biostatistics research methodology** Undertake research and produce a scientific dissertation (9)
Disaster management and Bioterrorism Define concepts in disaster management and outline the role of environmental health professional	**Disaster management and Bioterrorism** Develop measures to manage an emergency situation (2 - 9) Develop and execute plans for disaster prevention (2 - 9)	**Disaster management and Bioterrorism** Critically evaluate emergency support services Network with stakeholders in disaster management (2 - 9)
	Project Planning and Management Plan and Develop project protocols in environmental health (2 - 9)	**Project Planning and Management** Execute and review health projects(2 - 9) Manage environmental health intervention projects (2 - 9)
Epidemiology Describe causes of diseases and how diseases are classified and their mode of transmission Analyse, interprete and present basic statistical information (9)	**Epidemiology** Identify and apply appropriate study designs used in disease surveillance	**Epidemiology** Apply the five levels of prevention to combat communicable and non communicable diseases Collect, analyze and interpret information and disseminate findings to all relevant stakeholders(2 - 9)
Vector , Vermin and Rodent Control	**Vector , Vermin and Rodent Control**	**Vector , Vermin and Rodent Control**

ADDENDUM C – Community Health		
Level 2	**Level 3**	**Level 4**
Identify and describe vectors of disease relevant to environmental health in terms of their physiology, life cycle, distribution, significance, monitoring and control (2-4)	Prevent and control of outbreak investigation (2-4)	Carry out vector and rodent control interventions (2-4)
Environmental Health Education and promotion Explain the concepts of health promotion and education Describe the principles of health promotion	**Environmental Health Education and promotion** Evaluate and critically analyse national and international policies for health care delivery (6)	**Environmental Health Education and promotion** Critically analyse and apply health promotion models (7) Execute a situation or needs analysis to determine health promotion requirements (7)
Health Information Management Systems Describe management in health Outline health information management principles Describe the health management cycle Identify and describe national HIMS	**Health Information Management Systems** Develop and illustrate best practices in institutional management Develop effective data collection tools Develop, implement and evaluate HIMS components relevant to environmental health	**Health Information Management Systems** Analyze and interpret data Use data for effective health planning
Population Health Define the concepts in population health Explain different demographic techniques and their interpretation Describe health interventions applicable to different population groups	**Population Health** Identify, analyse and develop measures to address gender equality in communities Apply ethical issues in different cultures in population health research	**Population Health** Execute public, behavioural and health service interventions
	Environmental Health Impact Assessment Identify, rate and prioritise health risks (7) Conduct an environmental health impact assessment study (7) Plan and execute an inspection/audit, and report environmental health project findings (2-9)	**Environmental Health Impact Assessment** Manage the Environmental health risks (7) Review and evaluate effectiveness of management of health risks (7) Evaluate auditing reports regarding Environmental Health Impact Assessment (7)
Environmental Health Law and Legal Processes Describe how national and international laws and regulations are formulated, the legal processes and hierarchy	**Environmental Health Law and Legal Processes** Interpret the national and international legal framework (including protocols and conventions) for community	

ADDENDUM C – Community Health		
Level 2	**Level 3**	**Level 4**
(6) Describe the role of the EHO and other professionals involved in law enforcement (6)	health (6) Apply the principles and procedures of an outbreak investigation Describe environmental health issues associated with Port health (2,6)	

ADDENDUM D – Pollution Control		
Level 2	**Level 3**	**Level 3**
	Air quality management Apply monitoring and sampling principles and techniques Evaluate the respective options for air pollution engineering control (fit for purpose) (3) Evaluate radiation and radioactivity in the context of environmental pollution (3) Critically reflect on the measurement interpretation and prescribing controls and report on environmental noise complaints (3)	**Air quality management** Evaluate the impact (impact assessment) of air pollution on humans, animals, plants and building structures (5; 2) Critically review the processes involved in the national and international legal provisions for air quality management (6) Conduct, evaluate, and communicate emission inventories (8)
Water resources and quality management Describe water resource management Describe the difference between the chemical, physical and biological characteristics of water in terms of surface, drinking water purification and waste water treatment Describe the importance of water as an essential resource for health, development and the environment (5) Identify, describe and apply the specific local, national and international regulatory frameworks (6) Identify, describe and apply the specific local, national and international guidance and codes of practise (6)	**Water quality management** Independently validate appropriate water allocation strategies, water treatment, effluent treatment, recreational (e.g. swimming pools) and waste water disposal methods.	**Water quality management** Communicate the application of water resources management. Develop and implement water safety plans for small and large scale water distribution systems. Implement participatory approaches to water hygiene and management at household and community level (1) Critically review the national and international criteria and standards for water quality management (6) Conduct water and sanitary inspections (6; 7)
Waste management Explain the principles of biodegradation of waste Define the terminology relating to waste management. Identify, describe and apply the specific local, national and international regulatory	**Waste management** Explain the procedures , principles and practices for management of waste from 'cradle to grave' (collection, transport and disposal) Evaluate other disposal options such as incineration, pyrolisis, autoclaving and composting.	**Waste management** Critically review the processes involved in the international and national legal provisions for waste management (6) Develop innovative waste minimisation strategies and to communicate the outcome to groups e.g. communities and

ADDENDUM D – Pollution Control		
Level 2	**Level 3**	**Level 3**
frameworks (6) Identify, describe and apply the specific local, national and international guidance and codes of practise (6)		other professionals (1,8) Apply the procedures for management of all waste streams, e.g. health care waste, household waste, industrial waste (Solid, liquid and hazardous waste)
Hygiene and sanitation Explain the principles and importance of personal hygiene (1; 2) Describe the principles, practices and appropriate technologies of sanitation Explain the multidisciplinary team approach to sanitation.	**Hygiene and sanitation** Critically reflect on the environmental pollution control systems relating to a specific community (1) Implement participatory approaches to hygiene and sanitation management at household and community level (1)	
Environmental promotion and education Explain the concepts of environmental health promotion and education in the context of pollution control.	**Environmental promotion and education** Evaluate and critically analyse the local, national and international policies on environmental protection and sustainability (6) Exhibit ability to deliver Information Education and Communication (IEC) messages in environmental protection (1) Demonstrate an effective use of participatory methods of working with communities (1)	**Environmental ethics** Communicate the importance of environmental justice and corporate social responsibility (1;6)
		Environmental toxicology Identify and determine the toxic substances and describe their impact on the environment (3) Develop control measures on the impact of environmental toxins on the environment.
Environmental nuisance control Identify the general nuisance complaints. Identify, describe and apply the specific local, national and international guidance and codes of practise (6) Identify, describe and apply the	**Environmental nuisance control** Evaluate and control general nuisances Identify, describe and apply the specific local, national and international guidance and codes of practise (6) Identify, describe and apply the specific local, national and	

ADDENDUM D – Pollution Control		
Level 2	**Level 3**	**Level 3**
specific local, national and international regulatory frameworks (6)	international regulatory frameworks (6)	
	Disposal of the dead Explain and apply the methods by which bodies can be safely disposed Assess facilities for storage and transport of bodies Describe the methods and practices by which an exhumation can be conducted Describe the management and disposal of unclaimed bodies Identify, describe and apply the specific local, national and international guidance and codes of practise (6) Identify, describe and apply the specific local, national and international regulatory frameworks (6)	
	Inspection / Auditing Describes the principles and processes of conducting environmental audits / inspections (e.g. audit process, collecting of evidence and reporting)	**Inspection / Auditing** Plan, execute and report an effective environmental inspection / audit.
		Environmental impact assessment / management Design, conduct, evaluate and interpret environmental impact assessments of a development (air, water, waste and social impacts) (1) Develop and assess environmental management systems, e.g. ISO 14001 (6)
	Integrated environmental management Evaluate the inter relationship between the different components of the environment (land, water, air and social) and the related consequences from a biodiversity point of view	

ADDENDUM E – Occupational Health and Safety		
Level 2	**Level 3**	**Level 4**
Principles of Occupational Health, Safety and Hygiene **Identification** Describe the principles of risk assessment. Define and describe the basic concepts of Identification Evaluation and Control of the following stressors in the workplace: • Physical stressors • Biological Stressors (2) • Chemical stressors (4) • Psychosocial stressors • Ergonomic Stressors	**Principles of Occupational Health, Safety and Hygiene** **Evaluation and Control** Describe the principles of inspection and auditing Evaluate and control the following in terms of legislation and international standards by use of risk assessment and sampling. • Physical stressors • Biological Stressors (2) • Chemical stressors (4) • Psychosocial stressors • Ergonomic Stressors Critically evaluate ethical matters in OHS	**Principles of Occupational Health, Safety and Hygiene** **Management** Design, implement and critically evaluate management programs in terms of national and international legislation and standards to manage Occupational Health and Safety risks in the workplace that arose from the following factors: • Physical stressors • Chemical stressors(4) • Ergonomic stressors • Biologic stressors (2) • Psychological stressors • Safety Issues. Design and critically evaluate inspection/audit documents and systems to the effectiveness of OHS management programs. Design an emergency plan to manage accidents, incidents and catastrophic events. (1; 2;4; 5; 6) Identify, evaluate and take appropriate action with regard to ethical matters in OHS.
Toxicology Explain the definitions and equations pertaining to toxicology and dose response relationship. (1; 2; 4; 5; 6; 7; 8) Classify toxic effects in terms of reaction time, irritants, effect on the body. (1; 2; 4; 5; 6; 7; 8) Explain the concept of time weighted average. (1; 2; 4; 5; 6; 7; 8) .	**Toxicology** Define and discuss the concept "Occupational Exposure Limits". Relate these aspects to national and international legislation and norms. (1; 2; 4; 5; 6; 7; 8) Perform calculations to evaluate occupational exposure to stressors using the time weighted average principle. (1; 2; 4; 5; 6; 7; 8) Categorize and explain the effect of various toxic substances on the body. (1; 2; 4; 5; 6; 7; 8)	**Toxicology** Integrate toxicological information into risk assessments and management plans. (1; 2; 4; 5; 6; 7; 8)
Ventilation Define, identify and discuss ventilation concepts. Define, identify, sketch and	**Ventilation** Perform calculations pertaining to ventilation in order to evaluate and solve problems associated with ventilation systems. (2; 4; 5;	**Ventilation** Integrate information on ventilation systems from a specific workplace into risk assessments and management

ADDENDUM E – Occupational Health and Safety		
Level 2	**Level 3**	**Level 4**
discuss the components of various types of ventilation systems and air purifiers. (2; 4; 5; 6)	6)	plans. (2; 4; 5; 6; 7; 8)
Safety Define and discuss concepts pertaining to safety. Explain and differentiate between theories of accident prevention. Distinguish between hazard and risk (6)	**Safety** Evaluate a workplace in terms of safety hazards and perform a risk assessment. Devise a control program to manage the safety hazards. (5; 6)	**Safety** Design implement and critically evaluate management programs in terms of national and international legislation and standards to manage Occupational Health and Safety risks in the workplace. (5; 6; 7)

ADDENDUM F – Built Environment		
Level 2	**Level 3**	**Level 4**
Housing Explain the relationship between housing and health. (1) Describe the role of an EHP in housing (1). Explain the concept of low cost housing	**Housing** Identify and describe the specialised requirements for places of residence. (3) Develop and communicate IEC (Information Education and Communication) messages pertaining to good housing. (1)	**Housing** Assess risks to health from the built environment (7) Analyse information from a risk assessment of housing (7) Apply effective interventions for better housing. (1; 3) Investigate and report on state of housing as stipulated by the relevant legislation and regulations (6)
Building construction and services Explain the behaviour of different materials used in construction of buildings. Identify the advantages and disadvantages of different construction materials. Identify and explain the different types of loads on a building structure. Apply relevant building and engineering mathematics. (3) Design simple beams, columns, slabs and foundations.	**Building construction and services** Describe the suitability of a site on which to construct a standard building (3;6) Describe the necessary site development work to allow for drainage, levelling, orientation, entrances, surface water disposal, siting of septic tank (3;4;6) Determine stresses and strains of construction materials (3) Assess the appropriateness of building services (e.g. water supply, heating systems, domestic electrical and fire protection services, etc.) (3; 4; 6) Apply and critically evaluate the key principles of building construction (3; 6) Apply and evaluate the fundamentals of environmental sciences to the assessment of human comfort factors, humidity, condensation and ventilation associated with alternative forms of building construction (2; 3; 4; 6)	
Planning and development Identify and describe the various principles and systems of environmental planning at local and national level. (4,6)	**Planning and development** Apply and evaluate planning instruments and concept. Interpret prevailing housing	**Planning and development** Analyse and communicate outcomes in terms of the regulatory framework. (4; 6)

ADDENDUM F – Built Environment		
Level 2	**Level 3**	**Level 4**
Scrutinise and evaluate plans for domestic and commercial premises. Describe planning instruments and concepts (6) Describe activities involved in a land development project. (4,6)	standards (6) Apply prevailing legislation/ regulations to effectively deal with illegal and informal settlements (4;6)	
Sustainable development Describe the international guidance and codes of practice. (6) Describe the national and international framework for environmental health. (6) Describe the national and international frameworks which support sustainable development (Agenda 21, Rio Declaration, MDGs, WSSD, NEPAD)	**Sustainable development** Evaluate building projects in line with the principles of sustainable development. Apply the national and international frameworks which support sustainable development (Agenda 21, Rio Declaration, MDGs, WSSD, NEPAD)	**Sustainable development** Apply the principles of building and construction to sustainable development.

Addendum G: References

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Addendum H
List of Contribution organisations on Curriculum Development.

Africa Academy for Environmental Health
British Council, Johannesburg, SOUTH AFRICA
British Council, Nairobi, KENYA
Cape Peninsula University of Technology, SOUTH AFRICA
Central University of Technology, SOUTH AFRICA
Durban University of Technology, SOUTH AFRICA
Health Professions Council of South Africa (Professional Board for Environmental Health Practitioners), SOUTH AFRICA
Kenya Medical Training College, KENYA
Kenyatta University, KENYA
Mangosuthu University of Technology, SOUTH AFRICA
Ministries of Health of the following countries: KENYA & SOUTH AFRICA
Moi University, KENYA
Muhimbili University of Allied and Health Sciences, School of Hygiene, TANZANIA
National University of Science and Technology, ZIMBABWE
Nelson Mandela Metropolitan University, SOUTH AFRICA
South African Institute for Environmental Health, SOUTH AFRICA
The Association of Public Health Officers, KENYA
Tshwane University of Technology, SOUTH AFRICA.
University of Botswana, BOTSWANA
University of Johannesburg, SOUTH AFRICA
University of Malawi, MALAWI
University of Strathclyde, SCOTLAND, UNITED KINGDOM
University of Swaziland, SWAZILAND
University of Ulster, NORTHERN IRELAND, UNITED KINGDOM
University of Zambia, ZAMBIA