Special Symposium of BEEM2018 (http://www.beem2018.org)

Best Management Strategy for Environmental Management of Carcass Burial Site

June 12th, 2018

1:00-6:00 p.m.

Dae-Myung Resort, Hongcheon, Gangwon Province, Korea

Organized by:

SAFE Research Center for

Environmental Management of Burial Sites

Supported by:

Ministry of Environment

Korean Institute of Environmental Technology and Industry

Korean Society of Water and Wastewater

Hannam University

ABSTRACT

Animal mortalities are caused by various forms of diseases such as foot-and-mouth disease, bird flu, *brucellosis*, *tuberculosis*, and other catastrophes such as floods and heatwaves. During an outbreak, depopulation is a primary protocol to mitigate the virus spreading in many countries. Although many countries have prepared guidelines for dealing with such catastrophic incidents, the manuals or protocols emphasize the prevention of viruses only, and thus environmental consequences are often ignored. A variety of hazards and risks are associated with the disposal and management of carcasses during the livestock disease outbreak.

From the viewpoint of environment conservation, carcasses are intrinsically infectious wastes which massive discharged by the disaster. Animal carcasses thus should be regarded as the new forms of pollutants that cannot be managed properly with existing technologies and regulations. There is a need to consider what we may contribute to the national response to infectious animal diseases regarding scientific and technological knowledge. It is important to understand the causes of the disease, how it spreads, how to prevent it, how to manage infected animals, how harmful it is to the human health.

If risks are likely to spread, it is necessary to identify and respond to those in advance. The proactive risk management of infectious animal diseases refers to all activities taken focusing on the persistence and ubiquitous nature of risk, to reduce or eliminate natural or anthropogenic risks to the natural environment, ecology, properties, and human health.

We have to establish right response system considering risks what possibly exist, not limited to the magnitude of disasters what has occurred in an infectious animal disease in the past. The extent of prevention and control of risks that can cause massive damage to society and economies is impossible with the efforts of an individual or an organization.

We raise the question of how enough we prepared against possible risks. As we have suffered from the outbreak of foot-and-mouth disease in 2010, we have been able to find out how much knowledge our society has accumulated about risks. We have raised a lot of questions about how many unknown paths are available and who can judge how dangerous the risks are. It is necessary to check whether our society has a safety management system that makes people feel 'safe' about these problems. A comprehensive search and risk management framework for animal husbandry and food management needs to be established at the national level.

In the 6th symposium organized by SAFE Research Center for Environmental Management of Burial Sites, we are to discuss the direction of sustainable technology and policy developments. This symposium should discuss cutting-edge technology and site deployment strategies to minimize the adverse impacts of mass carcasses. The following questions will be asked to draw conclusions and agreements by participants;

- Do the current carcasses management tactics respond to future diseases?
- What are the most available technologies and what are the practical applications in the field?

A short symposium will not be able to cover everything, but it would be successful if it could be discussed that national scale of administrative and scientific approaches that deployable.

Invited speakers in this symposium are those who experienced in the formulation of a contingency plan for carcass disposal at the national level both in administrative and scientific perspectives with consideration of ecosystem evaluation including ecotoxicological risk assessments, energy conversion of carcasses, and advanced technological application in the construction of carcass burial sites. Additional oral/poster presentations on relevant

technologies and policies. Selected paper presented at this symposium will be published in the special journal issue after review.

Participants will visit the Test Bend for the carcass management operated by SAFE Research Center for the field trip.

Chair

Geon-Ha Kim, Ph.D., Professor
Department of Civil and Environmental Engineering
Hannam University, KOREA

Co-Chairs

Phil Longhurst, Ph.D., Professor
School of Water, Energy, and Environment (SWEE)
Cranfield University, UK

Lori P. Miller, P.E., Senior Staff Officer
Animal and Plant Health Inspection Service
United States Department of Agriculture, USA

Hyun-Woo Kim, Ph.D., Professor
Department of Environmental Engineering
Chonbuk National University, KOREA

Invited Speakers

Jason Weeks, Ph.D., Professor
Joint Nature Conservation Committee
Department for Environment, Food & Rural Affairs, UK

Gary A. Flory, Agricultural Program Manager
Virginia Department of Environmental Quality, USA

Saikat Chowdhury, Ph.D., Professor
Department of Soil Science
Sher-e-Bangla Agricultural University, Bangladesh

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Hyun-Woo Kim, Ph.D., Professor
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Chonbuk National University, KOREA

Advisory Panel **(alphabetical order)**

Nanthi Bolan, Ph.D., Professor
Global Centre for Environmental Remediation (GCER)
The University of Newcastle, Australia

Sang-Il Hwang, Ph.D., Chief Research Fellow
Korea Environment Institute, Korea

Zeng- Yei Hseu, Ph.D., Professor
Department of Agricultural Chemistry
National Taiwan University, Taiwan

Kye-Hoon Kim, Ph.D., Professor
Department of Environmental Horticulture
The University of Seoul, Korea

Sung-Eun Lee, Ph.D., Professor
Department of Agricultural Chemistry
Kyungbuk National University, Korea

Yong-Sik Ok, Ph.D., Professor
Korea Biochar Research Center
Kangwon National University, Korea

Jörg Rinklebe, Ph.D., Professor
School of Architecture and Civil Engineering
University of Wuppertal, Germany

Daniel Tsang, Ph.D., Professor
Department of Civil and Environmental Engineering
The Hong Kong Polytechnic University, Hong Kong

Journal Special Issue

Papers presented at the symposium are possibly published on the issues in:

- *Clean Technologies and Environmental Policy* (refer **Appendix A**)
- *Environmental Research* (refer **Appendix B**)

Field Trip

SAFE Research Center TEST BED (refer **Appendix C**)

June 13th (Wednesday)

Symposium Time Schedule

Time	Agenda	Chair
13:00 – 13:30	Registration	
13:30 – 13:40	Welcome Remark, Convener	Gary, Kim
Session I Management 13:40 – 15:10	Invited 1 (25 min) Lori	
	Invited 2 (25 min) Phil	
	Invited 3 (25 min) Saikat	
	(15 min)	
	(15 min)	
Session II Poster 15:10 – 15:40		Jason, Lori
Session III Treatment 15:40 – 17:10	Invited 4 (25 min), Jason	Phil, Saikat
	Invited 5 (25 min), Gary	
	Invited 6 (25 min), Kim	
	(15 min)	
	(15 min)	

Appendix A. Special Issue in *Clean Technologies and Environmental Policy*

1. Special Issue Title

Environmental Management of Mass Carcasses, *Clean Technologies and Environmental Policy* (http://www.springer.com/environment/sustainable+development/journal/10098)

2. Scope of the Special Issue

Foot and mouth disease (FMD) swept the country in the winter of 2010 in Korea, and over three million pigs and cows were buried to prevent an epidemic. Now, concerns over the possible leakage of the leachate discharged from the decomposing carcasses of the infected animals, and its contamination of the groundwater, are mounting.

Depopulation is a primary protocol to mitigate the virus spreading during animal disease outbreak in many countries. Korea is unique in field deployment of this policy fundamentally caused by conflicts between stakeholders. Government administrations, livestock breeding farmers, and NGOs influence on every step of decision making and even technology development. The assemblage of key technologies to cope with possible national disaster often hampered by this ignorance. Disaster prevention is a worldwide interest, and the essence of carcasses management is to promote biosecurity to achieve better public health.

Various types of hazards and risks are associated with carcasses management during an animal disease outbreak. Maximizing biosecurity during an outbreak is a primary cause which responsible for mass carcasses disposal. Burial is a widely adopted disposal practice in Korea during disease outbreak mainly due to its simplicity, and swiftness for implementation, especially where livestock farms are densely populated. However, the biosecurity side of carcass disposal is often overlooked again mainly due to critical demands from stakeholders, and this ignorance often leads to cause other risks to public health and environment. It can be taken into account from the many meetings of specialists that antibiotic agents which are a typical hazard should not be missed when assessing potential threats to the public health. Overdose medicals injected livestock to prevent early mortality may remain in the environment due to the mass depopulation of livestock, and the antibiotic is a critical material to consider when derives necessity techniques to secure the public safety. Many burials are being used as crop field without proper guidelines and thus becoming potential threats to public health security. Also, Korea is an only country which allows relocation of depopulated carcasses even right after burial when the groundwater quality is determined vulnerable without assessing its consequences to the public health.

In this journal issue, the state of the art technologies and deploy strategy to the field to minimize adverse impacts of burial sites are published. Topics which may include are ecosystem evaluation including ecotoxicological risk assessments, energy conversion of carcasses, and advanced technological application in the construction of carcass burial site including new types of membranes.

Papers selected for this special issue will be subject to a rigorous peer review procedure with the aim of rapid and wide dissemination of research results, development and applications.

Key Words: Biosecurity enhancement of burial managements, Environmental risk management of burial sites, Enhancement of carcasses decomposition, Assessment of soil and groundwater

quality in the vicinity of burial sites, Remediation of leachate-contaminated groundwater and soil

3. Submission Deadline
August 31th, 2018

4. Guest Editors:

Name: Geonha Kim, Ph.D. (Lead Guest Editor)
Affiliation: Professor, Department of Civil and Environmental Engineering, Hannam University, Ojungdong, Daedukku, Daejeon, 306-791, Korea
Email: kimgh@hnu.kr
Link: http://www.fmdsafe.re.kr
Interests: water quality management, diffuse pollution abatement, groundwater remediation, environmental site assessment

Name: Phil Longhurst, Ph.D., Professor
Affiliation: School of Water, Energy, and Environment (SWEE), Cranfield University, UK
Email:
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Interests:

Name: Nanthi Bolan, Ph.D., Professor
Affiliation: Global Centre for Environmental Remediation (GCER), The University of Newcastle, Australia
Email:
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Interests:

Name: Seung-Eun Lee, Ph.D., Professor
Affiliation: Division of Environmental Life Sciences, Kyungpook National University, Korea
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Link:
Interests:

Name: TSANG, Yiu Fa, Ph.D., Professor
Affiliation: Department of Science and Engineering, Education University of Hong Kong
Email: tsangyf@eduhk.hk
Link:
Interests:

Appendix B. Special Issue in *Environmental Research*

1. Special Issue Title

Endocrine Disruptors and Alternative Materials in Environment, *Environmental Research* (https://www.journals.elsevier.com/environmental-research)

2. Scope of the Special Issue

Endocrine disruptors (EDs) represent the chemicals that can mimic the endocrine function of human and various animal species. As such, EDs are realized as one of the most significant health concerns in our planet. Besides the classical target for EDs, the emerging unexpected functional targets and associated mechanisms (e.g., hormone sensitive cancers, neuronal diseases, and the next generation effect of EDs for human and wildlife animal health) have been highlighted.

Recently, materials that can replace the conventional plasticizers have been developed. Nonetheless, endocrine activity, as well as the toxicity of these alternative chemicals, are yet relatively poorly understood at *in vivo* and *in vitro* levels. For instance, animal disease outbreak is one of the primary occasions through which various forms of EDs (e.g., antibiotics, pesticides, and disinfectants) are introduced into the environments without proper regulations. Carcasses burial is a widely adopted disposal practice during animal disease outbreak mainly due to its simplicity and swiftness for implementation. Likewise, overdose injection of medicals, intended to prevent early mortality of animals, may remain in the environment due to the mass depopulation of livestock. Assessment of risks posed by EDs and other substances should thus be taken as an indispensable step for the proper countermeasures.
In light of the significance of EDs and related issues, the following topics are to be dealt intensively in this special issue:

- effects of EDs on wildlife animals
- EDs and hormone sensitive cancer
- EDs on neurological disorder
- effects of EDs on animals including human
- endocrine disruption by emerging POPs
- next generation effect of EDs
- phytochemicals with endocrine activity
- molecular biomarkers for endocrine disruption
- genetically engineered organism for a biosensor for EDs
- molecular and cellular action mechanisms of EDs
- sensor technology to detect EDs
- monitoring of EDs and their metabolites in the environmental media and animal bodies
- development of alternative chemicals for EDs
- toxicity and endocrine disruption by emerging persistent organic chemicals
- the state of the art technologies to minimize adverse impacts of burials
- assessment of leachate originating from carcass management practices
- risk assessment of carcass management for the better practice selection
- monitoring of trace organics in multi-sphere near burials.

3. Submission Deadline
June 30th, 2018

4. Guest Editors:

Name: Myungchan Gye, Ph.D. (Lead Guest Editor)
Affiliation: Professor, Department of Biology, HanYang University, Korea
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Link:
Interests:

Name: Cemyung Ko, Ph.D.
Affiliation: Professor, Department of Veterinary Medicine, The University of Urbana-Champaign, USA
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Interests:

Name: Geonha Kim, Ph.D.
Affiliation: Professor, Department of Civil and Environmental Engineering, Hannam University, Ojungdong, Daedukku, Daejeon, 306-791, Korea
Email: kimgh@hnu.kr
Link: http://www.fmdsafe.re.kr
Interests: water quality management, diffuse pollution abatement, groundwater remediation, environmental site assessment

Name: Nanthi Bolan, Ph.D., Professor
Affiliation: Global Centre for Environmental Remediation (GCER), The University of Newcastle, Australia
Email:
Link:
Interests:

Appendix C. SAFE Research Center TEST BED

Fig. 1. Bird-eye view of the test bed for the SAFE research center. The test bed is an area of 6,500 square meters, situated on the finished sanitary landfill site minimizing public concern.

SAFE Research Centre ("SAFE" hereafter) is a government funded research group to develop techniques for the environmental management of carcass burial site. SAFE is the acronym of four different technology forms being developed: Safety-enhancement, Action-oriented, Flexible-management, and Eco-friendly technology. The total research grant is 13 billion KRW equivalent to 12 million USD with research period from April 2012 to March 2017.

SAFE Research Centre established a test bed to evaluate field applicability of developed technologies by SAFE for the field deployment at Seolsung-myun, Icheon City, where most dense livestock breeding farms located in Korea. The test bed was built on the stabilized sanitary landfill site to minimize public concern over the facility.

Facility objectives can be summarized as the following:

1) Commercialization of technologies developed by SAFE Research Centre. The test bed is equipped with various auxiliary processes including odor control, pretreatment, post-treatment to simulate field condition, to attain actual design capability for field deployment.
2) Connected treatment of waste remains in an existing environmental infrastructure. Any conventional contaminants are to be terminated at the existing environmental

infrastructures: sanitary landfill, wastewater plant, incinerator, night soil waste plant. SAFE regard carcasses as a new form of disaster waste which existing environmental infrastructure cannot accommodate, and test bed itself is a prototype of required facility for the management of carcasses.

3) Platform to integrate related technologies. Key technologies being developed by SAFE have different performances and operating costs. For better design, these key technologies can be assembled in series.

This test bed was designed to prove key technologies developed by SAFE for the field deployment possibilities. Thus this facility possesses capabilities raw materials and treated materials. All facilities are contained to control airborne matters to minimize any risks associated with carcasses. Three different treatment trains are aerobic bio-reduction, high-pressure rendering, and Phyto-barrier treatment of soil.

This research facility has several elements which can be categorized into four different groups. It reflects SAFE research center technology map. We can store 1000 m^3 of carcasses wastes. Each process is evaluated separately, and serial processing is possible as a system. Maximum 500 m^3/month treatment capacity. Remains after treatment delivered to the environmental infrastructures such as incinerators. Most important aspect of this facility is that air-born virus is controlled.

CHAIRS

Geonha Kim, Ph.D. Professor,

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Education
Ph.D. Department of Civil and Environmental Engineering, Texas A&M University
M.S. Department of Civil and Environmental Engineering, Korea University
B.S. Department of Civil and Environmental Engineering, Korea University

Research Area
- Integrated watershed management
- Water quality monitoring
- Environmental geotechnical engineering
- Remediation of soil and groundwater

Dr. Geonha Kim earned his Ph.D. degree from Texas A&M University in environmental, geotechnical engineering field with the topic of "multidimensional finite element modeling of electrokinetic remediation." His wide knowledge in environmental engineering, geoenvironmental engineering, and water resources engineering enables him successfully carrying out interdisciplinary researches.

His field of research is mainly legislative and abatement technique aspects of water quality management. He has contributed an implementation of Total Maximum Daily Load law in Korea by carrying out various research projects and publishing papers. He is now leading a research group studying about "environmental management of carcasses burial sites" funded by Korean Ministry of Environment. This research group is responsible for developing field deployable technologies for securing any threat imposed by burial sites.
He is serving for the government as various roles including a member of regulatory reform committee and a member of performance evaluation committee. He was awarded several honors including Excellent Paper Award from Korean Society of Water Quality in 2007, Prime Minister's commendation in 2011, President's commendation in 2015, and National Assembly's commendation in 2015.

Phillip Longhurst, Ph.D., Professor
Chair in Environment and Energy Technology, School of Water, Energy & Environment, Cranfield University, College Road, Bedfordshire MK43 0AL UK. +441234 754953; +447904 157404; p.j.longhurst@cranfield.ac.uk

CURRENT ORGANISATION AND ROLE

Phil has research expertise in; energy from waste; waste strategy & material flow; amenity impact reduction and benchmarking performance; process emissions assessment, and regulatory control. He has developed a team of 10x academic, research, technical and support staff, and approximately 30x doctoral research and 30x M-level students completing postgraduate study on energy technology, resource management, risk, and regulation. The Centre for Bioenergy and Resource Management has 85% of core income generated from research and consultancy contracts with close working relationships with government and industry; particularly the waste and resource sectors.

QUALIFICATIONS

Ph.D. Innovation & Technology Assessment (1996), Cranfield University
BEd (Hons) 1st. Design & Technology (1988), Sheffield Hallam University

PROFESSIONAL MEMBERSHIP

DFES Qualified Teacher (Ref. No. 8930678x)

POSTS HELD

2016 to date	Professor of Environment and Energy Technology
2014 to 2016	Reader in Environmental Technology, Acting Head of Centre – BRM (2015)
2010 to 2014	DHoC, Institute for Energy & Resource Technology [IERT], SAS.
2006 to 2010	Head - Centre for Resource Management and Efficiency, School of Applied Sciences.
2003 to date	Senior Lecturer in Waste Strategy: Leading research within Cranfield on mass-flow analysis, environmental impact assessment for waste process selection and risk assessment for developing material markets.
2000 – 2003	Lecturer, School of Water Sciences, Cranfield University: Course Director, leading EIA, waste processing, and establishing the Integrated Waste Management Centre
1996 – 2000	Lecturer, International Ecotechnology Research Centre in SIMS
1995 - 1996	Research Fellow, IERC in the School of Industrial & Manufacturing Sciences.
1993 - 1995	Research Officer, International Ecotechnology Research Centre, Cranfield University. Centre for integrated modeling of ecological, economic and technological systems

Lori P. Miller, PE
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Lori P. Miller, PE is a licensed professional engineer with over 30 years of experience managing a variety of projects and programs aimed at reducing environmental impacts from industrial, military, and government activities. She oversees research and development activities so the findings can inform policy.

CURRENT ORGANIZATION AND ROLE

Ms. Miller currently serves as Senior Staff Officer/Environmental Engineer for the United States Department of Agriculture, Animal and Plant Health Inspection Service at their headquarters in Riverdale, Maryland, USA. In her current role, Ms. Miller focuses on planning and preparedness for animal health emergency response, specifically related to management of infected carcasses and biosecurity. Much of her work involves coordinating multi-agency partnerships to identify research gaps; then managing projects to fill the gaps. Recent projects include development of a non-freezing portable vehicle wash tunnel; evaluation of disposal capacities in major livestock production regions of the US; risk assessments for carcass management methods, risk assessment for transporting infected carcasses, risk assessment for landfill leachate from infected poultry, development of carcass management option decision tool and training modules, and evaluation of emergency rendering for outbreak response.

QUALIFICATIONS

BS	Civil Engineering (1988)	University of Maryland
Chi Epsilon	Civil Engineering Honor Society (1988)	University of Maryland

PROFESSIONAL MEMBERSHIP

Professional Engineer, Maryland License 20229

POSTS HELD

2008 to date	Senior Staff Officer/Environmental Engineer USDA APHIS
2012 to 2014	Program Manager, US Department of Homeland Security
2005 to 2008	Environmental Protection Program Manager, USDA APHIS
2001 to 2005	Senior Remedial Project Manager, USDA ARS
1998 to 2001	Environmental Coordinator, University of Maryland
1989 to 1998	Project Manager, Dames and Moore Environmental Consultant
1985 – 1989	Environmental Coordinator, Fusion Systems Corporation

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Education

Ph.D., Dept. of Civil and Environmental Engineering, Korea Advanced Institute of Science and Technology (KAIST), **Title:** "Bioenergy Production by Anaerobic Co-digestion of Sewage Sludge and Food Waste Using Temperature-Phased Anaerobic Sequencing Batch Reactor System."
M.S., Dept. of Civil and Environmental Engineering, KAIST
B.S., Dept. of Civil Engineering (Major), Dept. of Mechanical Engineering (Minor), KAIST

Research Interests

Dr. Hyun-Woo Kim earned his Ph.D. from KAIST, Korea and obtained intensive research experiences from the Biodesign Institute at Arizona State University, U.S.A. as a Research Scientist. He currently works at the Department of Environmental Engineering, Chonbuk National University as an assistant professor. As a principal investigator, he has been running the "Environmental Biotechnology and Biosystem Laboratory" based on the various research funds from Korea governments. His research backgrounds and intellectual commitments have inspired him with a number of novel research interests: (1) Environmental biotechnology for wastewater/waste engineering; (2) Pollutant treatment and resource recovery; (3) Membrane-assisted photobioreactor technology for microalgae to biodiesel; (4) Non-thermal plasma process for the removal of toxic substances, POPs, and PPCPs; (5) Low Impact Development for the reduction of non-point pollution source. With those interests, Dr. Kim has focused on finding a new solution using leading-edge environmental engineering systems to solve major social and environmental concerns with renewable, sustainable, and carbon neutral frameworks.

Dr. Kim has served as an active reviewer for a numerous SCI journals to shares his expertise with the world societies. And he is a vice-director of general affairs in Korea Society of Waste Management, a conference committee/editorial board member of Korean Society of Environmental Engineering, a lifetime member of Korean Society of Water & Wastewater and Korean society of Environmental Technology.

SPEAKERS

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December 2015–Present Associate IEH Consulting (United Kingdom) Environmental risk consulting, training. Ecological risk.
November 2013–December 2015 Professor of Environmental Risk Analysis Institute of Environment, Health, Risk and Futures, Cranfield University (United Kingdom) Main activities and responsibilities include all aspects of environmental risk analysis (including hazard characterisation, exposure prediction, risk assessment, risk perception and risk communication) and management and environmental regulation and governance. Horizon scanning and scenario analysis and associated risks and opportunities. Environmental risk assessment of veterinary pharmaceuticals.
2004–2013 Aquatic Veterinary Pharmaceutical Programme Director Cefas, Weymouth (United Kingdom) Aquatic Animal Health and Hygiene Business Development Manager (Cefas) and Member of the Cefas Senior Management Team. Extensive experience of SE Asian aquaculture industry including fish and shellfish. Directly responsible for the commercial programme within Cefas focussing on development of aquatic veterinary medicines for fish and shellfish and fish vaccine development. Extensive experience of disease challenge studies, GLP and veterinary pharmaceutical drug safety and efficacy testing.
1993–2004 Chief Scientist WRc-NSF WRc plc. Medmenham (United Kingdom) Responsible for the Ecological Risk Services component of the WRc-NSF consultancy business. Established a soil ecotoxicological capability within the company. Direct line responsibility and management of 45 senior and principal scientists (and 50 other analysts and support staff). Long-term strategic fiscal and human-resource planning/deliverance of a science business plan. Also managed key and complex research projects, programmes and consortia. Developed commercial applications and exploitation of novel and embryonic research initiatives as products through commercial development routes. Responsible for the derivation and propagation of the business unit themes in the areas of chemical risk assessment, microbial auditing and risk assessment, the National Centre for Environmental Toxicology and the Environmental Monitoring and Assessment business units. Member of the executive management board of WRc.

EDUCATION AND TRAINING 1987–1990 PhD University of London (United Kingdom) Marine science - ecotoxicology

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Gary Flory is the Agricultural & Stormwater Program Manager for the Valley Regional Office of the Virginia Department of Environmental Quality. In this role, Gary provides leadership on numerous issues surrounding the nexus of agriculture, the environment, and public health. A passionate problem solver, he is regularly selected to execute new and potentially controversial regulatory programs including stormwater management, biosolids land application, agricultural permitting and compliance, and the Total Maximum Daily Loads (TMDLs) program.

Gary also founded G.A. Flory Consulting, a global consulting firm, to help clients with a range of services including animal disease and natural disaster response, agricultural emergency planning, emergency response training and public speaking. Gary was deployed to the Midwest on five separate occasions in support of USDA's efforts to control Highly Pathogenic Avian Influenza outbreaks and was a lead author of USDA's recently released *Mortality Composting Protocol for Avian Influenza Infected Flocks*. Gary has published numerous articles including recent articles on the weaponization of emerging infectious diseases, biosurveillance, and counter-agroterrorism for the journal *Chemical, Biological and Nuclear Warfare*. He shares his expertise at conferences around the country and as far away as Malaysia and Azerbaijan. Gary also serves on the Editorial and Scientific Advisory Boards of some scientific journals.

Gary participates in a variety of working groups including the Chesapeake Bay Program's Agricultural Workgroup, Virginia Poultry Disease Taskforce, Animal Health Quadrilateral Meeting of the Emergency Management Task Group & Disposal, Destruction & Disinfection Network, BioWatch Extended Veterinary Network, and the Virginia Catastrophic Livestock Mortality Taskforce

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