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<p>Institution: University of Portsmouth</p>
<p>Unit of Assessment: 7 Earth Systems and Environmental Sciences</p>
<p>a. Context</p> <p>Our impact arises from our growing reputation for excellence in cutting-edge research and involves a wide range of end-users. The majority of impact-generating activities, nationally and internationally, are in four of our six research clusters: <i>Ecotoxicology and Environmental Modelling</i>; <i>Environmental Microbiology and Biotechnology</i>; <i>Natural Resource Management and Modelling</i> and <i>Applied Geology</i>. The types of economic and societal impact generated include:</p> <ul style="list-style-type: none"> • Influencing national and international policies, guidelines and legislation through provision of research evidence on, for example, water quality and wood degradation; • Increasing public awareness, improving the level of debate and understanding of issues related to pharmaceuticals in the environment, nuclear power and evolutionary science; • Improving business performance through the development of new products and technologies for the monitoring of environmental pollutants in the air and water and protection of marine vessels and structures; • Enhancing environmental protection and impact reduction through provision of expert consultancy on geohazard risk and management, nuclear risk, marine materials and their protection; • Contributing to international development through influencing the management of natural resources (aquaculture, mining and energy resources, timber). <p>As a result, significant benefits have been delivered to:</p> <ul style="list-style-type: none"> • Large industries in the energy and technology sectors (Horizon Nuclear Power, Shell, BP, QinetiQ, 3M); • Small and medium environmental and engineering businesses (Dustscan, Grundon Waste Management, Integrix, Hydrock, TRADA); • Broadcast media and film makers (including the BBC, Channel 4, Atlantic Productions); • National bodies responsible for the management of environmental resources and policy (Environment Agency, Japan Atomic Energy Agency, Gansu Provincial Government, Canary Islands' Government); • International organisations and agencies with particular responsibility for promoting sustainable development (World Bank, British Council, FAO, and DfID).
<p>b. Approach to impact</p> <p>This Unit takes an integrated approach to pure and applied research, and the representation of user perspectives is inherent in all activities. This approach aligns strongly with the University's strategic "social, economic and cultural impact" theme, and has benefitted from significant institutional investment. In 2010, the University of Portsmouth Environment Network (UPEN) was established to coordinate and promote the excellent and diverse environmental sciences strengths that exist across the institution, and to match these with the needs of end-users by developing links with private and public sector organisations. In 2011, the Centre for Applied Geosciences (CAG) was established as a focus for the provision of internationally-recognised training and consultancy in engineering geology, remote sensing and spatial data analysis with strong industry links.</p> <p>During the REF period, this UoA has proactively and effectively employed the following approaches to impact:</p> <p>Membership of advisory boards and secondments to influence environmental policy</p> <p>We encourage and support proactive engagement with task forces, organisations and national initiatives that are concerned with the development of environmental policy. For example, the UPEN Facilitator (Dr David Hutchinson) is the Environment and Health Science Coordinator for the Environmental Exposure & Health Initiative (EEHI) and Environmental & Social Ecology of Human Infectious Diseases (ESEI) programmes within the UK Research Council Living With Environmental Change (LWEC) partnership. <i>Cragg</i> is providing expert guidance to Technical Committee 38 of the European Standards Commission (CEN) charged with revision of current standards for testing wood resistance to biodegradation. <i>Thorpe</i> (Karen) is currently on a NERC-funded Policy Placement Fellowship with the Food and Environment Research Agency, York, working on the recent OECD assessment framework strategy for testing endocrine disruption in</p>

fish. *Smith* has advised the FAO and IAEA on emergency preparedness following nuclear accidents and on remediation of radioactively contaminated land.

Developing partnerships with key stakeholders for collaborative research and consultancy

UPEN and the University Research and Innovation team (RIS) broker contacts between academic staff and the business community and both advise and assist in consultancy activities. Through UPEN, the expertise of relevant researchers within this UoA is proactively communicated to key stakeholders through a newsletter to 500 individuals/organisations and regional conferences. UPEN hosted the Solent Climate Change Workshop (2011), with 130 delegates from local universities, local government, NGOs and businesses, and the inaugural "Future Solent" conference (2012) to which 56 delegates from external organisations ranging from Gosport Fairtrade Action to IBM attended. UPEN has established strong links with Solent LEP, South Downs National Park (Learning Partnership), Business South, Solent Forum and Portsmouth City Council. UPEN is represented on the Future Solent Board which acts on behalf of the LEP to create a road map for a Solent low carbon economy. As part of this, the board has been awarded £1.9M regional development funds to facilitate collaboration between 'green-sector' businesses and environment-related expertise within the HE sector. The UoA has held two KTPs supporting SMEs (Grundon Waste Management 2007-09; Dustscan Ltd. 2013-15) to develop new airborne dust monitoring technologies that improve accuracy in assessments.

CAG has strong industry links through: a Visiting Industrial Professor (Patrick Power, MD Fugro:GeoConsulting), the Engineering Geology Industrial Alliance and Bursary Scheme, and seminars by business speakers. Such contacts have led to a rise in consultancy income; recent highlights include research on oil pipeline assessment and environmental monitoring in the Niger Delta (for Shell International and Integrix) and Georgia (for BP). Applied research on communications during volcanic emergencies (based on a NERC "Urgency" grant on risks during the El Hierro eruption) led to a documented improvement in the Canary Islands Government's response to the crisis.

The relevance of research in this UoA to national and international industry and government organisations is reflected in the range of funders for PhD studentships including the Atomic Weapons Establishment, Cefas, GSK, Ministry of Defence, Thai Office of Atoms for Peace, Petroleum Technology Development Fund Nigeria and Zoological Society of London. Many PhD projects involve a period working directly with project partners and, in this way, postgraduate research students (PGRS) receive ongoing skills development that ensures the delivery of high-quality, appropriately-trained people to a range of employers and stakeholders. Our PGRS are encouraged to consider, from the outset, the impact of their research and to develop the potential to influence policy and practice.

Developing consultancy and exploitation of expertise and facilities

ISO9001 accreditation of The Environmental Biogeochemistry Analysis Group (TEBAG), supported by University investment, combines in house expertise with state of the art analytical facilities to provide commercial clients with environmental analysis and consultancy services. This has led to a rapid increase in external income. University funds are supporting a 0.5 FTE post to market the Institute of Marine Sciences expertise, together with aquarium, lab facilities and floating research platform, to marine biotechnology and engineering companies. University funding has recently been awarded to assist in establishment of a Portsmouth Microanalytical Centre (PMC), creating a new hub for coordination and development of research and KT activities in related state-of-the-art microanalytical techniques in the UoA.

Public engagement and promotion of public understanding

The UoA has a strong track record of public engagement: for example, *Martill* began work in 1999 as a key scientific adviser on the BBC's *Walking With Dinosaurs*. Our outreach and media activities are supported by the University Press Office (UPO) and Education Liaison and Outreach team. The UPO provides individual-level guidance on responding to media queries and, where appropriate, supports staff at media interviews. Significant press coverage has been achieved, for example, NERC-funded research on the effects of pollution by pharmaceuticals on crustaceans was covered by national newspapers in 20 countries and TV networks worldwide, and has highlighted potential policy issues in both UK and European parliaments. *Smith* made a major contribution to the worldwide coverage of the 2011 Japanese Tsunami and on the resulting Fukushima nuclear disaster. The unit strongly supports outreach: for example, in academic year 2012/13 researchers directly interacted with more than 3500 members of the public in a variety of

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formats including Portsmouth “Up for it” events for school children, the worldwide Cafe Scientifique events and fossil fairs.

c. Strategy and plans

A key strategic aim for this UoA is to build on the approaches outlined above and maximise the impact of its research activities. Specific objectives include to:

- Consolidate existing partnerships with key external stakeholders and develop new collaborations through UPEN and CAG to promote the co-design of research projects and improve access to a range of national and European external funding schemes that promote impact;
- Prioritise internal support for research projects that address key stakeholder challenges, involve key partners and include a range of impact activities. For example, work on the use of wood borer enzymes for biofuel generating processes is being actively supported with funding from the University, the BBSRC and the US National Renewable Energy Laboratory;
- Develop user-relevant training in engineering geology and geotechnics for the global construction, risk management and mining sectors via, for example, a programme of PhD by publication for appropriate professionals. CAG links with companies in these sectors, such as Anglo Gold Ashanti, BHP Billiton, and Balfour Beatty indicate significant potential in this area;
- Maximise the commercial potential of our facilities and skills via TE BAG, the Institute of Marine Sciences and the Portsmouth Microanalytical Centre (PMC). We aim to double commercial income from these facilities and have invested in dedicated resource for marketing to marine biotechnology and engineering companies as well as in development of the PMC. We also aim to increase consultancy income by 50% over the next REF period;
- Develop emerging impact within the *Crustal Evolution* group through PMC and further development of impact within *Biodiversity and Evolution* through links with the oil industry (to add to current public engagement activity in this group);
- Construct a robust framework for the monitoring, assessment and evidencing of impact of research across the UoA and throughout the research lifecycle;
- Continue to host events for key stakeholders that promote our work and provide an opportunity for user engagement, aiming for at least one such event per academic year;
- Increase participation in regional, national and international knowledge exchange hubs such as the Environmental Sustainability KTN and the European Society for Marine Biotechnology (*Hellio* is vice-President).

Achievement of these objectives will be supported by **actions and processes that create an environment where impact-related activities are explicitly acknowledged, resourced and rewarded.** We will

- Support staff in identifying the potential impact of their research, and appropriate avenues to exploit it;
- Include impact-related activities as part of our annual staff appraisal process and provide training and professional development (enterprise and media training) to support these;
- Increase opportunities for staff mobility and research exchanges with external stakeholders that maximise the impact of research within this UoA. We will also appoint appropriate additional Honorary Research Associates to CAG to further strengthen industry links;
- Target funding sources for networking workshops, seminar series, exchanges, and engagement activities to maximize the impact of the research across the UoA; target internal resources (e.g. funding for strategic projects, conference and workshop attendance), where appropriate, at activities designed to increase the impact of our research.

d. Relationship to case studies

Our case studies demonstrate the delivery of economic and societal impact from our research. UOP07CHEMCATCHER and UOP07MARINE exemplify the development of new methods and technologies for environmental monitoring that, in turn, have influenced environmental guidelines and legislation through international stakeholder partnerships and networks. UOP07PTEROSAUR and UOP07FUKUSHIMA illustrate direct engagement of the public with the research in the UoA which stimulated awareness and debate on issues relating to early life evolution and the risks associated with nuclear power.