

Further Particulars CASE Studentship for Ph.D. in Social Anthropology

Project Title: Adoption of Novel Technologies for Nuclear Decommissioning

The project sets out to explore the social and cultural processes of technological innovation in the context of the decommissioning of the Sellafield nuclear site in West Cumbria. The study will focus on how technology development and implementation happens currently in the highly regulated and potentially hazardous nuclear industry, and how a deeper understanding of these processes might help to avoid problems encountered in the past, and build on and strengthen processes that work for the future.

The Sellafield site was established in the 1940s as a Royal Ordnance Factory and in 1947 became an atomic energy site supporting the UK's ambitions to develop nuclear weapons. In addition to operating fuel reprocessing facilities, Sellafield now contains 170 major nuclear facilities and is currently providing temporary storage for more than 120,000 m³ of intermediate level waste, 400,000 m³ of low level waste and the equivalent of 200,000, 200-litre drums of plutonium contaminated material. Much of this waste is stored in facilities that were constructed in the 1950s and 1960s with a design lifetime of approximately 20 years. These facilities are now in urgent need of decommissioning, with the Nuclear Decommissioning Authority describing the legacy storage ponds and silos, in particular, as 'intolerable risks'. The decommissioning of the site is projected to cost at least £70 bn, and to take more than 120 years to complete.

Sellafield Ltd's analysis of their clean-up mission has highlighted many opportunities for the deployment of new technologies with the potential to dramatically reduce the costs and timescales of decommissioning. However, many of the technologies identified as necessary to the decommissioning process are not yet fully developed, or have been developed for different working contexts. The successful translation of novel technology from concept through to routine adoption is built around demonstrating efficacy, and establishing and maintaining confidence amongst a broad cross-section of invested stake-holders. To further understanding of how this might best be achieved, three key stakeholder groups and their interactions will provide the focus for this empirical study.

(i) **Decision makers – experts and management:** The challenges posed to 'sense-making' and decision-making in organizations defined as 'high-hazard' has generated a voluminous body of work in disciplines such as management and organization studies (Roberts, 1990, 1993; Perrow, 1999; Weick and Sutcliffe, 2007). A broad consensus seems to have emerged in this literature which suggests that successful 'high reliability organizations' must have what is called 'open cultures' (Weick, 1987), characterised by 'collective mindfulness' (Weick and Roberts, 1993), and decision making structures and practices based on expertise rather than bureaucratic hierarchies (Roberts et al 1994). However, there is much that is not yet known concerning the occupational and organizational practices through which risk gets understood and assessed. The ways in which quantitative risk data is generated and used will be a central concern of this study (Amoore, 2011) alongside ethnographic attention to more holistic understandings of risk as embedded social imaginary.

(ii) The wider ‘community’ – unions, supply chains, and sub-contractors:

The decommissioning of the Sellafield site has significant social implications. Sellafield currently employs more than 10,000 people, and effectively provides a living for an estimated 50% of the residents of west Cumbria. Anthropological research on the social embeddedness of industrial facilities is long-standing (e.g. Parry, 2003, 2005; Mollona, 2009; Goddard & Narotzky, 2015; Zonabend, 1993; Zeiderman, 2015), supported more recently by an increased attention to supply chains (e.g. Tsing, 2009), sub-contracting (Mollona, 2009) and the wider fields of circulation, including those of nuclear materials and nuclear waste (Alexander and Reno, 2012; Garcier, 2012; Gregson, 2013; Hecht, 2012), that extend the field of social impact well beyond the sites in question. Building from engagements with employees and sub-contractors, the project will explore diverse understandings of technological change, addressing both fears and expectations, seeking to document the diverse ways in which people associate technological innovation with their livelihood and potential futures.

(iii) Developers of new technologies: In addition to the diverse perspectives within management, the workforce and the wider community, the study will address technological innovation from the perspective of developers. Building on previous work on technology development (e.g. Balsamo, 2011; Edwards, 1995; Hyysalo, Elgaard Jensen & Oudshoorn, 2016; Oudshoorn & Pinch, 2003) the research will attend to the social dynamics of technological innovation. A key focus will be on developer understandings of analogous organizational settings. For example, robotic systems are used in a variety of industries, such as food packaging, automotive manufacture and space exploration. By contrast, their use in the nuclear industry has been minimal. Elaboration of the social, cultural and organizational specificities of ‘first of a kind’ technological solutions deemed successful at other times, or in other places, will provide important indicators of how new technologies might be successfully integrated into Sellafield’s decommissioning activities in the future.

Methodology: The research questions that drive this project are formulated at the intersection of social anthropology, science and technology studies (STS), and management and organization science. The approach has proved particularly fruitful in recent years, particularly in the fields of infrastructures (Harvey, Jensen & Morita 2016; Larkin, 2013), biotechnologies (Haraway, 1998), human/machine configurations (Suchman, 2007, 2011; Richardson, 2015) human/animal configurations (Law 2002, 2011, 2012; Lien 2016) and the growing interest in big data (Mckenzie, 2015, 2016 Ruppert, 2014). Social science researchers are increasingly deploying expansive conceptions of ‘organization’ that suggest that organizational practices are often far more experimental and open-ended than has been admitted in the past (e.g. Mol, 1999; Latour, 2013; Law, 2004). Recent work in anthropology including Blaser (2013), de la Cadena (2010, 2015), Viveiros de Castro (1998) that focuses on issues of translation and equivocation will also be central to the way that this research project approaches current debates on the ontological politics of technological change.

The project will also build on the work of STS and anthropology scholars who have made the nuclear industry the specific object of their research and analysis

(Gusterson, 1998, 2004; Hecht, 1998; 2012; Masco, 2006; McKenzie & Spinardi, 1995; Mort, 2002; Wynne, 1982). The attention their research devotes to historical contextualisation, state intervention and regulation, broad economic drivers, and political interests is particularly helpful. This study seeks to make an ethnographic contribution, following a methodological commitment to rich qualitative data, drawn from participant observation, interview, and archival work (drawing in this case specifically on the Sellafield archive).

Timetable:

Year one: The student will undertake extensive literature reviews, along the lines outlined above, and will conduct initial interviews with key stakeholders (including current Sellafield employees and managers, suppliers, and academic partners/developers) in order to identify (i) those areas where new technologies are deemed (by at least some of those involved) to offer the possibilities of substantial reduction in the costs and the timescales of the decommissioning process (ii) previous technologies that have successfully been introduced in the past with demonstrable benefit to the decommissioning process (iii) previous attempts at introducing new technologies that have failed.

Year two: The student will choose at least two examples of technological innovation for in-depth study, working with the full range of stake holders who were involved in the process, including the developers, the academic researchers (in engineering and/or robotics). Central to this phase of the research will be the more nuanced understanding of how 'success' and 'risk' are identified by those involved, how 'success' and 'risk' are measured, and how different notions of 'best practice' are negotiated and understood. The student will also identify and follow at least two examples of new technologies that are currently under development. In this phase of the research a close analysis of organizational processes will be conducted. How are new technologies introduced and show-cased? Are there standard routines and practices – or does the introduction of new technologies vary in relation to the diverse internal procedures of the organization? Developing case studies from work sponsored by Sellafield's Academic Hub will ensure good access for the exploration of new developments in robotic technologies and the specific attitudes around automation that inflect understandings of potential benefits and risks.

Year three: The student will focus primarily on writing – but will also organise (with supervisors) at least two collaboratories – workshops that researchers organise in collaboration with diverse practitioners to discuss and debate emerging research findings (Ruppert et. al 2015).

Dissemination of outcomes:

- Conference presentations in years 3 and 4. The student will present at two international conferences.
- Presentations will be made to technical committees within Sellafield and at the NNL annual conference.

- Two ‘collaboratories’ will be organized by academic partners to bring together different stake-holders to discuss questions and possibilities raised by the research.
- Publication in Sellafield and University newsletters (both internal and external).

Supervisory Team

Professor Penny Harvey, Social Anthropology, University of Manchester

Professor Barry Lennox, School of Electrical & Electronic Engineering,
University of Manchester

Xavier Poteau, R&D Technology Delivery Manager at Sellafield Ltd. And a Royal Academy Visiting Professor at the University of Manchester.

Anthony Banford, Chief Technologist for Waste Management and Decommissioning at the National Nuclear Laboratory, and Royal Academy of Engineering Visiting Professor in Nuclear Engineering at the University of Manchester.

This student will be based within the Engineering Design Academic Hub (EDAH) adjacent to the Sellafield site in West Cumbria for at least half the research period. The Hub is located at the National Nuclear Laboratory’s Workington Facility where a major programme of research is undertaken to support the Sellafield mission. The student will benefit from an industrial as well as academic supervisor and will interact on a daily basis with engineers and scientists working within this facility. The student will also have the opportunity to access the Sellafield site (subject to security clearance) and work with staff who are directly engaged with decommissioning activities on a nuclear licensed site.