Prof. Marie Harder

1. Employment History

Employment:	01/2008	**Professor of Sustainable Waste Management** **(active within broader field of Sustainable Development)** University of Brighton
	03/2005	Principal Lecturer, University of Brighton Head, Waste & Energy Research Group
	10/2004	Senior Lecturer, University of Brighton Head, Waste & Energy Research Group
	09/2001	Principal Lecturer, University of Brighton while Chief Executive Officer of Brighton Environmental Body
	03/1992	Senior Lecturer, University of Brighton
	09/1989	Lecturer, University of Brighton
Degrees:	1985-89:	University of Sussex: DPhil in Nuclear Structure
	1982-85:	U.C.N. Wales at Bangor; BSc (Hons) in Chemical Physics
Schooling:		In 12 schools in USA, Pacific Islands, India, Wales, Ireland

2. Summary of achievements using common academic metrics

In the sections below, I provide standard evidence as often required to show that I have:

- built up a successful, growing, self-funding research group from scratch, and extended and developed it sustainably for many years
- written 54 refereed publications,
- given many presentations at international conferences, including invited keynote talks
- successfully supervised 9 PhD students,
- personally brought in over £1,800,000 of public and private funds in 7 years
- brought together collaborators from industry, research, manufacturing, engineering, NGOs, voluntary groups, SMEs, schools, community groups and local, national, regional and European governments to work on tens of projects I have initiated
- been invited to contribute to national and international waste issues,

refereed publications	(x 54)	
conference presentations	(x 33+)	
major reports	(x 26)	
PhD completions	5 in nuclear physics	1999-2003
	4 in waste/resource management	2005-2010
	3 current in waste:	due 2010, 2011, 2013
	2 current in sustainable development, due	2015
(EPSRC grants (pre-2001: physics);	6 grants totalling £385,175	pre –2001)

Landfill Tax Funds;	6 grants totalling	£824,358	1999-2004
Industry/LA funded research;	11 grants totalling	£102,238	2001-2004
Industry/LA/DEFRA funded research:	30 grants totalling	£900,997	2004-2006
Various funded research:	c30 grants totalling	c£886,700	2007-2011
TOTAL (not counting physics grants pre-2001)		£ 2,714,293	1999-2011

It is in Knowledge Transfer that I believe I have made the most significant contributions at a high level, contributing to the application of knowledge to dozens of stakeholders at county, regional, national and international level. This has not been through narrowly focussed studies on specific characteristics of isolated aspects of academic interest, but multi-disciplinary, applied, solution-driven pieces of work with external partners, and whose lessons learned are extracted and disseminated for others to learn from.

In later sections I have grouped my work into the following strands for presentation:

- Sustainable Development
- Waste Stream Flows: quantification & modelling
- Household Waste: minimisation and increased recycling
- Public Education: waste awareness
- End-of-Life Vehicles (ELV): materials recovery
- Pyrolysis of Shredder Residues: and related metal contaminations

In all six strands of my work there is demonstrable impact. In Sustainable Development I am running an international novel project, ESDinds, which involves five large 'umbrella' Civil Society Organisations such as Earth Charter International, and further groups have asked to be involved, such as the International Federation of the Red Cross and Red Crescent. Businesses are asking to commercialise the preliminary results of that work, and I was asked to be a Keynote Speaker at an EU conference to present the design of the project, which is novel. Other work has significant impact e.g. in some national policy, and local capacity building. In pyrolysis of waste I was invited as one of the seven keynote plenary speakers in the 5-day International Conference on Analytical and Applied Pyrolysis in Budapest in June[1]. In end-of-life vehicles (ELV) I was asked to give a main talk at the ELV 2006 conference in Warwick in September[2]. In waste modelling I have published a paper[3] suggesting a new type of Performance Indicator for recycling which can be used worldwide, which a consultancy firm has since asked to develop. Furthermore, modelling work with a graduate student has been used within DEFRA's waste predictor model, LAWR. In waste minimisation my determination of the overall impact of household food waste digesters has been used by DEFRA for UK strategy[4] and published for worldwide consideration. In waste education and behaviour change my systematic studies on the use of various incentives for householders to increase

[1] "A Review of Developments in the Pyrolysis of Automotive Shredder Residue" International Conference on Analytical and Applied Pyrolysis, Budapest 2006.
[2] "A Review of Current Options for Post-Shredded End –of-Life Vehicles" ELV'06 Conference, Warwick 2006.
[3] Ref [4], "Development of a New Quality Fair Access Best Value Performance Indicator (BVPI) for Recycling Services".
[4] "Systematic Evaluation of the Minimisation of Household Waste due to the Use of Green Cone Food Digesters", Report to DEFRA and West Sussex County Council, Nov 2005.

their recycling has led to a commission by DEFRA to review their programme of 51 different studies nationwide, to directly feed into the Waste Strategy Review[5]. I was asked to speak on this issue at a major international conference in Canada in 2008[6]; a national conference dedicated to my portion of the work was already held in London in September 2006[7].

3. Sustainable Development

Below I summarize projects undertaken recently which involve expertise from the University but with great impact in society; the Sustainable Development approach is dominant. Some of the projects are novel and leading internationally (especially ESDinds); others are novel developments in capacity building of importance to local communities near the University – which also provide examples of approaches of interest to other communities nationally and internationally.

Project Title and sub-projects	**Funding**	**Funders**	**Knowledge Transfer Impact**
United Nations Regional Centre of Expertise in Education for Sustainable Development (UN RCE) Development of a UN RCE led by University of Brighton for the UN Decade of ESD UN Approval is achieved: funding is now being sought	Not yet achieved	Various	Expertise in University to coordinate and capacity build across South East of England and participate in a world-wide network
Sustainable Schools Strategy Development Working with the School of Education at the University, to develop a strategy for a County Council 2010-11	c£38,000	Department of Trade & Industry	Expertise in University to County Council and for national use
Commercial & Industrial Waste: Development of a Strategy for a County Council 2010-11	c£38,000	Department of Trade & Industry	Expertise in University to County Council and for national use
ESDinds: The Development of Indicators & Assessment Tools for CSO Projects Promoting Values-based Education for Sustainable Development 2009-11	c£553,000	European Union: Framework 7 Research: Environment programme	Novel development of useful indicators for Civil Society Organisations
Waste in Action: French-English training of waste officers 2009-11	c£65,000	European Union: INTERREG programme	University expertise used for capacity building
Clean Development Mechanism (CDM) calculations and scenarios for Domestic Anaerobic Digestion Systems in Bangladesh 2009-12	c£2,700	Chartered Institute of Waste Management	University expertise used for capacity building and national policy
R&D into use of Recycled Glass for Arsenic Filtration in Bangladesh 2009-12	Not yet achieved	tbc	University expertise used for capacity building and national policy

[5]"Household Incentives Schemes in Sussex", pub. Resource Recovery Forum, London, Sept 2006.
[6]"Waste – The Social Context '08" May 2008, Edmonton, Canada. Organised by the Edmonton Waste Management Centre of Excellence.
[7] "Recycling Incentives", Resource Recovery Forum, London, September 2006

Better Tomorrows: various contracts for community engagement in waste, recycling and minimisation A not-for-profit body set up by a local authority 2007-11	c£80,000	Better Tomorrows	University expertise used for capacity building
Waste Prevention Advisors Training of volunteers to actively engage in community action in waste reduction 2007-11	c£30,000	West Sussex County Council	University expertise used for capacity building
Carbon Reduction Constulancy Training of volunteers to actively engage in community action in waste reduction 2007-11	c£80,000	Confidential	University expertise used for capacity building
TOTAL FUNDING:	**£ 886,700**		

streams of waste arising at landfill and civic amenity sites, and then reflect the maturation of the field as studies were carried out on flows across a county, or on specific waste flows in preparation for transforming them into a resource.

4. Waste Stream Determination and Flow Modelling

Below I summarize projects undertaken in the analysis and modelling of waste streams. They begin with rigorous work to establish the then-unknown data on

Project Title and sub-projects	**Funding**	**Funders**	**Knowledge Transfer Impact**
BEB 1:Sussex Waste Strategy Development: Materials flows into Landfill sites Material flows into Civic Amenity sites Heterogeneity of waste arriving at Landfill 1999-2002	£82,000	Landfill Tax Credit Scheme Viridor Waste Management	Industry previously only estimated this data
Investigations of Waste Fractions at Civic Amenity Sites 2001-2003	£1,279	East Sussex County Council	Relative fractions of materials now known
Survey & Analysis of Materials Flow to a Landfill Site: 2001-2004	£2,859	confidential	Industry previously only estimated this data
BEB 11: Packaging Life Cycles; Identifying Bottlenecks in Minimisation Waste Materials Flows Life Cycle Analysis 2001-2004	£83,947	Landfill Tax Credit Scheme Biffaward PIRA International INCPEN British Packaging Federation VALPAK	Allowed shared exploration of bottlenecks with stakeholders
BEB 7:Sussex Waste Strategy: Data Materials flows into Landfill sites Material flows into Civic Amenity sites Heterogeneity of waste arriving at Landfill 2002-2004	£68,448	Landfill Tax Credit Scheme Viridor Waste Management East Sussex County Council	Industry previously only estimated this data
University Material Waste Flows at two sites 2002-2003	£500	University of Brighton	Client previously not aware of savings possible
Study of Waste Flows across a UK County 2003-2004	£4,000	Viridor Waste Management	WERG analysis expertise assisted decisions
Surveys of Trade Waste mingled with Household Waste 2005	£10,000	West Sussex County Council	Client previously only

			estimated this data
Survey of Specific Forestry Wastes in the SE 2006	£1,050	Forestry Commission	
Determination of Baseline Data for Consideration of combined household and commercial recyclates collection 2006	£1,000	Viridor Waste Management Ltd.	Preparation for bid for pilot programme for county
Consultations on various waste flow and current issue matters 2006-7	£13,000	Centre of Excellence in the South East, (Waste Division)	WERG analysis expertise assisted decisions
Study of Waste at County Council Properties 2007	£9,900	West Sussex County Council	WERG analysis expertise to assist decisions
TOTAL FUNDING:	**£277,983**		

streams of waste arising at landfill and civic amenity sites, and then reflect the maturation of the field as studies were carried out on flows across a county, or on specific waste flows in preparation for transforming them into a resource.

5. End-of-Life Vehicle (ELV) shredder residues: characterisation and recycling

This single, huge project, listed above, spawned several others, spanning many scientific disciplines. For example, it was crucial to determine the relative proportions of different families of polymers present in the shredder residue, and the academic literature would lead one to believe that numerous systems exist such as infra-red and x-ray, which can do that. When trials of these showed them not to be useful, the group devised its own system of identification using a combination of several techniques from physical and chemical sciences. The extended piece of work detailing the findings of the materials present in shredder residue is in preparation for publication in academic journals, but its results have already been made use of in the related UK industries, as the key stakeholders were collaborators in this work.

Project Title and sub-projects	**Funding**	**Funders**	**Knowledge Transfer Impact**
BEB 2:Development of Automotive Products from Polymer Wastes: Determination of materials compostition in shredder residue(SR) Determination of different polymer contributions in ELV and mixed shredder residues (SR) Investigation of mechanical methods of separating fractions of SR Development of recycled household polymers for automotive use Determination of physical characteristics of recycled polymer blends Development of manufacturing tools for use of recycled polymers 1999-2003	£357,534	Landfill Tax Credit Scheme Viridor Waste Management CARE (Consortium for Automotive Recycling) Ford, Rover, BMW, SIMSmetals, European Metal Recycling, Indepenent Shredders, BMRA (British Metal Recycling Association)	Car industry became willing to use recycled polymers in volume; SR was characterised; quantitative analysis of SR materials now known
TOTAL FUNDING:	**£357,534**		

6. Household waste: characterisation, minimisation and recycling

These projects show a variety of large, systematic studies which have been used to advise national (and international) policy, as well as small, focussed projects designed to assist particular clients with specific research expertise and solutions.

Project Title and sub-projects	**Funding**	**Funders**	**Knowledge Transfer Impact**
Development, Execution and Evaluation of Pilot Kerbside Trials for County Rollout Design of three pilot schemes for the County Execution of Pilot Studies and Collection of Data Evaluation of Results and Recommendations to the Council 2002-2004	£23,250	DEFRA Horsham District Council	Direct Transfer of applied Uni expertise to a District problem
3-Month Trials of Food Digesters in 120 Households 2002-2003	£9,900	Green Cone Ltd	Results suggested Govt Could consider endorsing it.
Crawley Household Waste Survey 1999-2004	£1,200	Crawley Borough Council	
Scoping Study on Waste Funding 2004-2005	confidential	confidential	Academic expertise advised client
Survey of Satisfaction of Clients at Household Waste Recycling Centres 2004-2005	confidential	confidential	Academic expertise allowed appropriate survey
Trials of Green Cone Food Digesters in users across a County Validation of reductions in household waste Determination of public response Analysis of use against demographic parameters Comparision with composter use 2004-2005	£64,613	DEFRA West Sussex County Council Horsham District Council Worthing District Council Arun District Council Crawley Borough Council	Academic expertise on robust sampling and data was required; results allowed trials to 15,000 households
Development of a new infrastructure for kerbside collections Consultations on options Development of a Materials Recycling Facility 2004-2005	£42,000	DEFRA Hastings Borough Council	Uni expertise used to advise and assist
Surveys of Public Satisfaction with Communal Residual Bins 2004-2005	confidential	confidential	Independent Analytical expertise given
Surveys of Household Satisfaction with Kerbside Recycling Scheme 2004-2005	confidential	confidential	Independent Analytical expertise given
Material Flows in Packaging: Life cycle analysis 2004-5	confidential	confidential	
Surveys of Household Participation in Kerbside Recycling Scheme 2004-5	£20,256	Eastbourne District Council	
Surveys of Household Participation in Kerbside Recycling Scheme 2005	£5,458	Crawley District Council	
Surveys of Household Participation in Kerbside Recycling Scheme 2005	£5,000	Mid Sussex District Council	
Assistance with setting up of new MRF Development of processes for collecting and sorting kerbside waste 2005	£53,243	Hastings Borough Council	Knowledge allowing 40,000 householders a recycling scheme.

Consultation regarding Composting Sites 2005	confidential	Environment Agency	Expertise used to advise EA and public
Systematic Trials of Green Cone Food Digesters offered to 2000 households Validation of reductions in household waste Determination of public response Analysis of use against demographic parameters Comparision with composter use 2005	£60,000	DEFRA West Sussex County Council Horsham District Council	Academic expertise on robust sampling and data was required; results to be used to decide on national programme
Household Incentivisation Pilot Studies: Designing a suite of medium scale pilot studies to increase public recycling Consultation with two County Councils and twelve district Councils Execution of four types of Incentives Schemes in fourteen sub-studies Trials of impacts of use of: vouchers for participation for use in local shops or leisure centres, schemes to trigger funds to local primary schools, publicly reported competitions between sets of three neighbouring communities 2005-6	£203,000	DEFRA West Sussex County Council East Sussex County Council Arun District Council Mid Sussex District Council Adur District Council Horsham District Council Chichester District Council Crawley Borough Council Worthing District Council Lewes District Council Eastbourne District Council Hastings Brorough Council Rother District Council	Overall expertise with household recycling issues was used to put Sussex at forefront of government schemes trialling new incentives. Results will feed into national plans.
Studies and surveys of Household Participation in Kerbside Recycling Scheme - focus on multiple-household buildings 2006	£33,200	Crawley District Council	
DEFRA: Post-evaluation of a nationwide programme of studies on household recycling incentives 2006	confidential	DEFRA (Department for the Environment, Food and Rural Affairs)	Commisioned to advise the UK Waste Strategy Review
TOTAL FUNDING:	**£573,090**		

7. Public Education in Waste & Recycling issues

Although I had initially focussed on technology and knowledge transfer to businesses and authorities, I found that more social issues in sustainable resource management required support and development. From 2004 I fully embraced this work, and have not only expanded to the specific requirements of clients but have also started incorporating such teaching into undergraduate and now postgraduate modules.

Project Title and sub-projects	**Funding**	**Funders**	**Knowledge Transfer Impact**
West Sussex County Council **Public Education on Waste Awareness** Design and production of education newsletters to householders 2004-5	£12,000	DEFRA West Susex County Council Horsham District Council	Direct application of knowledge to 10,000 households
Development of a County Waste Awareness Strategy Chairing consultations with Districts Devising and collecting consultations from businesses and householders Public Education via Newsletters to 20,000 householders 2004-5	£40,250	DEFRA West Sussex County Council Mid Sussex District Council Adur District Council Horsham District Council Chichester District Council	Direct Transfer of applied academic expertise to a District-wide problem

WSCC Public Waste Awareness Programme Monitoring, execution and evaluation of door-to-door education on waste and recycling awareness Surveys of pre & post-event participation rates 2004-6	£58,000	DEFRA Horsham District Council Worthing District Council Arun District Council Crawley Borough Council	
Public Education in Waste Awareness: Door-to-door education to 5,000 households 2005	confidential	confidential	Direct public education to 5,000 houses
Public Education in Waste Awareness: **Development and delivery of a Campaign for Hastings** Delivery of Public Education to every household door-to-door Design of PR campaign to town Design of text in printed information 2005	£143,000	WRAP Hastings Borough Council	Direct application of expertise to design suite of Activities to educate all householders
Review of newly Developed CIWM accredited modules in Waste Management Diploma, Certificate and MSc levels 2005	confidential	confidential	Application of knowledge to assist national training programme
Training Waste Advisors for Voluntary Work Development of a course with University Credit Recruitment to and delivery of course over three years Provision on ongoing support for Volunteers in the Community 2006	£60,000	West Sussex County Council	Application of knowledge to assist county training programme
Public Education of Use of Green Cone Food Digesters 2006	£50,000	West Sussex County Council	Direct application of expertise to tutors and the 15,000 householders they will tutor
WRAP Public Questionnaires on Recycling Habits 2006	£1,500	Adur District Council	Application of expertise to assist a council to collect robust data
Support for Volunteer Waste Advisors Development of a support course with potential University Credit Provision on ongoing support for Volunteers in the Community 2006	£5,500	West Sussex County Council	Application of knowledge to assist county training programme
Specialist development of CIWM accredited MSc modules in Waste Management MSc level 2006	confidential	confidential	Application of knowledge to assist national training programme
TOTAL FUNDING:	£382,557		

8. Pyrolysis of shredder residues and issues of heavy metal contamination

The projects below represent my work on pyrolysis of wastes – an example of how I have had to move across disciplines like mechanical engineering for the separation of shredder residue, to chemical engineering for pyrolysis and physics for X-ray fluorescent spectroscopy, because this flexibility is needed to pursue problems in waste/resource management to a solution.

Project Title and sub-projects	**Funding**	**Funders**	**Knowledge Transfer Impact**

BEB 5: End-of-Life (ELV) Automotive Shredder Residue (ASR) Pyrolysis Development of shredding and separation techniques for ASR Development of continuous feed and exit pyrolysis unit Development of seals for rotating continuous feed Development of milling and crushing techniques for pyrolysis char Development of metal recovery techniques from char Chemical characterisation of char and its contaminants 2000-2002	£149,875	Landfill Tax Credit Scheme Biffaward CARE (Consortium for Automotive Recycling) Ford, Rover, BMW, SIMSmetals, European Metal Recycling, Indepenent Shredders, BMRA (British Metal Recycling Association)	A feasible process for the recovery of significant amounts of metals fromSR developed, opening options for meeting new EU Directives
BEB 14: Levels of Lead in ASR Characterisation of pyrolysis ash Detailed comparision of material composition of ASR from different UK sites Characterisation of raw SR & ASR Development of methods for determination of lead contamination in SR Development of processes to reduce lead contamination 2001-2004	£82,554	Landfill Tax Credit Scheme Biffaward CARE (Consortium for Automotive Recycling) Ford, Rover, BMW, SIMSmetals, European Metal Recycling, Indepenent Shredders, BMRA (British Metal Recycling Association)	Knowledge was developed in this project on lead speciation in complex SR material; info used by DTI to determine non-hazardous nature of SR subject to further developments.
Delivery of a Conference on Products from Waste 2004	confidential	confidential	Sharing of applied academic findings
Scoping Study on Commercial Viability of Pyrolysis of ASR 2005-6	confidential	confidential	Use of expertise to assist direction of development of SME
TOTAL FUNDING:	**£236,429**		

An issue that was brought to light with this above work was the unexpected lead content as a contaminant in the resultant ash. The level found prevented immediate consideration of the material as a substitute raw material for brick making, but even more importantly was an indicator of the hazardous nature of the automotive shredder residue. This became a crucial issue for the industry, the Environment Agency and the DTI, who later quoted my work in making their borderline decision to categorise SR as non-hazardous. A fundamental question was the speciation of the lead present, in order to determine its source, e.g. from wheel weights (metallic) or compounds used in older polymers. We are currently developing a novel approach to resolve this problem, working with manufacturers of specialist analytical equipment.

As SR is mixture of many materials whose composition varies by the hour, I have also helped the field develop a better understanding of statistical sampling, and am working to show that the use of a portable XRF spectrometer to take multiple (hundreds), approximate readings of SR contaminants is more useful than a few sent to precision labs. This work is currently the focus of a large DTI Technologies bid, with the manufacturer of the PXRF. It is also the subject of several academic papers which are in preparation for academic journals.

9. Physics: (An area of research undertaken before moving into Sustainable Resource Management)

(I present the information below only for systematic disclosure of my research career; I do not submit it as a direct contribution to my work in Sustainable Resource Management. However, as discussed in section 5 above, the in-depth background I developed in nuclear spectroscopy is invaluable in development of my emerging work in contamination of heavy metals, which is squarely within Sustainable Resource Management.)

Project Title and sub-projects	**Funding**	**Funders**	**Knowledge Transfer Impact**
STUDIES OF EXOTIC NUCLEAR STATES WITH RADIOACTIVE BEAMS AM Bruce & MK Harder within 1996-2001	£228,849	EPSRC (Engineering and Physical Sciences Research Council)	n/a
STUDY OF UNDERLYING SYMMETRIES IN NUCLEI AM Bruce & MK Harder within 1996-2001	£21,055	EPSRC	n/a
DEVELOPMENT OF RIST AND INVESTIGATION OF NUCLEAR SYMMETRIES AM Bruce & MK Harder within 1996-2001	£18,571	EPSRC	n/a
SUPPORT OF THE BRIGHTON NUCLEAR PHYSICS GROUP IN THE DEVELOPMENT OF AN EXPERIMENTAL PROGRAMME AT GANIL AM Bruce & MK Harder within 1996-2001	£56,025	EPSRC	n/a
SHELL MODEL CALCULATIONS FOR EXOTIC A=60-100 NUCLEI ACCESSIBLE IN RADIOACTIVE BEAM EXPERIMENTS MK Harder & AM Bruce within 1996-2001	£18,110	EPSRC	n/a
STUDY OF FP SHELL NUCLEI AM Bruce & MK Harder within 1996-2001	£42,565	EPSRC	n/a
TOTAL FUNDING:	**£385,175**		

10. Teaching

I have taught quite a variety of courses from Quantum Mechanics to Foundation Year Engineering; Materials Science to Citizenship.

I passionately enjoy teaching, and I have continually expanded my teaching repertoire and skills. Feedback forms from students indicate I have achieved high standards. In particular, I have developed my teaching of Independent Study Modules, offered at Level 2 and Level 3, so that they are highly innovative in providing opportunities for the students to explore themselves as well as a current topic of their choice (related to energy or waste or related issues in Sustainable Development). Although this requires that I put in more time than usual for a module, especially at the beginning of the term, I obtain great satisfaction to see the students knowingly develop a challenging path of work of personal interest to themselves, and then work hard to their own contract specifications. It is one of the few modules where students with special abilities can be individually guided to achieve their full potential, and for weaker ones to focus on their weakness or their strengths, as they decide in their contract. I have seen many individual students fight their personal demons in that module, and have had many come back to thank me later.

Similarly, even though a professor I continue to teach a module in Alternative & Renewable Energy, which I have had to continually adapt because the students taking it have changed from Engineering and Physics students to a mixture from twelve courses including BA and BSc Geographers, Environmental Scientists and Teacher Trainers. In this module I have introduced a set text and fortnightly tests, which leaves me free to fluently vary the lecture content depending on the level of understanding of the audience to the specific topic on the day. I also develop the longer assessment of that module to be specific to the background of each student, to ensure good level of learning is taking place.

Dissertation and PhD teaching

It is clear that my Final Year Project students and PhD students have benefited greatly from the success of my research group (WERG). Rather than having artificial projects, my annual 6-8 Project Students are permitted to develop work relating to one of the current projects for clients such as local authorities, waste management companies, or consultancies. Several have achieved work approaching Masters level in recent years, and many have gone on to take permanent jobs in waste or recycling – at least 21 in the last 10 years. Several have become Waste or Recycling Officers; some now serve at County or Regional level and at least one sits on several national committees after spending a year on the team leading the development of Public Private Partnerships in Waste Management. Three have been invited to join the Centre for Excellence in the South East, in the Waste Division, recently set up to develop and disseminate Best Practice in local authorities nationally.

I have had the pleasure of being able to fund three PhD studentships, from monies from some of the projects discussed above. For three of these students, this allowed them to earn RA salaries while working directly on their theses, part time. They all completed on schedule and with excellent reports.

WERG attracts interest from researchers based elsewhere, and we have so many enquirers who wish to be involved as volunteers or self-funded researchers that we

now allocate one desk just for that. My group is developing a reputation as an excellent place for personal development in areas relating to Sustainable Development, and all staff leaving WERG since its inception have gone on to related jobs at a higher level.

11. National (and international) standing

(I do not feel comfortable producing such as list, as it seems to overstate the importance of such activities, but as it is standard requirement in these days of university metrics, I provide it…)

I review papers for several international journals in waste[8], grant proposals for the EPSRC and have been external examiner of several PhD candidates at other universities[9]. I have served on the Editorial Panel of *Proceedings of the Institute of Civil Engineers for Waste & Resource Management.*

In all six strands of my work there is demonstrable impact. In pyrolysis of waste I was invited as one of the seven keynote plenary speakers in the 5-day International Conference on Analytical and Applied Pyrolysis in Budapest in June[10]. In end-of-life vehicles (ELV) I was asked to give a main talk at the ELV 2006 conference in Warwick in September[11]. In waste modelling I have published a paper[12] suggesting a new type of Performance Indicator for recycling which can be used worldwide, which a consultancy firm has since asked to develop. Furthermore, modelling work with a graduate student has been used within DEFRA's waste predictor model, LAWR. In waste minimisation my determination of the overall impact of household food waste digesters has been used by DEFRA for UK strategy[13] and published for worldwide consideration. In waste education and behaviour change my systematic studies on the use of various incentives for householders to increase their recycling has led to a commission by DEFRA to review their programme of 51 different studies nationwide, to directly feed into the Waste Strategy Review[14]. I have been informally asked to speak on this issue at a major international conference in Canada in 2008[15]; a national conference dedicated to my portion of the work was already held in London in September 2006[16].

At a national level, I was an early petitioner for peer review of landfill tax projects, leading to my inclusion in national groups to further that matter: VESG (Value

[8] Journal of Analytical and Applied Pyrolysis, Waste Management, International Journal of Environmental Health Research, Resource Conservation Recycling, Proceedings of the Institute of Civil Engineers (Waste & Resource Management).
[9] E.g. Universities of Sussex, Leeds, Cardiff.
[10] "A Review of Developments in the Pyrolysis of Automotive Shredder Residue" International Conference on Analytical and Applied Pyrolysis, Budapest 2006.
[11] "A Review of Current Options for Post-Shredded End –of-Life Vehicles" ELV'06 Conference, Warwick 2006.
[12] Ref [4], "Development of a New Quality Fair Access Best Value Performance Indicator (BVPI) for Recycling Services".
[13] "Systematic Evaluation of the Minimisation of Household Waste due to the Use of Green Cone Food Digesters", Report to DEFRA and West Sussex County Council, Nov 2005.
[14] "Household Incentives Schemes in Sussex", pub. Resource Recovery Forum, London, Sept 2006.
[15] "Waste – The Social Context '08" May 2008, Edmonton, Canada. Organised by the Edmonton Waste Management Centre of Excellence.
[16] "Recycling Incentives", Resource Recovery Forum, London, September 2006

Enhanced Steering Group - for Landfill funded research), and FORWARRD (Forum for Waste and Resource Research and Development). I work with several national bodies such as the Consortium for Automotive Recycling (CARE), the British Metal Recycling Association (BMRA), Viridor Waste Management Ltd and Veolia Waste Management Services Ltd. I have been invited to participate on several national committees and working groups; however, I have found it difficult to take up or maintain those commitments, as I am the only permanent member of my research group at the moment and have constant demands from it which I cannot delegate.

Local Members of Parliament have taken interest in my research, with both Liberal Democrat Charles Hendry (Wealden) and Labour Member David Lepper (Brighton) visiting my group specifically. Charles Hendry MP brought the work to the attention of the then Minister of the Environment, Margaret Beckett, who wrote an encouraging letter to the research group. David Lepper has subsequently mentioned me, WERG and the University of Brighton in Parliament more than once - as documented in Hansard, - and asked me to become more active with the Associate Parliamentary Sustainable Waste Group where I have since led a workshop.

In fact, I enjoy attending APSWG events, as they focus on issues under formulation at Westminster, and provide an opportunity to interact with MPs in the discussion periods. Below I list those I have interacted at, as well as other national meetings.

Date	Title of Event	Name of the Organisers	Location
3rd April 03	The End of The Landfill Tax Credit Scheme? Where do we go from here?	Associate Parliamentary Sustainable Waste Group	Westminster London
7th June 03	UK Producer Responsibility Summit 03	Associate Parliamentary Sustainable Waste Group	Westminster London
8th Dec 04	PFI: Panacea or Pandora's Box	Associate Parliamentary Sustainable Waste Group	Westminster London
18th Jan 2005	Waste Strategy & New Technology - Solutions for 2025	Associate Parliamentary Sustainable Waste Group	Westminster London
19th Jan 2005	Raising Public Awareness of Recycling	MRW Materials Recycling Weekly	London
9th June 2005	Waste Treatment & Disposal Technologies	Associate Parliamentary Sustainable Waste Group	Westminster London
29th June 2005	New Parliament Meeting	Associate Parliamentary Sustainable Waste Group	Westminster London
11th July 2005	Science Committee	Associate Parliamentary Sustainable Waste Group	Westminster London
20th & 21st Aug 2005	Sustainable Waste – finding Partners	SEEDA	Oxford
11th Oct 2005	Sustainable Waste – what and how	Associate Parliamentary Sustainable Waste Group	Westminster London
12th Oct 2005	What Are Our Priorities? Waste & Energy for 2006	Associate Parliamentary Sustainable Waste Group	Westminster London
30th Nov 2005	Better Regulations at What Price?	Associate Parliamentary Sustainable Waste Group	Westminster London
7th Dec 2005	Review of Waste Strategy 2000	Resource Recovery Forum	London
13th Dec 2005	Plastic Recycling: Meeting the Global Challenges	Associate Parliamentary Sustainable Waste Group	Westminster London
15th Feb 2006	EU Legislation – which ways forward?	Associate Parliamentary Sustainable Waste Group	Westminster London
3rd April 2006	Transporting Waste Across International Borders	Royal Geographical Society	London
9th May	Hitting the Recycling Targets	SEEDA	Winchester

2006			
9th May 2006	Waste Minimisation in Belgium + AGM	Resource Recovery Forum	London
Jan 2007	What Hierarchy for Waste to Energy?	Associate Parliamentary Sustainable Waste Group	Westminster London

I have liaised with the DTI, DEFRA and occasionally with WRAP on a variety of topics of national interest, e.g. hazardous vs. non-hazardous nature of ELV residues; impacts of innovative incentives for household recycling; determination of waste diversion of home food waste digesters.

At an international level, I have spoken at several conferences[17], chaired sessions and been invited to be on the final Panel for Questions[18]. In past years I initiated and arranged an International Conference (in Nuclear Physics, Lewes 1998) including co-editing the Proceedings[19]. I served on the Scientific Committee of the 2006 International Conference in Analytical and Applied Pyrolysis in Budapest, where I was also invited as a plenary/keynote speaker to review developments in pyrolysis of ELV shredder residue[20].

Since positioning my work more firmly in the domain of Sustainable Development I have been awarded the significant funding for my project ESDinds from the EU, and spoken on it at international conferences as a Keynote or Plenary Speaker. The project has attracted the direct involvement of several major international Civil Society Organisations, and will now be developing its Community of Practice with a further 50 such bodies before January 2011.

[17] E.g. keynote addresses in London 2006, Budapest 2006, Warwick 2006; presentations in Delhi 2003, Stratford 2006, Alicante 2004 as listed in 6.3, 6.4.
[18] International Conference on Plastics & Environment, Delhi, 2003.
[19] "Nuclear Structure at the Extremes – an International Conference on the Occasion of the 40th Anniversary of the SU(3) Symmetry", Lewes, June 1998. Co-organisers: M Harder & A Bruce.
[20] "A Review of Developments in the Pyrolysis of Automotive Shredder Residue" International Conference on Analytical and Applied Pyrolysis, Budapest 2006.

12. Publications

12.1 Journal Publications (Refereed, international)

(Note Woodard, Bench and Singh are supervised authors under MK Harder until 2007 pubs)

29. The Earth Charter and the ESDinds initiative: Developing indicators and assessment tools for Civil Society Organisations to examine the values dimensions of sustainability projects
Podger, D, Piggot, G, Zahradnik, M, Janouskova, S, Velasco, I, Hak, T, Dahl, A, Jimenez, A, and Harder, MK*
Journal of Education for Sustainable Development (accepted, April 2010)

28. Use of home food digesters to reduce household waste
Harder, M.K. and Woodard, R. (2009)
Waste and Resources Management, 162 (2). pp. 69-73. ISSN 1747-6526

27. Development of a new quality fair access best value performance indicator (BVPI) for recycling services
Harder, M.K., Stantzos, N., Woodard, R. and Read, A. (2008)
Waste Management, 28 (2). pp. 299-309.
doi:10.1016/j.wasman.2006.12.015

26. Identification and mapping of heavy metal pollution in soils of a sports ground in Galway City, Ireland, using a portable XRF analyser and GIS. Environmental Geochemistry and Health, 30 (1). pp. 45-52
Carr, R., Zhang, C., Moles, N. and Harder, M.K. (2008)
http://dx.doi.org/10.1007/s10653-007-9106-0
This paper is the outcome of cross-faculty collaboration with a geoscientist, using a portable X-ray spectrometer developed by Harder for ELV waste, but this time applied to contaminated soil.

25. Systematic studies of shop and leisure voucher incentives for household recycling
Harder, M.K. and Woodard, R. (2007)
Resources Conservation and Recycling, 51 (4). pp. 732-753. ISSN 09213449
doi:10.1016/j.resconrec.2006.12.001

24. Characterisation of rotary kiln residues from the pyrolysis of shredder residues: issues with lead
Forton, O.T., McGrady, L., Singh, M.M., Taylor, E.R.M., Moles, N.R. and Harder, M.K. (2007)
Journal Of Analytical and Applied Pyrolysis. pp. 395-402. ISSN 0165-2370
http://dx.doi.org/10.1016/j.jaap.2006.12.015
This paper shows how consensus values for contamination levels of heavy metals in ELV waste can be obtained, by systematically using a range of analytical techniques and using them together. It bravely states what typical levels are in UK ELV waste, including lower limits achievable by de-polluting ELVs to new EU standards.

23. A Critical Review of Developments in the Pyrolysis of Automotive Shredder Residue
Harder, M.K. and Forton, O. Tening (2006)
Journal of Analytical and Applied Pyrolysis, 79 (1-2). pp. 387-394. ISSN 01652370
http://dx.doi.org/10.1016/j.jaap.2006.12.015
This paper provides a timely overview for international stakeholders in industry, policy and research on advancements in knowledge and technical solutions for this difficult waste material. It includes new data from research funded by CARE and BIFFAward.

22. Two measured parameters correlated to participation rates in curbside recycling schemes in the UK
Harder, Marie K., Woodard, Ryan and Bench, Matthew L. (2006)
Environmental Management, 37 (4). pp. 487-495. ISSN 1432-1009

21. Value from shredder waste: ongoing limitations in the UK
Forton, O.T., Harder, M.K. and Moles, N.R. (2006)

Resources, Conservation and Recycling, 46 (1). pp. 104-113. ISSN 0921-3449
doi:10.1016/j.resconrec.2005.06.007

20. Participation in curbside recycling schemes and its variation with material types
Woodard, R., Harder, Marie K. and Bench, Matthew L. (2006)
Waste Management, 26 (8). pp. 914-919. ISSN 0956-053X
doi:10.1016/j.wasman.2005.08.009

19. Waste minimisation: home digestion trials of biodegradable waste
Bench, Matthew L., Woodard, R., Harder, Marie K. and Stantzos, Nikolaos (2005)
Resources, Conservation and Recycling, 45 (1). pp. 84-94. ISSN 0921-3449
doi:10.1016/j.resconrec.2005.02.003

18. The development of a UK kerbside scheme using known practice
Woodard, Ryan, Bench, Matthew L. and Harder, Marie K. (2005)
Journal of Environmental Management, 75 (2). pp. 115-127. ISSN 0301-4797
doi:10.1016/j.jenvman.2004.11.011

17. The optimisation of household waste recycling centres for increased recycling—a case study in Sussex, UK
Woodard, Ryan, Bench, Matthew L., Harder, Marie K. and Stantzos, Nikolaos (2004)
Resources, Conservation and Recycling, 43 (1). pp. 75-93. ISSN 0921-3449
doi:10.1016/j.resconrec.2004.05.002

16. Household waste recycling sites: waste material composition by weight with a view to facility optimisation
Bench, Matthew L., Woodward, Ryan and Harder, Marie K. (2003).
CIWM Scientific & Technical Review. pp. 2-8.

15. Evaluating the performance of a fortnightly collection of household waste separated into compostables, recyclates and refuse in the south of England.
Woodard, Ryan, Harder, Marie K., Bench, Matthew L. and Philip, M. (2001)
Resources, conservation and recycling, 31 (3). pp. 265-284. ISSN 0921-3449
doi:10.1016/S0921-3449(00)00087-2

14. Fermi superallowed $^{+}$ decays and T = 1 ground states of heavy odd-odd N = Z nuclei.
J.Garcés Narro, C.Longour, P H.Regan, B.Blank, C.J.Pearson, M.Lewitowicz, C.Miehé, W.Gelletly, D.Appelbe, L.Axelsson, A M.Bruce, W.N.Catford, C.Chandler, R.M.Clark, D.M.Cullen, S.Czajkowski, J.M.Daugas, P.Dessagne, A.Fleury, L.Frankland, J.Giovinazzo, B.Greenhalgh, R.Grzywacz, M.K.Harder, K.L.Jones, N.Kelsall, T.Kszczot, R.D.Page, A.T.Reed, O.Sorlin, and R.Wadsworth.
Physics Review C63 (2001) 044307.

13. The material composition of shredder residue in the UK,
C. A. Ambrose, M. M. Singh & M. K. Harder,
Institute of Wastes Management Scientific & Technical Review, November 2000, pg: 27- 35.

12. Determination of civic amenity waste components
R Woodard, Matthew Bench & M K Harder (2000),
Institute of Wastes Management Scientific & Technical Review, July 2000, pages: 18-21.

11. Shell-model calculations near N = Z = 28
M.K. Harder, P. Halse and L. Frankland
J. Physics G: Nuclear Particle Physics 25(1999) 867-869

10. Quadrupole-octupole coupled states in 144Nd
S. J. Robinson, M. M. Hindi, H. G. Börner, Y. D. Chan, D. E. DiGregorio, C. Doll, M. R. Dragowsky, M. K. Harder, M. C. P. Isaac, K. S. Krane, R. -M. Larimer, A. O. Macchiavelli, R. W. Macleod, P. Miocinovic, E. B. Norman, A. Shadkam and K. Zaerpoor
Physics Letters B, Volume 465, Issues 1-4, 21 (1999), Pages 61-66

9. An investigation of shell model structure near 56Ni
P. Halse and M.K. Harder,
J. Phys. G: Nucl. Part. Phys. 25(1999) 871-875

8. Observation of Fermi Superallowed beta+ decays in heavy odd-odd, N = Z Nuclei: Evidence for 0+ Ground States in 78Y, 82Nb, and 86 Tc
C. Longour, J Garces Narro, B. Blank, M. Lewitowicz, Ch Miehe, P.H Regan, D Applebe, L. Axelsson, A.M. Bruce, W. N. Catford, C. Chandler, R. M. Clark, D. M. Cullen, S. Czajkowski,J.M.Daugas, Ph. Dessagne, A. Fleruy, L. Frankland, W. Gelletly, J. Giovinazzo, B. Greenhalgh, R. Grzywacz, M. Harder, K. L. Jones, N. Kelsall, T. Kszczot, R. D. Page, C. J. Peaarson, A. T. Reed, O. Sorlin, and R. Wadsworth
Physics Review Letters, Volume 81, Issue 16, 19 October 1998, Pages 3337-3340

7. First observation of excited states in the neutron deficient nuclei 168Pt and 170Pt,
S. L. King, J. Simpson, R. D. Page, N. Amzal, T. Bäck, B. Cederwall, J. F. C. Cocks, D. M. Cullen, P. T. Greenlees, M. K. Harder, K. Helariutta, P. Jonesd, R. Julin, S. Juutinen, H. Kankaanpää, A. Keenan, H. Kettunen, P. Kuusiniemi, M. Leino, R. Lemmon, M. Muikku, A. Savelius, J. Uusitalo, and P. Van Isacker
Physics Letters B, Volume 443, Issues 1-4, 10 December 1998, Pages 82-88

6. A comparison of RIST and ISOLDE tantalum targets and geometries used on-line at ISOLDE
P.V.Drumm, J.R.J.Bennett, C.J.Densham, W.R.Evans, M.Holding, R.Murdoch, A.H.Evenson, E.Kugler, J.Lettry, H.Ravn, O.Tengblad, P.Van Duppen, R.Catherall, O.Jonsson, J.Kay, D.D.Warner, M.Harder, C.Thwaites, J.Honsi, R.Page, J.Billowes, S.J.Freeman, I.S.Grant, S.Schwebel, G.Smith, C.Bishop and P. M.Walker
Nuclear Instruments and Methods in Physics Research 126 (1997) 121-124

5. An IBM description of coexistence in the platinum isotopes,
M. K. Harder, K. T. Tang and P. Van Isacker
Physics Letters B, Volume 405, Issues 1-2, 17 July 1997, Pages 25-30

4. The IBM extended consistent-Q formalism across the N = 82-126 shell -Empirical trends and anomalies,
M. K. Harder and K. T. Tang
Physics Letters B, Volume 369, Issue 1, 15 February 1996, Pages 1-6

3. A study of an integrated land-fill and coppice power station
M.K. Harder and L.A. Freeman
Renewable Energy, Volume 9, Issues 1-4 , (1996), Pages 989-992

2. Anomaly in O(6) 196Pt,
M. K. Harder and B. Krusche
Physics Letters B, Volume 331, Issues 1-2, 30 June 1994, Pages 25-29

1. Softness and shape coexistence in light platinum isotopes
M Veskovic, M K Harder, K Kumar and W D Hamilton
J Phys G, 13, , (1987) L155-L161

12.2 Conference Proceedings (Refereed)

25. A brief evaluation of pilot household waste recycling schemes
Harder, M.K. (2008)
In: Waste 2008, Waste and Resource Management - A Shared Responsibility. Golder Associates, Stratford upon Avon, UK, pp. 125-126.

24. Increasing levels of recycling - assessing the impact of household incentives (revenue neutral).
Woodard, R. and Harder, M.K. (2008)

In: Waste 2008, Waste and Resource Management - A Shared Responsibility, Golder Associates, Stratford upon Avon, UK, pp. 537-546.

23. The role of community Waste Prevention Advisors in West Sussex.
Woodard, R. and Harder, M.K. (2008)
In: Waste 2008, Waste and Resource Management - A Shared Responsibility, Golder Associates, Stratford upon Avon, UK, pp. 715-723.

22. Sampling and Characterisation of Heterogeneous Waste:
Case Study of Shredder Residue
Osric Forton*, Norman Moles, Marie Harder
Waste 2006 International Conference on Waste, Stratford-Upon-Avon September 2006
Pp 103-112, ISBN-10 0-9539301-3-0

21. Development of Better Performance Indicators for Recycling
Marie Harder*, Ryan Woodard
Waste 2006 International Conference on Waste, Stratford-Upon-Avon September 2006
Pp 633-642 ISBN-10 0-9539301-3-0

20. Household Food Digesters: Rigorous Testing of Residual Waste Reduction
Robert Swabey*, Marie Harder
Waste 2006 International Conference on Waste, Stratford-Upon-Avon September 2006
Pp 125-132 ISBN-10 0-9539301-3-0

19. The Use of Cash Vouchers to Incentivize Householders to Recycle
Ryan Woodard*, Firooz Firoozmand, Marie Harder
Waste 2006 International Conference on Waste, Stratford-Upon-Avon September 2006
Pp 477-486 ISBN-10 0-9539301-3-0

18. Developments in the Pyrolysis of Automotive Shredder Residue
M K Harder* & O Tenning Forton
Waste 2006 International Conference on Waste, Stratford-Upon-Avon September 2006
pp61-72 ISBN-10 0-9539301-3-0

17. Determination Of Detection Limits For A Portable XRF Using Soil CRMs
O.T. Forton[1], E.R. Manzanares[2], N.R. Moles[1] & M.K. Harder[2]
GeoAnalysis2006 International Conference, China, September 2006

16. Household attitudes to waste minimisation through home digestion of biodegradable waste
Bench, Matthew L., Woodard, Ryan, Harder, Marie K. and Stantzos, Nikolaos (2004)
In: ISWA World environment congress and exhibition, Rome, October 2004. ISWA, Rome.

15. The use of GIS for optimising household waste
Stantzos, Nikolaos, Woodard, Ryan, Bench, Matthew L. and Harder, Marie K. (2004) facilities In: ISWA World environment congress and exhibition, Rome, October 2004. ISWA, Rome.

14. Achieving recycling targets in the UK - practical examples from East and West Sussex
Woodard, R, Bench, M., Greenfield, D.W.J. and Harder, M.K. (2002)
In: Kocasoy, Günay, Atabarut, Tamer and Nuhoglu, Irem, ed. Appropriate environmental and solid waste management and technologies for developing countries. International solid waste association, Turkey, pp. 561-568. ISBN 975-518-179-2

13. Landfill disposal in the South of England: trends from the past five years
Woodard, Ryan, Harder, Marie K. and Bench, Matthew L. (2001)
In: Waste in a competitive world: International Solid Waste Association Annual Congress, Stavangar, Norway, September 2001. ISWA, Copenhagen, pp. 275-284.

12. Profit from plastic
Hooper, R., Harder, Marie K. and Potter, A.K.N. (2001)

In: Sixth International Conference on Engineering for Profit from Waste, 13-14 November 2002, IMechE London, UK. Mechanical Engineering Publications, Bury St Edmunds, pp. 225-232. ISBN 1860583318

11. Proving the principle: recovery of plastics from shredded ELVs
Williams, K.S., Singh, M.M., Hooper, R. and Harder, Marie K. (2001)
In: Sixth International Conference on Engineering for Profit from Waste, 13-14 November 2002, IMechE London, UK. Mechanical Engineering Publications, Bury St Edmunds, pp. 181-189. ISBN 1860583318

10. Pyrolysis of shredder residue to recover valuable materials
Williams, K.S., McGrady, Lucas and Harder, Marie K. (2001)
In: Sixth International Conference on Engineering for Profit from Waste, 13-14 November 2002, IMechE London, UK. Mechanical Engineering Publications, Bury St Edmunds, pp. 216-224. ISBN 1860583318

9. Pyrolysis of shredder residue: a method to recover material and energy.
Williams, K.S., McGrady, Lucas and Harder, Marie K. (2001)
In: Business and environment Wales 2001 conference: conference procedings: 9-10 October 2001, Cardiff International Arena. Cardiff University, Cardiff, pp. 113-118.

8. Environmental Impact of Transportation During the Transfer and Disposal of Construction and Demolition Waste to Landfill,
L A Freeman and M K Harder
Proceedings of the Second International Conference,
Buildings and the Environment, Paris 1997

7. Analysis of the Volume and Composition of Construction Waste Arriving at Landfill
M K Harder and L A Freeman,
Proceedings of the Second International Conference,
Buildings and the Environment, Paris 1997

6. Anomaly in 196Pt: a Clean Test?
MK Harder and B Krusche,
Proceedings of the International Conference on the IBA, Padova. 1994 ed. RF Casten et al, 1994, p401-405

5. Internal Conversion in the rare-earths
M K Harder, S Judge and B Krusche .
Eighth International Symposium on Capture Gamma-Ray Spectroscopy, Fribourg (1993)
(World Scientific, 1993, Singapore) p. 983-987

4. A Development of the decay scheme of ^{158}Gd from new (n,gamma) and (n,e-) data.
K T Tang, M K Harder, A Williams and B Krusche.
Proceedings of the Eighth International Symposium on Capture Gamma-Ray Spectroscopy, Fribourg (1993) (World Scientific, 1993, Singapore) p. 460-466

3. Nuclear Characterisation by measuring EO transition: ^{196}Pt
M K Harder, M Veskovic, K Kumar and W D Hamilton
6th Conference on Capture Gamma-Ray Spectroscopy, Leuven (1987)
eds. K Abrahams and P van Assche, (Institute Of Physics, Bristol)
Institute of . Physics Conference Series , No 88, p529-534, (1988)

2. The first excited O+ state in ^{144}Nd
M K Harder, W D Hamilton, G Colvin, A R H Subber,
Nuclear Science Research Conference Series, Vol 13, (1987), p285-289
(Harwood Academic, 1987, Chur)

1. The first excited O+ state in ^{144}Nd

M K Harder, W D Hamilton, G Colvin, A R H Subber,
Nuclear Structure, Reactions and Symmetries, Dubrovnik, Yugoslavia June 1986pp676-681
eds. R A Meyer and V Paar, (World Scientific, 1986, Singapore) p687-691

12.3 Other Conference Contributions

Invited Keynote Speaker:
The Emergence of Design as a Necessity for Sustainable Development
All Our Futures 2: Sustainable Design Conference
Sustainable Futures, Plymouth, September 2009

Invited Plenary Speaker:
The Need for Better Design of Research Projects with Civil Society Organisation Partners
MK Harder
Sustainable Development – a Challenge for European Research
26-28 May 2009, Brussels: European Commission, ERA
http://ec.europa.eu/research/sd/conference/2009/index_en.cfm

Invited Speaker for Panel Discussion
Alternative visions: the contributions of civil society organisations to research for sustainable development
MK Harder
Sustainable Development – a Challenge for European Research
26-28 May 2009, Brussels: European Commission, ERA
http://ec.europa.eu/research/sd/conference/2009/index_en.cfm

Addressing Urban Challenges through United Nations Regional Centres of Excellence
(Urban Challenges)
MK Harder
Fourth International UN RCE Conference
13-15th May 2009 Montréal, Québec, Canada

Supporting Institutional Changes for Environment and Sustainability in Universities
MK Harder
Fourth International UN RCE Conference
13-15th May 2009 Montréal, Québec, Canada

An overview of recent SD central-led initiatives at the University of Brighton
MK Harder
All Our Futures Conference 2008, Centre for Sustainable Futures, Plymouth
http://csf.plymouth.ac.uk/allourfutures/streams_aof1

Measuring SD in Higher Education
MK Harder
All Our Futures Conference 2008, Centre for Sustainable Futures, Plymouth
http://csf.plymouth.ac.uk/allourfutures/streams_aof1

Student Champions – a project in preparation for 2008/9
Ed Bending (Student Union) and Marie Harder
All Our Futures Conference 2008, Centre for Sustainable Futures, Plymouth
http://csf.plymouth.ac.uk/allourfutures/streams_aof1

Grass-roots growth via Action Networks
Marie Harder and Poppy Villiers-Stuart
All Our Futures Conference 2008, Centre for Sustainable Futures, Plymouth
http://csf.plymouth.ac.uk/allourfutures/streams_aof1

Incentivizing Householders to Recycle With Vouchers
Marie Harder, Ryan Woodard
Waste – the Social Context: Urban Issues and Solutions, Edmonton, Canada May 2008

http://csf.plymouth.ac.uk/allourfutures/streams_aof1

Developing Best Value Performance Indicators for Local authority Recycling Schemes
Marie Harder, Ryan Woodard
Waste – the Social Context: Urban Issues and Solutions, Edmonton, Canada May 2008
(unscheduled presentation)

Capacity Building by Training Volunteers
Marie Harder, Ryan Woodard
Waste – the Social Context: Urban Issues and Solutions, Edmonton, Canada May 2008
(unscheduled presentation)

Invited Plenary Speaker:
Results from a series of community and school incentive schemes
MK Harder & R Woodard
Resource Recovery Forum International conference "Recycling Incentives", London, , September 2006

Invited Plenary Speaker:A Review of Current Options for Post-shredded End of Life Vehicles
M K Harder & O Tenning Forton
ELV '06 Conference, Warwick, September 2006

Results from a series of voucher incentive schemes
R Woodard & MK Harder
Resource Recovery Forum International conference "Recycling Incentives", London, September 2006

An investigation of the residual metal content in ASR and SR after post-pyrolysis processing
Osric T. Forton , Marie K. Harder , Norman Moles
ELV '06 Conference, Warwick, September 2006

Invited Plenary Speaker:
A Review of Developments in the Pyrolysis of Automotive Shredder Residue
M.K. Harder & O. Tening Forton
International Conference on Analytical and Applied Pyrolysis, Budapest, May 2006

Characterisation of rotary kiln residues from the pyrolysis of shredder residues: issues with lead
Osric T. Forton , Marie K. Harder , Norman Moles
International Conference on Analytical and Applied Pyrolysis, Budapest, May 2006

Development of a Pyrolysis Process for Shredder Residue Fines using a Continuous Kiln
MK Harder, LJ McGrady, S Mikhalovsky, MM Singh,
16th International Symposium on Analytical & Applied Pyrolysis, Alicante 2004

Determination of lead sources in pyrolysed automotive shredder residue – by size fraction" MK Harder, LJ McGrady, N Moles, OT Forton
16th International Symposium on Analytical & Applied Pyrolysis, Alicante, 2004

Determination of the Relative Contribution of Polymers in Shredder Residue Waste
M.K. Harder and M.M. Singh,
International Conference on Plastics and Environment, Delhi 2003.

M.K. Harder, **Chair of Session on Technical Session on Waste Recycling**,
International Conference on Plastics and Environment, Delhi 2003.

M.K. Harder, **Invited Speaker for Panel Discussion,**
International Conference on Plastics and Environment, Delhi 2003.

Pyrolysation of shredder residue, Our Sustainable Future?
M. K. Harder, K. Williams, L. McGrady, A. Clark, A. Webster,
CIWM Annual Conference & Exhibition
2002, June 2002, Paignton, Torquay, UK

Pyrolysis of Shredder Residue: A method to recover material and energy
K. S. Williams, L. McGrady, M. K. Harder,
Wales Business & Environment Conference, 2001, Cardiff, UK.

Internal Conversion in the Rare-Earths
M K Harder, S Judge, B Krusche
Institute of Physics Conference, Brighton, 1994.

Analysis of the (n,e-) spectrum of 184W
N I Asseter, M K Harder, B Krusche,
Institute of Physics Conference, Brighton, 1994.

Development of the Decay-Scheme of 158Gd from (n,gamma) data
K T Tang, M K Harder, A Williams.
Institute of Physics Conference, Brighton, 1994.

Applicability of the Extended Consistent-Q Formalism Across a Major Shell
M K Harder and K T Tang,
Institute of Physics Conference, Telford, 1994.

Phenomenological Systematics from a Simplified IBA-1 Hamiltonian Across a Major Shell
K T Tang and M K Harder,
Institute of Physics Conference, Telford, 1994.

12.4 Invited Lectures (in recent years)

Kingston University, 18th February 2010-05-09
"Recycling the World One Heart at a Time – Science and Technology Involving the Community"

University of the 3rd Age, Lewes

Professorial Inaugural Lecture, University of Brighton , November 11th 2008
"Recycling the World One Heart at a Time – Science and Technology Involving the Community"

Transition Town Brighton & Hove, 19th June 2008
"Increasing Public Awareness of Waste in Sussex"
http://www.transitionbrightonandhove.org.uk/2008/05/talks-waste-resources-and-carbon-agenda.html

12.5 Major Reports to Clients (up to 2007)

(most co-written with colleagues)

"Interactions between the Small Dole Action Group and the Environment Agency regarding Horton Landfill Site March 2007- July 2008"
Report commissioned by the Environment Agency
http://www.environment-agency.gov.uk/homeandleisure/waste/106762.aspx

"Post-Evaluation of the Household Incentives Pilot Schemes"
A report commissioned by DEFRA for input into the UK Waste Strategy Review, 2007.

"Household Incentive Schemes in Sussex", September 2006, published by the Resource Recovery Forum

"Preliminary Results on Household Incentivisation Pilot Studies carried out in Sussex", Report to DEFRA, January 2006

"Lets sort it! Final report" – a programme of work to increase participation in four districts
A report for the Lets sort it! Project Board: Crawley, Horsham, Mid Sussex and Worthing Councils, 2006

"Consideration of Composting Facilities at (confidential site)"
Report to the Environment Agency, December 2005

"Systematic Evaluation of the Minimisation of Household Waste due to the Use of Green Cone Food Digesters" Report to West Sussex County Council and DEFRA, November 2005

"Communal bin & recycling monitoring project"
(Confidential Client), February 2005

"Participation Surveys in Rottingdean"
(Confidential Client), February 2005

"Household waste recycling site user satisfaction survey"
(Confidential Client), February 2005

"Brighton & Hove City Recycling monitoring report".
A report for Brighton and Hove City Council, 2005

"Kerbside recycling participation in Eastbourne – across the town"
A report for Eastbourne Borough Council, 2004

"Waste Awareness in West Sussex results from the Sort it Out! Project"
A report to West Sussex County Council and Districts and DEFRA, 2004

Analysis of Waste Flows in the County of (Confidential),
(Confidential Client), March 2004

Report on Funding Opportunities in Waste,
(Confidential Client), November 2003

"Minimisation of Food Waste through Home Digestion; Results of trials in West Sussex"
A report for West Sussex County Council, December 2003

"Recycling Trials in Horsham District" – proposal and analysis of trials schemes for rollout
A report for Horsham District Council 2003
Supplementary Report on Demographics, Modelling and Life Cycle Analysis
Supplementary Report on Glass Collection at Kerbside

"Polymer Processing A: Household Plastics into Automotive Products"
A report by the Waste and Energy Research Group, commissioned by
Brighton Environmental Body Ltd and Consortium for Automotive Recycling CARE, 2002

MK Harder "Polymer Processing B: Towards Processing Polymers from ASR Polymer Processing",
A report by the Waste and Energy Research Group,
commissioned by Brighton Environmental Body Ltd 2002

Woodard R, Bench M and Harder MK, "Monitoring of the Paperchasers Recycling Scheme",
A report by WERG for Brighton & Hove City Council 2002

Harder MK, " Pyrolysation of Shredder Residue (fines)",
A report for the CARE Group 2002

Harder MK, "Polymers Processing",
A report for the CARE Group 2001

"Monitoring of the CHEERS Recycling Programme"
A report for Crawley Borough Council, 2001

"Waste Material Composition by Weight at Brighton and Hove City CA sites"
A report for Brighton & Hove City Council 2001

" The impact of CROWN on the composition of waste generated in Wealden District "
A report for Wealden District Council 2000

"Analysis of Civic Amenity Waste in Sussex",
A report for Brighton & Hove Unitary Authority and East Sussex County Council 2000

"East Sussex Civic Amenity Sites: Observations & Recommendations",
A report for Brighton & Hove Unitary Authority and East Sussex County Council 2000

13. A Personal Narrative

For some it may be difficult to understand how they work I have carried out has evolved and in what way it is coherent. I have thus prepared the narrative below to illustrate this.

The inter-disciplinary and multi-disciplinary work I carry out has a modern name: Sustainable Development. It is a discipline which many people find difficult to define and specify. It involves a simultaneous, multi-pronged approach of related issues covering environmental, financial and social domains. People often find Sustainable Development difficult to grasp because it is not a separate discipline to others, but overlaps many, in different ways. For workers in this field, an ability to keep an overview across different disciplines is critically important, but so also is the need for depth in some specialism. For example, my specialism has been physical sciences and waste management in particular, but I have demonstrated that I deal with waste issues in fuller environmental, social and financial contexts – this approach then qualifies as Sustainable Development. This does not mean that I work on 'everything'; it means that I take wider, real-life, issues into account when I work on 'anything'.

The evolution of my work towards this end point in the pages below; from physical sciences specialism to approaches which take into account the direct needs of society by considering wider issues affecting overall sustainability. My latest approaches also have great overlap with 'Science in Society', 'Public Engagement in Science', 'Participatory Research', and Community Engagement. These areas are my current interest.

I started my career in the physical sciences (nuclear spectroscopy) and my early publications[21] and EPSRC involvement[22] show that I was promptly productive. However, I volunteered to develop a half-degree course in Energy Studies to

[21] My publications are listed chronologically in section 6.
[22] "Shell Model Calculations For Exotic Nuclei Accessible In Radioactive Beam Experiments; A=60-100", and five other projects, as listed in 2.6

complement Physics courses, and found the general field to be stimulating because it was very young and full of opportunities for significant scientific development and knowledge transfer. As an example, at that time only 2-3 landfill sites were being used to generate electricity, and the fundamental requirements for maximum methane production were still undetermined. Using third year project students I was able to produce research results which were publishable and useful. I thus quickly developed expertise and offered more useful services to the industry, rapidly becoming successful at obtaining funding for large, very rewarding projects[23].

Looking back, I realised I joined the field at a nascent time. The possibilities of using waste for energy - other than as a by-product of incineration – were just emerging, with landfill methane and coppice/forestry biomass as possibilities under the Non-Fossil Fuels Obligation. Then, as European Directives put increasing pressure on large corporations to take responsibility for their waste, such as automotives and electrical, material recovery became increasingly important. I successfully led research projects looking at aspects of all of these issues, initially focussing on automotive waste. Two such work programmes[24] included developments in mechanical separation techniques, material characterisations, development of recoverable polymer streams, development of manufacturing adaptations to allow large-scale production using recovered materials, development of specifications for recovered polymers, options for pyrolysis of the small sized waste, and determination of heavy metal contamination in several recovered streams. In those work programmes it was always necessary to bear in mind the financial viability of the potential outcomes of the work, as the businesses involved[25] were unlikely to support funding unless eventual viability was likely. The work I was developing was thus not only multi-disciplinary, but also hard-nosed. Having become aware of the financial benefits of businesses turning their wastes into a resource, I carried out several self-funding projects involving wastes specific to other industries[26], and collected data on waste arriving at disposal sites to determine which streams were ripe for development. This work was of great interest to local planners and the waste industry in general, as at that time systematic data collection was rare.

The next step in the development of my work and the field was due to increasing pressure for household waste to be recycled. Waste operators who had previously done nothing more than collect waste and take it to landfill were increasingly finding they had to provide an ‘integrated waste management’ solution whereby recoverable materials were diverted. Again, without baseline data on the typical composition of waste in a bin, or a breakdown of materials sent to landfill by a given council, the industry had much groundwork to carry out before it could show effective progress. I led research in many related areas[27], and my work on waste arriving at landfill and

[23] Six projects totalling £824,358 over 2001-04.
[24] “Development of Automotive Products from Polymer Wastes” and “End-of-Life Automotive Shredder Residue Pyrolysis”; fully listed in 2.2 and 2.5.
[25] Including: the Consortium for Automotive Recycling (CARE) with partners Ford, Rover, BMW; British Metal Recycling Association (BMRA); Viridor Waste Management Ltd.; SIMSmetal, European Metal Recycling (EMR).
[26] “Investigations of Waste Fractions at Civic Amenity Sites”, “Survey & Analysis of Materials Flow to Landfill” etc.; fully listed in 2.1.
[27] “Sussex Waste Strategy Development”; “Sussex Waste Strategy: Data” as listed in 2.1 and refs e.g. “Landfill Disposal; Trends from the Last Five Years…”; “Analysis of the Volume and Composition of Construction Waste Arriving at Landfill”.

other disposal sites was sought out by companies needing it to make accurate plans for 25 year contracts with local authorities[28]. I carried out studies on the recycling performances of different early schemes, and made recommendations to authorities for improvements. I bid in open competition for a tender with Horsham District Council to propose, execute and evaluate a set of trials for different recycling schemes, and won – providing me with full funding for what I considered to be an excellent opportunity for a large-scale rigorous experiment[29]. All of this early work in household recycling was of interest not only to the businesses and local authorities which contracted it to us, but to others across the country, and where possible and when time permitted, I published it.

In parallel with these developments to recover materials from waste, were developments for solutions for the residual waste that was always also present. Instead of following the traditional route to landfill, its potential to be processed further to add value was now considered; for example for a calorific-rich waste replacement for fossil fuel, or for gasification for energy production, or for waste ash to replace material in another industry such as brick making. These are all of areas where I carried out research[30]. 'Integrated waste management' was being replaced by a new industry – 'sustainable resource management', where the solution was not just to make a resource out of one part of the waste, but find a combination of solutions for as much of it as possible. One company's waste might be another's feed material; only that which had to be disposed of was any longer deemed 'waste'. The concept of putting fewer virgin resources into a long-term, large scale cycle of use which included energy, material and human input, was beginning to be developed in reality. In this concept, an important factor is the minimisation of waste requiring disposal. And, like all components of Sustainable Development, this involves the important addition of social factors.

Contemporaries of mine who stayed in physics might wonder how social factors are important in something like the sustainable resource management of household waste. But efficiently recovering and using useful materials from waste cannot be optimised by technical solutions alone. For example, the behaviour of householders in separating out their recyclates (or not!), and in accepting goods made from recycled materials, is critical. I have thus led work in mapping out the relative impacts of different types of incentives for householders to increase their recycling, which included some social considerations as well as some financial considerations for the local authorities[31]. Although this is not truly integrated Sustainable Development approach, it is a stepwise move towards it, and revealed rather relevant information. For example, it was found that householders are very receptive at taking advice targeted at them individually, to the extent that a feedback card from the collection crew telling them what they got wrong can be as effective as a voucher for use in the local shops[32]. (A series of systematic studies showed that, if vouchers are used, they need to be worth at least £1, and the shops or swimming pool need to be within a mile for it to be

[28] "Surveys and Analysis of Materials Flow to a Landfill Site", "Study of Waste Flows across a County" as listed in 2.1.
[29] "Development, Execution and Evaluation of Pilot Kerbside Trials for County Rollout", as per 2.3.
[30] e.g. "Profit from Plastic"; "Pyrolysis of Shredder Residue to Recover Valuable Materials"; "Proving the Principle – Recovery of plastics from shredded ELVs".
[31] "Household Incentivisation Pilot Studies" funded by DEFRA; full listing in 2.3.
[32] Report to DEFRA, "Post-Evaluation of the Household Incentives Pilot Schemes".

effective with medium and low-performers[33].) Similarly, studies focussed on optimising the amount of waste householders will divert to their gardens needed to consider social and behaviour aspects, and I have led a series of studies on the use of food digesters to determine the limitations of their impact nationally[34]. The main drivers of this work were intertwined: environmental (reducing landfill emissions) and financial (cost of subsidising the digester against disposal fee saved at landfill and reduced penalties for not diverting organic waste from landfill).

In recent years workers in all aspects of Sustainable Development have found the social elements have come to the fore. It is no longer sufficient to calculate and model the optimised flow of waste into resources via appropriate technology centres such as sorting facilities, composting centres, etc. The public play key roles at every point, from setting out recyclates to planning approval. Whatever the technology involving waste, the public need to be involved fully for success. At first my work in public education and awareness was only designed as bolt-on projects[35]; in recent years it has grown to be integrated fully in the planning and execution of my projects. For example, monitoring of the public's recycling behaviour, surveys of satisfaction, rolling out of new recycling schemes are now planned and executed alongside door-knocking on thousands of doors, for my surveyors to enthusiastically explain and resolve recycling problems[36]. I have even developed my training materials for local authority volunteers, and have recently adapted a range of Masters level modules for use by members of the public such as local authority Council Members to improve their knowledge of sustainable resource management – all funded externally.

Over the past ten years I have thus undertaken tens of projects in different branches of Sustainable Development[37], and tried to contribute in real time to a developing field.

[33] E.g. ref ,"Systematic Studies of Shop and Leisure Incentives for Household Recycling"
[34] "3-month Trials of Food Digesters in 120 Households", "Trials of Green Cone Food Digesters Across a County", "Systematic Trials of Green Cone Food Digesters Offered to 2000 Households", listed more fully in 2.3. Affiliated publications include [a), b), 7].
[35] E.g. "West Sussex County Council Public Education in Waste Awareness", "Development of a County Wide Waste Awareness Strategy" and other projects listed in 2.4.
[36] E.g. "Public Education in Waste Awareness: Development and Delivery of a Campaign for Hastings" as per 2.4; "Surveys of Household Participation", "Studies and Surveys…Focus on Multiple-Household Buildings", as per 2.3.
[37] As listed in 2.1-2.5 below.