IChemE The Institution of Chemical Engineers

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A Registered Charity in England and Wales

Form C

COMPETENCE AND COMMITMENT REPORT

To download guidelines on completing your form visit www.getchartered.org

Please complete this report electronically. Each subsection can be expanded to allow you to provide sufficient evidence of your chemical engineering competence. Your report should be around 2500 words.

Surname: Personal name: Title:

A Evidence that you have the ability to apply to practical situations:

either **chemical and general engineering knowledge and understanding (for CEng route)**

or **scientific knowledge and understanding (for CSci route).**

Tick one box only to indicate which Application Route this Section A refers:

CEng Route ☒ **CSci Route** ☐

Notes: (i) if you wish to apply via both routes, an additional Section A **must** be submitted separately.
(ii) even if you do not intend to take up a registration you **must** tick one box to aid us with your application for Corporate membership of IChemE.

Evidence:

i) Identifying or defining a problem, opportunity or project:

During the course of my PhD research I indentified that a standard analytical technique for determining the amount of wall slip in flows of paste materials was invalid and was causing researchers to interpret data incorrectly. An analysis of Mooney from 1931 yields values for wall slip from experimental flow data based on a number of well founded assumptions. These have been repeatedly verified by direct measurement of slip. However, Mooney's analysis has been found to not work in certain instances. In 1969, Jastrzebski postulated a modification based on an unexplored assumption. This modification had become adopted as a standard technique when Mooney's original analysis did not work. By considering the basis of Jastrzebski's previously unexplored assumption, I found that the reasoning behind his modification was not supported by any experimental evidence. Furthermore, I showed that there were theoretical reasons why it would be invalid.

ii) Combining ideas and contributions from different people and disciplines:

When I started my first academic appointment as a chemical engineering lecturer, my research expertise was in the flow of multiphase materials, such as pastes and foams. I took advantage of the EPSRC's First Grant scheme to develop a collaboration with a microbiologist at a nearby university.They had identified an organism from nature which excreted an extremely potent biosurfactant. Through discussions I developed an understanding of how this organism produced the biosurfactant and the biochemical engineering limitations of its large scale production. I used my previous understanding of the fluid flow within foams to devise a research idea which could address the existing limitations. The resultant proposal was highly recommended by the EPSRC's referees and a grant awarded. The project is now underway and the combination of microbiology and chemical engineering is proving to be fruitful.

iii) Creativity and innovation: developing your own ideas to produce new solutions, new designs and new technological approaches:

I developed a new experiment for the third year chemical engineering laboratories at my university. There was a perceived need for a new experiment to replace older equipment and to introduce a biological component into what had been a traditional set of experiments based on cheimcal engineering unit operations. Most biological materials and systems require specialised methods and equipment which were not available in the laboratory. I identified that an experimental design I used during my post-doctoral research could be used to provide an innovative solution. A bread maker was used to mix flour, water, salt and fast acting dried yeast into a dough. The system enabled the carbon dioxide release from the yeast to be carefully measured over time. Analysis of the results drew on the material from their Introduction to Bioprocess Engineering lecture course. The experiment enabled realistic study of a safe and practical biological system, as used by food processing industries. The results were academically valuable in that it required ingenuity for students to correctly interpret the results as showing an activation phase followed by steady state metabolism, rather than exponential growth - which a superficial interpretation of the results suggested.

iv) Scientific or technical evaluation and optimisation (of product, process, equipment, method, project etc against the requirements you identified, or the brief you were given.):

The Chorleywood Bread Process is used for the vast majority of industrial bread production in the UK and many other countries. The basis of its operation is the rapid development of the dough through a period of intensive mixing along with the use of ascorbic acid as an improver. Mixing is initially carried out under a pressure of several atmospheres to increase the oxygen availability for the biochemical reactions. A final period of mixing under vacuum is required to decrease the amount of air bubbles in the dough, and so achieve the desired form of bread crumb. Thus, the entrainment of air bubbles within the dough is of central importance to this industry, but until recently there was no reliable method for characterising the process or determining exactly when vacuum should be applied.

I took on this challenge whilst working as a post-doctoral researcher. It occurred to me that a mass balance approach was insufficient to characterise the bubbles of air entrained in the dough. The issue was not just what mass of air was in the dough, but also the size distribution of the bubbles it was divided into. This insight led me to develop a population balance model for the dough aeration process during mixing. This successfully delivered, for the first time, a set of invariant mixing characterisation parameters. I published this work in a series of three papers in Food and Bioproducts Processing, and it has opened up a new line of research in the area.

v) Planning and execution of projects: organising or performing technical work to implement or validate solutions, designs etc:

XXX was a public engagement in engineering project born at an EPSRC IDEAS Factory Sandpit in March 2006. A diverse range of people including engineers, artists and science communicators worked intensively to develop novel ideas about what public engagement is and how it can be achieved. I was involved with the XXX project from the outset along with two professional science communicators. I contributed to the development and planning of the project, leading the writing of the proposal and providing the academic structure. Project organisation required careful consideration since we were planning a series of ten engagement events at locations spanning the whole of the UK, whilst all three of us were based in different cities. The project won funding and I acted as principal investigator, coordinating the project manager and the researcher/communicator and overseeing the delivery of a wide range of successful events.

vi) Other:

(expand as necessary)

B Evidence that you are able to handle the wider implications of your work as an engineer

i) Ability to handle health, hazard and safety aspects: to apply appropriate principles, good practice, meet legislative requirements etc.

I was the organiser of the third year chemical engineering undergraduate laboratories. This involved understanding the health, hazard and safety implications of running an undergraduate laboratory and understanding the nature of the experimental programme in order to be able to make an assessment of the risks. I updated and signed off Risk Assessments and COSHH forms for all six experiments. I introduced new procedures for the use of PPE in the laboratory and trained demonstrators to ensure that undergraduates understood and complied with all regulations.

As the leader of a research group, I am responsible for the safety of all my students and researchers. I develop training programmes for my group members as appropriate to their planned work; training them myself and making use of courses, inductions and technical support staff. I oversee and sign off Risk Assessments and COSHH forms for all of my group's activities, and I monitor adherence to policy.

ii) Ability to handle sustainability aspects: these could include environmental, public concern and other societal issues, recognition of risks etc.

I ran an "Energy and the Environment" course for second year engineering undergraduates for three years. This was a one week intensive course intended to give undergraduates in depth insight into different engineering disciplines and issues, thus enabling them to make informed career choices. The "Energy and the Environment" module gave an overview of the UK's energy requirements and sources, along with analysis of their environmental implications and in depth engineering analysis of specific technical aspects. I provided a series of key overview lectures, which I then supplemented with invited lectures and activities delivered by experts from across the country.

A highlight was coordinating a role play game run by a former senior manager from the oil industry. The forty students on the course broke up into a myriad of different interest groups who would be involved following a major oil find in a fictional undeveloped African country. Groups ranged from rival government groups and international oil companies to indigenous tribes and maverick journalists. We facilitated as each group developed their priorities and strategies, after which groups launched into playing out their roles and implementing their strategies over two days, representing the first year after the oil discovery. This highlighted a great many of the issues which arise when large scale engineering works are initiated, emphasising how technical challenges are often trivial compared to dealing with the societal implications.

iii) Ability to handle commercial and economic aspects:

I currently manage a research portfolio of two EPSRC research grants and three EPSRC CASE PhD studentships with a total grant value greater than £400,000. I have developed project management skills to map out expenditure scenarios and account for unexpected twists in research direction. This has required negotiation with suppliers in order to optimise prices for equipment and services. I have been trained in the Oracle financial systems software and have developed knowledge of University accounting procedures such as Full Economic Costing.

I handle the commercial considerations of research particularly carefully with my CASE studentships. I developed each of the three projects with contacts I have established at different companies and then won funding through EPSRC Knowledge Transfer Networks (Food Processing and Chemistry Innovation). I had to prepare a research plan for each project which both addressed significant academic research issues whilst also delivering results of commercial advantage to the companies. Following award of the studentships, I then oversaw the establishment of intellectual property agreements between the university and companies.

iv) Other:

C Evidence of interpersonal, leadership and communication skills

i) Managing interpersonal relationships:

I was a Lecturer at XXX for two and a half years which involved delivering three hours a week of small group supervision to their engineering undergraduates. Teaching groups as small as two students is a very personal process and involves careful consideration of their individual strengths and weaknesses, and their motivations and limitations. At first I found it very challenging to engage the students in what I thought were the important aspects of the work. However, with persistent attention to the individual group dynamics, the students and I found that these tutorials became very rewarding.

I have taken these insights with me to my new Lectureship post. Over the past year I have been the personal tutor for eight of the first year undergraduates. This role provides both mentoring their academic progress and providing a pastoral role to the students.

ii) Demonstrating leadership in a professional role:

I have supervised or co-supervised a total of sixteen final year MEng/MSc research projects. As the leader of each project, I define a remit which contains an element of genuine research risk, whilst also delivering a secure research basis. I won an Award to Newly Appointed Lecturers from the Nuffield Foundation to design, construct and commission a set of foam fractionation equipment which has provided a foundation for many of these projects. I have guided each of these students through the process of reading the background literature, designing their own experiments, designing, building and commissioning their equipment and developing scientific laboratory techniques. The principal leadership role comes in guiding students through the process of critically evaluating their results and relating them to those of previous researchers. Students normally find this the most challenging aspect of their projects, but, once they realise that they are able to make a genuine contribution to knowledge, they find it the most rewarding aspect. Five of these sixteen students have gone on to study for PhDs.

iii) Communicating ideas and plans by report writing and oral presentation:

My PhD thesis reported in detail and with scientific rigour on an intensive three year period of research. I have published a total of 13 papers in international peer reviewed journals including Chemical Engineering Science, Applied Rheology, Food and Bioproducts Processing. In addition, I have written one chapter of a forthcoming book. I have developed and delivered three different lecture courses each with written notes, web resources, tutorial questions, lectures, coursework and exam questions. I have been invited to present research seminars at universities across the world including the Universities of XXX, XXX, XXX and XXX. I have presented papers and posters at a wide range of national and international conferences, including the World Congress of Chemical Engineering, the American Association of Cereal Chemists Annual Meeting, the International Congress on Particle Technology and the International Congress on Rheology. I have had articles published in the national media as well as in leading trade magazines.

iv) Other:

(expand as necessary)

D Evidence to show that you are committed to high standards of professional conduct

I was awarded funding for my first major grants towards the end of 2006 and these included aspects of biochemical engineering with which I had previous experience. Although there was a co-investigator on the project with a life sciences background, I wanted to improve my knowledge and understanding of this area. I had joined the IChemE Biochemical Engineering Subject Group earlier that year which has introduced me to the leading edge within the profession, numerous industrialists and the latest developments in research. I have supplemented this by attending biological safety training courses at School, Faculty and University level, as well as organising training for researchers in my group.

I have been a Student and Associate Member of the IChemE for over a decade and have committed to achieving Chartered Chemical Engineer status over recent years, culminating in this application. I am also a member of the Food and Drink Subject Group and have been a member of the Particle Technology Subject Group. I have written numerous articles for The Chemical Engineer and Subject Group newsletters. Furthermore, I am a member of the Society of Chemical Industry, the British Society of Rheology (BSR), and, for a period, the American Association of Cereal Chemists.

E Continuing Professional Development (CPD)

(i) Report of CPD already undertaken	Benefits received
University of XXX New Academics Programme	This is a comprehensive course for new academics which provides grounding in basic teaching, research and management skills as well as exploring some advanced areas. Highlights so far have included sessions on media relations and knowledge transfer partnerships with industry.
Course: Safe use of GMOs, 10/03/08	This course gave me the project management skills I needed to supervise research involving Genetically Modified Organisms for the first time. It covered the fundamentals of HSE legislation, risk categorisation and safe working practices.
Public presentations through XXX project	Through my EPSRC Public Engagement in Engineering project XXX I have organised, facilitated and presented at a wide range of public events. This has been one of the most challenging and rewarding experiences of my career, demanding me to learn communication and presentation skills on the job and under pressure.

(ii) Future CPD Plan	Expected benefits
Complete University of XXX New Academics Programme	Over the next year I will complete the New Academics Programme. This will provide a foundation for passing my probationary period as a lecturer. A key element of this will be writing reflective self appraisal essays to facilitate the consolidation of my experiences.
Learn to develop models using COMSOL Multiphysics	My research expertise is largely experimental and I plan to start expanding my groups modelling capabilities over the next year. At first this will be through learning to use commercial, but very flexible, packages such as COMSOL Multiphysics. This may then lead to more sophisticated modelling through program development in the future.
Develop my involvement with the Diamond Light Source JEEP user working group	I have recently been started attending the user working group of the Diamond Light Source I12 Joint Engineering, Environmental and Processing (JEEP) beamline. This is due to come online in 2009 and I am currently conducting a user need review for the large scale imaging stage. Through this I will learn about a unique, new world leading imaging facility, develop new contacts and help facilitate the research community's use of this new resource.

Applicant's statement

This Competence and Commitment report presents a true account of my professional working experience and of my CPD report & plan

Signed……Date……

Confirmation

This is a true account of the professional working experience and the CPD report & plan of……*(Candidate's name)*

Surname: ……Forename:……..……Title:……..

Signed……Date……

Professional qualifications……..

Relationship to candidate……

[If the experience described covers more than one employment, then each section should be initialled by someone who is familiar with it, and all should sign at the end. The people who sign do not have to be either referees of the application, or Chartered Engineers or Chartered Scientists but they should indicate their professional status and working relationship to you]

Footnote - Confidentiality

It is understood that this document may contain confidential information. The IChemE will endeavour to respect the confidentiality of the information provided and this C&C Report will be disclosed only to those few IChemE Members dealing directly with your application for Corporate membership.