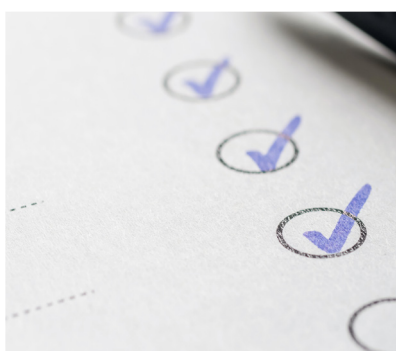


IChemE

Stage 2 – Initial Professional Development (IPD)

Example submissions from applicants



Document control

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Introduction

This document provides real examples that previous successful applicants have provided in their IPD submission forms. These examples will give you an idea of the detail expected when compiling evidence for your own IPD submission.

All examples in this document were assessed by the IPD assessors as providing good evidence of experience for the specific section they relate to. These examples could be used as the main example for a section in order to demonstrate depth of experience.

Please note that this document is not an example of a single previously submitted IPD submission form. You will see that there are various examples listed for each section. We would not expect to receive so many examples within your IPD submission form, or for all of them to be described in such detail. We would expect you to provide one or two main examples described in depth for each section (like the examples provided in this document), and up to four simpler examples (one to two sentences). A supporting example could be the details of a training course you completed.

Section A

Section A: Evidence of applying your knowledge and understanding to practical situations

A1: Applying appropriate theoretical and practical methods to identify or define a problem, opportunity or project

- developed a mass balance on a gas production facility to enable back-calculation of the biogas production from sewage digesters, since flowmeters were suspected to be inaccurate. This improved the accuracy of estimated biogas production and helped to quantify offset of flowmeters;
- I created mass, heat, and energy balances for the design of a new advanced anaerobic digestion (AAD) facility. This included carrying out process calculations to size the sludge handling processes, such as new digesters, thermal hydrolysis process (THP), sludge holding tanks, screens and centrifuges, and the energy utilisation processes, such as the combined heat and power (CHP) engines, boilers and heat exchangers;
- I identified operational and final effluent compliance issues and devised a solution by designing a new sludge processing plant. I carried out a mass balance and hydraulic calculations to size a new sludge dewatering unit with sludge holding and balance tanks. I included odour control using Ferric Sulphate dosing, specifying the average flow rate and produced a feasibility report;
- following proposed changes to the operating mode of an offshore asset, I performed hydrate formation analysis to identify and define potential issues with hydrates, taking into account produced water salinity. I demonstrated that the new conditions would remain outside of the formation envelope;
- I carried out process calculations and mass balances for five water treatment works to identify opportunities to improve the removal of organic precursors to disinfection by-products. From the calculations I highlighted areas of non-compliance with specifications and industry best practice and suggested improvements. I also developed outline process designs for additional treatment options.

A2: Combining ideas and contributions from different people and disciplines to arrive at appropriate engineering, technical or scientific solutions

- collaborating with process operators to understand the practical limitations of potential changes and combining their practical ideas with my theoretical understanding to determine appropriate solutions that address the theoretical problem, whilst being efficient to implement and operate;
- I was the process engineer in a multi-disciplinary team producing outline designs for upgrade or replacement of an existing water treatment works which had experienced *Cryptosporidium* breakthroughs into the final water. I combined information for the process scientist, operators, and asset planner with my own data analysis and process calculations to develop a root cause analysis and propose solutions. I developed the process design for the options and worked with other disciplines to ensure a buildable solution, such as working with civil engineers to produce an appropriate site layout and with electrical engineers to ensure appropriate monitoring and controls were specified;
- I wrote the functional description for a proposed modification to an existing bitumen plant, to manufacture crumbed rubber bitumen. I articulated the client's requirements as well as requirements advised by my teammates with expertise in mechanical engineering, and electrical instrumentation and control systems;
- I was tasked with leading a business continuous improvement project. This project had the aim of improving quality to customers but also bringing various business stakeholders together and ensuring all voices are heard. One section of this was to redefine mechanical and electrical maintenance needed for specific treatment plants. Whilst this was based largely on manufacturers' recommendations and breakdown history, it also involved listening to the experiences of the operators, maintenance teams and engineering to define what is actually feasible and sustainable.

A3: Displaying creativity and innovation: developing your own ideas to produce new engineering, technical or scientific solutions, new designs and new technological approaches

- whilst carrying out dosing calculations for monosodium phosphate (MSP) I identified that the company's standard calculation for pH adjustment did not include MSP or orthophosphoric acid addition which are both commonly used in water treatment. A calculation was previously developed by another process engineer to determine alkalinity change from MSP. To determine the resultant impact on water stability, I incorporated the calculation into the standard template and developed a similar calculation for orthophosphoric acid dosing. Where these chemicals are included in industry standard models the weakly acidic nature of phosphoric acid is not modelled so this was an improvement on the industry standard;
- I created a metal-free photocatalyst that can purify indoor air;
 - the photocatalyst is made of photo reduced graphene oxide (PRGO), a carbon and oxygen-based material;
 - upon absorbing UV light energy, this PRGO photocatalyst produces reactive oxygen species (ROS);
 - the ROS are short-lived radicals that can degrade air pollutants;
 - this is the first study reporting the ability of PRGO to photodegrade air pollutants;
 - the results were published in an international research journal.
- the key highlight of my PhD work is the reduced required CIS concentration for cancer treatment due to the resulted synergistic drug-drug interaction of tocotrienols and caffeic acid with CIS. This achievement of reduced required CIS concentration also resulted in lowered toxicity and reduced side effects on normal cell;
- designed and delivered a lab procedure to evaluate several bio-catalysts robustness to shear stress for commercial manufacture. The selected catalyst was then successfully used for 150 batches. Awarded Company Science Award.

A4. Undertaking scientific or technical evaluation and optimisation (of product, process, equipment, method, project etc) against the requirements you identified, or the brief you were given

- within my role, I perform technical reviews on capital projects. One aspect of this is reviewing the acceptance criteria for each project. A project looking to install a dissolved air flotation (DAF) system had no process guarantees. I co-ordinated involvement from operational staff and applied my own engineering knowledge to determine what the minimum requirement should be. I then led discussions with the designer to develop a set of clarified water guarantees that the design would be held to during the 28-day performance test. These were then agreed and signed off by senior management and external designers;
- I was responsible for monitoring the process performance during commissioning of a hybrid activated sludge process which was designed to meet a tightening final effluent ammonia standard. I took daily interstage samples to assess nitrification performance and took regular mixed liquors samples to test suspended solids concentration and carried out microscopy to determine the impact of operating parameters on the health of the biomass. From my sampling, analysis, and monitoring operational parameters I identified that low dissolved oxygen concentration was having a detrimental effect on the process and that low winter temperatures were causing slow growth and preventing the biomass being established effectively;
- I researched oxygen removal technologies to optimise a carbon capture and storage process. I ranked each feasible technology against process conditions and requirements. I reviewed the optimal option with the vendor, determined the technology readiness level and delivered my findings to guide the next phase;

- I collected hourly and daily data of weather at the factory area (the factory is located at the earth equator with no four seasons) to compare them against the production line speed performance
 - based on my analysis, it was found that colder rainy weather has a negative impact on the production line speed;
 - this was due to poor oven insulation and thus heat energy wastage (especially at colder weather due to a larger driving force of heat transfer);
 - I then used a thermal imager to identify heat leaking spots in the production line;
 - the results were shared to the maintenance department to upgrade the heat insulation of the production lines;
- scaled down a continuous filtration and drying unit operations from commercial scale to lab batch mimic to increase production capacity of 10% target. Design Experiment was then adopted to find optimum conditions which were then translated to plant conditions.

A5. Planning and executing projects: organising or performing technical work to implement or validate solutions, designs etc

- planning and executing is a key part of being a project manager. Since 2009 I have managed in excess of 200 outsourced water treatment contracts. In each of these I would need to plan and manage the schedule before bringing all stakeholders such as logistics and field service together on to that schedule. At the same time pull together the materials that the process design required and ensure they were ready for the shipment;
- in 2012 I project managed what was then a nine-month contract in North Africa. This involved deploying a 30-unit system including dissolved air floatation, media filters and desal. Planning was done over one month and due to the urgent need units were shipped immediately. As well as managing the equipment deployment I coordinated the provision of technical operators including working through the strict security procedures required for that country. Once on site I oversaw commissioning providing front line technical support and ongoing management through the operating phase. In all this project lasted five years;
- I project managed an independent technical review of a feasibility study for a proposed greenfield bioprocessing facility. As I was working within a fixed budget, I scoped out the review activities required by each of the required technical disciplines (mechanical, civil/structural, electrical & instrumentation engineering, and town planning) to ensure efficiency of the review. I conducted regular meetings with the project team and the client, to share progress updates and ensure alignment of expectations and priorities.

Section B

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

B1: Ability to handle health, hazard and safety aspects: to apply appropriate principles, good practice, meet legislative requirements etc

- I discussed with engineers and EHS (Environmental Health and Safety) representatives potential risks and I created a risk assessment document for the installation of a new NIR spectrometer in a tablet press machine. The two main hazard risks identified were dust explosion and equipment ergonomics. I proposed solutions to mitigate these risks and implemented them;
- part of my current role involves attending the HAZOPs for all new and refit equipment introductions. My main contribution is to provide input based on operational experience and consider the equipment in the industrial environment. On average I complete three to four HAZOPs a year;
- when I was leading the emergency preparedness element for our service centre I organised a joint exercise with Cambridgeshire Fire and Rescue. The exercise utilised our facility for a large-scale chemical rescue drill involving several rescue teams and a decontamination unit. As well as a close to real life test for the Fire Service, it was also a fantastic opportunity to test my own procedures and turn lessons learned into corrective actions;
- as a process engineer, for each Management of Change (MOC) I organise and coordinate the SHE review. During the review process, myself and key personnel from production, as well as process safety would identify the potential hazard which could arise by executing MOC. Upon identifying a potential hazard, I would incorporate risk control to overcome the hazard by including safety measures;
- I coordinated the update and submission of the Safety Case for an oil refinery and terminal in Australia. I updated parts of the Safety Assessment, Safety Management System, Emergency Response and Community Consultation sections of the Safety Case, ensuring that these sections met the requirements set out in the state's Work Health and Safety Regulations;
- I facilitated eight bow tie workshops for major process safety risk events such as loss of containment of toxic gas, loss of containment of flammable gas, explosion of fired heaters, etc with a team of site engineers across our various manufacturing sites, to create a suite of standard bow ties for my company.

B2: Ability to handle sustainability aspects: these could include environmental, public concern and other societal issues, recognition of risks etc

- I have been responsible for carrying out whole life carbon assessments for initial options being considered to accommodate growth at existing wastewater treatment works which involved accounting for the embodied carbon of the proposed interventions as well as the operational carbon from power and chemical consumption. The outputs were used to assist the client with option selection as a significant driver is the goal of net zero carbon emissions by 2040;
- during an assessment of filter backwash efficiency, I identified that the filters were being refilled following backwash from the clean backwash water tank (which was fed by filtered water). Although this did not negatively impact the backwash effectiveness, it did reduce the water efficiency of the water treatment works and I recommended that this procedure was stopped and replaced with a more typical approach of slowly starting the filters from the clarified water;
- designed novel NO_x removal process for cement plant to meet emission requirement. I worked with the cement plants in China to develop a process to reduce NO_x from the flue gas using pyrolysis oil from biomass and catalysts to meet the emission requirement of less than 400 mg/m³. The new process can replace the need for ammonia, which is also a potential pollutant;
- I developed a decontamination (removal of hazardous chemicals and construction materials) philosophy for a new-build floating liquefied natural gas vessel. I issued this philosophy to establish the operator's decommissioning responsibilities to the local regulator prior to final sail away;

- I cooperated with a group of chemists to trial run a washing chemical developed from the waste effluent of a chlorination process system;
 - I provided the specifications and functions of the washing chemical required for my production line;
 - the washing chemical was developed by using the waste effluent of a chlorination process, which would have been disposed of if not recycled;
 - I managed the trial run of the washing chemical in the actual production process;
 - I found that the performance of the washing chemical was comparable to commercial chemical standards. I recommended it to be used in the whole factory to reduce waste and cost.

B3: Ability to handle commercial and economic aspects

- I prepared a business case for automating a dosing system on a sulphur palletisation process that was accepted and resulted in the initiation of a project. For this, I prepared a capital cost estimate and determined the payback period compared with current operations. I subsequently managed this project and its budget;
- I conducted a technical-commercial exercise to assess and recommend a supplier of enhanced primary treatment (EPT). I analysed proposals from several consultants to source an EPT technology with a budget of £25,000. I ranked the proposals against a selection matrix which included cost, methodology and technical expertise, with one supplier getting the contract;
- at times contract disputes will arise during a project and I often lead the effort to resolve. These involve analysing the customer's claim against the contract and then comparing to actual events in order to either agree, dispute or counter claim. Claims I have resolved are often greater than £100k and involve contracts throughout Europe, the Middle East and Africa;
- I have produced documents detailing the required cost, time and resources (CTR) for major work-scopes, including a heat tracing evaluation study and a locked valve desktop review;
- I performed due diligence on tender submissions for France's first offshore windfarms. By using the source MetOcean data, I reverse engineered the proposed schedules from each bid's stated operational constraints. With risk-assessed schedules, I highlighted the feasibility of each bid achieving the defined milestones;
- I write a monthly downtime report and analyse the cost incurred due to unplanned downtime;
 - I assisted in writing incident report of unplanned downtime and the cost incurred;
 - I managed cross department planned and unplanned downtime analysis/meeting;
 - I assisted in the monthly budget planning for production to do upgrading work;
 - I managed manpower in the production department.
- I costed and reviewed planned maintenance routines for offshore systems. I analysed the costs of a failure event (loss of production, schedule impact and/or life) against the annualised maintenance costs. I proposed optimised, safe maintenance intervals which saved the client as much as 65% on their maintenance outlay.

Section C

Section C: Evidence of your interpersonal, leadership and communication skills

C1: Managing interpersonal communications and relationships including demonstrating an awareness of diversity and inclusion

- as a lecturer in academia, I am continuously working with our students, delivering lectures, supervising projects, supporting their studies and solving their complaints. I am teaching a cohort of 400 undergraduate students. It is not always easy to solve students' complaints. For example, there are always a few students who are complaining about their group mates for the final year design projects. I usually arrange face-to-face meetings with the students to hear their complaints and concerns. I then calmly explain how we, academic staff, can support them if other group members do not do their fair share of work. I also call the other group members in and hear their side of the story. Then, I can find a solution to support them if they need it;
- in my career I have had to manage two occasions where an employee has been absent long-term due to sickness. During these times I had to manage the HR process as well as ensuring the person remains connected to the business in a positive way. This ensured when they did return the return to work was as low stress as possible but also that there could be open dialogue to discuss challenges as they arose;
- at present I am the leader of a function of 16 people split between three teams. Two of these teams I inherited and the other I built from scratch. Creating and maintaining a cohesive function which strives to improve involves managing the different personalities, ensuring everyone feels valued and dealing with issues when they arise;
- as a design assurance engineer in the retail fuel industry, I was responsible for ensuring the design of the retail fuel outlets were fit-for-purpose and met stakeholder requirements (sometimes competing). In one case, the design consultant wanted a particular building roof design which was not approved by the internal standards team. I managed the communication and negotiation between the different teams, helping each team understand the others' perspective. It resulted in the standards team moving from an absolute rejection to eventually approving a deviation to the standard design, and even considering it as an update in a future revision.

C2: Demonstrating leadership in a professional role

- as part of my day-to-day work as a Senior Thermal Design Engineer I am responsible for mentoring and coaching junior engineers, providing critique in a supportive manner;
- the last 18 months has been highly unsettling for most places of work and mine was no different. During the pandemic, providing leadership has been vital to keeping my function on track and focused, especially when they switched from being in very close proximity to working remotely. I did this by utilising video conferencing tools to ensure people still had the experience of seeing each other, I created a virtual lunch time to try to prevent isolation and used chat board functionalities to avoid communication breakdowns;
- in 2016 one of my team was leading the execution of a large contract in the Middle East which, at the time, was facing mounting challenges and delays. I travelled to site to assist and found that whilst the teams were working very hard, they had lost some direction. Following a meeting with the customer I gathered the team and walked through the issues one by one. Giving strong direction on each of the items raised gave them the chance to refocus and the plant was in fact operational 48 hours later;
- as a process engineer, I supervised an engineering intern for three months. I provided technical guidance to the intern in terms of process engineering such as P&ID mark-up and review, as well as to perform hydraulic calculations for pump and pipe sizing;
- I held a daily short meeting/discussion with the production team, which consisted of engineers, operators and technicians with diverse race, age group, and nationalities;
 - this is to summarize production issues in a day;
 - build team spirit;

- evaluate short term performance;
- share knowledge among the team;
- I also have to solve conflicts within the department;
- I reviewed the performances of the operators and proposed promotions to top performers.

C3. Communicating ideas and plans by report writing and oral presentation

- wrote 12 competitive research proposals (in assessment of a novel liquid ammonia energy storage, direct air capture systems, testing of new materials for enhancing biodigestion etc) as principal investigator submitted to different funders namely EU H2020, UKCCSRC, Net Zero Research, Research England, Innovate UK, UK PACT, AURA Innovation Center etc. Three of the proposals were selected for funding;
- I made 23 oral presentations at globally-acclaimed international conferences/meetings/seminar. I was the lead presenter in 11 of the conferences/meetings/workshops;
- throughout my career, I have written many technical reports summarising the purpose of my research, findings and recommendations. For example, I compiled my PhD research of four years at Unilever R&D Port Sunlight on my thesis named 'Improving Personal Care Product Quality using Innovative Data Analysis and Measurement Techniques' and successfully defended it in front of two external assessors during my Viva meeting in November 2014;
- I often create technical reports for consumption by customers. Most recently was a report to counter a customer dispute where they were claiming contract non-conformance. I had to gather the timeline of events, review contract terms, analyse process telemetry and then present the findings back in a written report which clearly laid out the conclusions;
- I have produced training materials including in-person and computer-based presentations, for instance on methods for performing relief-sizing calculations, and training of the site shift teams on operation of the new condensate loading package;
- for my PhD, I authored and successfully defended my 250 pages thesis during oral examination (viva voce) to experts in the field (external and internal examiners). My PhD thesis focused on generation of multiple nano emulsions encapsulating natural active compounds to be used as drug delivery tools for cancer treatment;
- last year I wrote an article which was published in *The Chemical Engineer* magazine on the potential benefits of doing an industrial placement as part of an undergraduate degree. This was a collection of personal experiences and input from previous industrial placement students in order to give a full spectrum of views.

Section D

Section D: Evidence to show that you are committed to high standards of professional and ethical conduct

D1: Professional conduct

- I have hosted work experience for high school students incorporating visits to sites which included organisation of PPE and completion of appropriate risk assessments;
- all of my process design calculations and assessments were carried out in line with water company specifications and standards. I also carried out various DSEAR assessments in line with British Standards, industry guidance and relevant codes of practice;
- crediting sources used in my research and performing plagiarism checks using appropriate software before submitting technical articles for publication;
- as a function leader I believe it's very important to pass on experiences and learnings in areas such as professional conduct to my team members in order to coach their own development. For example, recently I have been mentoring my lead project manager on how to create the right image when interacting with a senior leader and last year ran some informal training for my logistics personnel on how to interact with customers;
- I have helped work to expand the profession, particularly in under-represented groups, for instance through volunteering for mentorship schemes, mock interviews, assessment centres and women in engineering events;
- working for the past six years as an engineer (2015-the present), I have always ensured that I work professionally and ethically, adhering to the professional conduct/code of ethics as stipulated by Board of Engineers Malaysia (BEM) and IChemE;
- as a senior leader I have had to chair two formal complaints between company staff. This involves carrying out a neutral, non-biased and fact-based investigation before deciding where the complaint has validity or in the second case whether the person had committed misconduct.

D2: Ethical decision making

- a supplier shared the results of a test they had carried out at our wastewater pilot plant. This gave internal staff a good insight into how the process unit performed in real-world conditions. As part of a project, an external design team asked me for this information so they could incorporate it into their design. Aware of commercial sensitivity I checked with the supplier if I could share their information, they advised they would prefer I didn't. I explained this to our partners and kept to our confidentiality agreement;
- due to business pressures, I was being pushed to sign off on changing the content of the sodium hypochlorite (1.11g/cm³) tank to instead temporarily store sodium hydroxide (2.13g/cm³). However, this was without fully completing the management of change process. I advised the plant manager that this will likely be unsafe and advised the possible outcomes. I also advised that the business should consider renting a tank for that period. The conclusion was that a temporary tank was rented;
- when reviewing taste and odour customer complaints for water treatment works, I noticed that some of the customers' personal information was included in the data. This was a breach of the General Data Protection Regulation (GDPR). I reported the breach to the project manager to ensure the client was informed and removed all personal data from our file management system;
- within my team, I promote a positive culture by encouraging them to 'speak up', respect inclusion and support teamwork and trust. I organise monthly team building activities such as quizzes and walking challenges to promote mental and physical wellbeing. In addition, I organise regular process safety discussions and inspections to encourage safety awareness for employees and patients;
- as a team manager for the last ten years I have led an annual ethics review with my team members which gives them the chance to raise any concerns or questions over policy. It is my responsibility to record anything raised and submit reports for further investigation;

- during onsite work I have stopped the job whenever something is wrong, for instance when I noticed that the sampling probe might have been incorrectly installed during commissioning, or after having observed a partial vacuum in the vent header line during commissioning of the tanker loading system;
- a client repeatedly asked to exclude certain factors in a study resolving a production blockage to eliminate alternatives to a short-cut approach being developed internally. I refused, delivering the concept selection to the client with the safe and environmentally optimal options clearly communicated to stakeholders;
- I declined a candidate during an interview because the candidate was working for a direct competitor at that time. It was against my company's ethics to provide company's details to a direct competitor within two years of leaving a position, vice versa;
- as a project manager I led a number of contracts outside the European Union from 2010 to 2016. In these I would often be leading the logistics effort to ship units and therefore heavily involved in import/export activities. On two occasions it became clear that units were being delayed at customs and it was suggested additional payments could be made to speed up the process. This is in direct breach of the company ethics charter and in each case, it was declined and the event reported.

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