KNOWLEDGE ASSESSMENT SELF REVIEW (FORM KA02)

Name of Applicant: _____ Membership number or date of birth: _____

Section One

Important Instructions and Guidance

Carefully read the following instructions and guidance. They are designed to assist you in providing in providing a portfolio of evidence that best demonstrates the comprehension and application of your engineering knowledge to Washington Accord equivalence.

Section One – Instructions and Guidance

- Familiarise yourself with the definition of ' complex engineering problems' (Appendix One) as you are required to demonstrate you can apply your engineering knowledge to solve complex engineering problems.
- Identify the 'engineering discipline and field' (Appendix Two) you will provide evidence of your comprehension and application of engineering knowledge in.
- The knowledge assessment is based on Washington Accord knowledge profile. This form is designed to capture information to assist the evaluation of your evidence

Section Two – Knowledge Profile

- As you do not have a formal engineering qualification that formally benchmarks to a Washington Accord accredited degree, it is essential that you demonstrate that you have acquired an equivalent level of knowledge.
- The Context and performance indicators provide guidance on the evidence to be provided
- Consider each element of the knowledge profile, including the context statements and performance indicators. Summarise key aspects of your knowledge under each element and how this has been developed through academic study, on-job learning and/or continuing professional development. It is important you use the performance indicators and complexity definitions to enable you to describe your knowledge and how it has been developed.
- When describing how your educational program contributed to your development, focus on the more advanced pieces of work you did, the knowledge you needed in order to perform that work, and the abilities you needed in order to apply your knowledge in an engineering context.
- The word document is formatted to allow you expand a text box if required.
- Write your material in the first-person using 'I' or 'me' instead of 'we' or 'us'. This makes it easy for the assessors to see what your personal contribution was.

Section Three – Evidence of Application of Knowledge

- Describe 3-4 engineering projects or activities (Work/Study Episodes) that you have been involved with, which demonstrate your ability to apply your engineering knowledge to solve complex engineering problems. Think of activities where you have had to apply a high level of engineering knowledge – such as some analysis that you have done, work you have done in scoping a problem and then developing a solution or design. What engineering models did you use? What assumptions were made in the development of the model and how did you test the model was relevant in the way you used it?
- For engineers with limited practical experience post-graduation, project work undertaken during your study is likely to be one of the best ways of illustrating the application of your knowledge. As well as projects conducted within university or college, you may be able to draw on any industry experience required as part of the educational program.
- You are required to include actual samples of your work – calculations, analyses or reports that you have personally undertaken - to substantiate your work/study episodes.
- Write your material in the first-person using 'I' or 'me' instead of 'we' or 'us. This makes it easy for the assessors to see what your personal contribution was.
- The word document is formatted to allow you expand a text box if required.

Section Four – Supplementary Evidence

- You are required to submit a certified copy of your academic transcript(s) (formal record of papers taken and grades received) if you have not submitted to IPENZ already.
- Summarise your work history but include a representative sample of specific engineering projects or activities that evidence the development and application of the knowledge profile.
- Rather than listing all your CPD activities, provide details of those activities that have extended your professional engineering knowledge in your discipline and field and have assisted you to develop the knowledge profile of a professional engineer. A summary of all relevant activities – including those going beyond the most recent 6 years - will assist knowledge assessors in assessing your engineering knowledge. Assessors will be looking for how any gap between your qualification and a Washington Accord qualification has been bridged by your CPD.
- The word document is formatted to allow you expand a text box if required.

Section Five – Payment

- The fee for a knowledge assessment is NZ$1,351.25 GST incl. Please complete your credit card details.
- Send all documentation to address advised

What happens next?

The knowledge assessor will review your portfolio of evidence to determine the need for further challenge tests. This will involve an interactive assessment, that you will need to make yourself available for, either via tele or video conference and may also involve a series of challenge tests that may include one or a combination of:

- an oral and/or written examination
- a work simulation
- a case study

Your knowledge assessor will be in touch with you to discuss the next steps.

SECTION TWO – KNOWLEDGE PROFILE

ELEMENT ONE A systematic, theory-based understanding of the natural sciences applicable to your discipline (e.g. calculus-based physics)	
Context All engineering fields are rooted in one or more of the natural sciences. In a broad context, natural science is separated into physical and biological sciences. Physical sciences include chemistry, calculus-based physics, astronomy, geology, geomorphology, and hydrology. Biological sciences involve living systems and include biology, physiology, microbiology, and ecology. Washington Accord graduates are expected to be able to apply this knowledge of the natural sciences to solve complex engineering problems in their discipline.	
Performance Indicators • Fundamental quantitative knowledge underpinning nature and its phenomena. • Knowledge of the physical world including physics, chemistry and other areas of physical or biological science relevant to your discipline • Knowledge of key concepts of the scientific method and other inquiry and problem-solving processes; • Application of knowledge from one or more of the natural sciences to the solution of complex engineering problems relevant to your discipline	
Summarise your knowledge of the natural sciences relevant to your discipline and how it has been developed through formal study, on-job learning and/or continuing professional development. Note: please cross reference to your academic transcript(s) and continuing professional development records, as appropriate. I retain a comprehensive theoretical understanding of the physical properties of the leachate formation. The process starts when a complex sequence of physical, chemical & biological reaction occurs within the landfill. I have an excellent theoretical knowledge of the chemical parameters testing. I tested leachate for numerous parameters like concentration of Chlorides, Sulphates, Chemical Oxygen Demand & pH. I comprehend the significance of the diverse chemical properties of the Landfill Leachate. I have studied the changes in quality parameters of Landfill leachate before & after the treatment with one stage & two stage distillation of leachate. I have a respectable understanding of the distillation process. I examined removal of Chemical Oxygen Demand throughout the two stages of distillation.	Provide annotations to your supplementary evidence (document and page number) Episode 1, pages 1-2, clauses 1.1, Episode 1, pages 1-2, clauses 1.2 Episode 1, pages 1-2, clause 1.2 Episode 1, page 2, clause 1.4

Commented [DJ 1]: What is the logic for giving Page no. Is it the page no. of word file or episode. It should have consistency. Please advise me on that.
(These are the page numbers of corresponding Episode in this Ka02 Form)

	Episode 1, page 3, cla 1.6
I demonstrated my knowledge on the experimental setup for the distillation process. I have an expertise in distillation methodology. I fixed the experimental setup accordingly.	Episode 1, page 2-3, clause 1.5
I drafted the methodology of the distillation process. This was entirely my brainchild.	Episode 1, pages 3-4, clauses 1.7
I am well aware of the chemical analysis procedure of the leachate. After distillation the Chemical Oxygen Demand decreased from 14880 mg/L to 1416mg/L in one stage & further reduced to 950 in two stages of distillation. Similarly excellent results were obtained for Chloride, sulphate concentration	Episode 1, page 2, cla 1.9
I have an unmatched expertise in using Spectro-photometer. I used Spectro-photometer for numerous parameters analysis.	Episode 4, page 1, cla 4.3
I prepared the water balance of the biding stage in order to calculate water demand for pretreatment plant.	Episode 4, page 6, cla 4.11
I requested that boiler cooling tower blowdown water is of very pure quality so this can be directly moved to Ash water sump without treatment in waste water treatment system. This suggestion resulted in significant reduction in the capacity of UF and RO units.	

ELEMENT TWO

Conceptually-based mathematics, numerical analysis, statistics and formal aspects of computer and information science to support analysis and modelling applicable to your discipline

Context

Branches of mathematics applied in engineering include arithmetic, algebra, geometry, trigonometry, calculus, differential equations, numerical analysis, optimization, probability and statistics, simulation, and matrix theory. Engineers apply mathematics in a wide variety of functions typically carried out in engineering organisations such as planning, design, manufacturing, construction, operations, finance, budgeting, and accounting.

Washington Accord graduates are expected to be able to apply this mathematical knowledge to solve complex engineering problems in their discipline.

Performance Indicators

- Knowledge of mathematics, statistics and numerical methods that supports the development or application of models that replicate 'real world' behaviours
- An understanding of the assumptions behind theoretical models and their impacts in the development and use of those models
- Ability to organise and analyse a data set to determine its statistical variability;
- Knowledge of trigonometry, probability and statistics, differential and integral calculus, and multivariate calculus that supports the solving of complex engineering problems
- Ability to apply differential equations to characterize time-dependent physical processes

Summarise your mathematical knowledge relevant to your discipline and how it has been developed through formal study, on-job learning and/or continuing professional development. Note: please cross reference to your academic transcript(s) and continuing professional development records, as appropriate.	**Provide annotations to your supplementary evidence (document and page number)**
As an Environmental engineer, I drafted varied graphs for illustrating various effects of distillation on Leachate.	Episode 1, page 5-6, clause 1.7
I developed detailed mathematical process calculations for the water treatment plant to be installed in Mumbai. I converted the generic mathematical model into a practical model.	Episode 2, pages 1, clauses 2.3
I have accomplished design calculations for the sizing of the experimental equipment, as well as heat/mass balance calculations.	Episode 1, pages 3, clauses 1.6
Lused Lucid charts P & ID software for preparing the GA drawings.	Episode 2, page 3, clause 2.12

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Commented [DJ두3]: Clause was not Matching so I have corrected it. Please review for correctness. (Good to go)

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I prepared technical data sheets for submission with the technical proposal.	Episode 2, page 1, clauses 2.3
I used Microsoft Word & Power Point to draft the chemical analysis of the effect of distillation on the Chemical Oxygen Demand.	Episode 1, pages 4-5, clause 1.7, 1.8
I calculated the clarifier overflow rate. Similarly I performed other calculations also in the design	Episode 4, pages 5, clause 4.8

ELEMENT THREE

A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline

Context

Engineering fundamentals provide the knowledge base for engineering specialisations and represent a systematic formulation of engineering concepts and principles based on mathematical and natural sciences to support applications.

The core areas of engineering fundamentals knowledge include fluid mechanics, statics and dynamics, electric circuits, solid mechanics, thermodynamics, heat transfer, mass transfer, and properties of materials.

Washington Accord graduates are expected to be able to apply this knowledge of engineering fundamentals to solve complex engineering problems.

Performance Indicators

- Ability to define key factual information in core areas of fundamental engineering knowledge relevant to your engineering discipline
- Evidence of sufficient depth of knowledge of engineering fundamentals to demonstrate an ability to think rationally and independently within and outside a chosen field of specialisation
- Evidence of sufficient breadth of knowledge of engineering concepts and principles to allow subsequent professional development across a broad spectrum of engineering
- Ability to apply knowledge of engineering fundamentals to solve complex engineering problems relevant to your discipline

Summarise your knowledge of the core engineering fundamentals (as listed above) and how they have been developed through formal study, on-job learning and/or continuing professional development. Note: please cross reference to your academic transcript(s) and continuing professional development records, as appropriate.	Provide annotations to your supplementary evidence (document and page number)
I calculated the Chlorine dosing at Inlet Bay for Chlorination design.	Episode 2, page 4, clause 2.6
I executed a distillation system which adhered to the international standards of distillation process.	Episode 1, page 4-5, clause 1.7
I calculated that 40 m3/hr portable water treatment plant will be required for the power plant staff & colony.	Episode 3, page 1, clause 3.1
I possess a broad knowledge of distillation. I also studied the effect of landfill leachate on the Ground Water Quality.	Episode 1, pages 5, clauses 1.11

I was a part of the Suez's Technical formulation team for project execution. The team comprised of only experts from the designated field.	Episode 2, page 2, clause 2.4
Relying on my specialization, I have managed to perform the preliminary calculation for water treatment plant. I prepared the preliminary calculations for all major process units & corrected vendor technical proposals.	Episode 2, page 3, clauses 2.6
I installed safety shower in the potable water treatment plant. The pressure in the line was way higher than required. Instead of replacing the entire safety shower I installed inline pressure reduction wall which reduced the line pressure to 1 bar from 5 bar.	Episode 3, Page 3, clause 3.5
Based on the literature re-search I advised to use UF membrane with 100,000 Daltons. This lead to the best retention.	Episode 4, pages 2-3, clause 4.4

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Element Four

Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline

Context

In addition to a broad understanding of fundamental engineering principles, professional engineers are required to develop specialised engineering knowledge to support their practice. This may be aligned with traditionally defined fields of specialisation such as structural, industrial or geotechnical engineering; coherent combinations of such traditional areas; or more recently emerging fields such as software, biomedical or mechatronics engineering.

Advancing technological knowledge and complexity means that technical specialisation is increasingly necessary for an engineer to remain abreast of technological development throughout their career.

Washington Accord graduates are expected to be able to apply this engineering specialist knowledge to solve complex engineering problems.

Performance Indicators

- Evidence of sufficient depth of knowledge to support practice within one or more recognised field of engineering
- Evidence of a systematic understanding of the coherent body of knowledge related to a particular field of engineering: its underlying principles and concepts; its usage and applications; and analytical and problem solving techniques
- Ability to apply specialist engineering knowledge to solve complex engineering problems

Summarise your specialist engineering knowledge and how it has been developed through formal study, on-job learning and/or continuing professional development. Note: please cross reference to your academic transcript(s) and continuing professional development records, as appropriate.	Provide annotations to your supplementary evidence (document and page number)
I am proficient in the development of detailed graphs. I drafted graph which clearly depicted the effect of distillation.	Episode 1, pages 5-6, clauses 1.12
I am an expert in the design of complex water treatment systems. I designed the methodology for 900 MLD Water Treatment Plant.	Episode 2, pages 2, clauses 2.4,
Based on my deep knowledge and previous development experience, I was able to troubleshoot complex chemical & technical problems effectively.	Episode 1, page 5, clause 1.4
I am a specialist in the installation and commissioning of modern Water Treatment System. I decided to use the Suez's proven technology of Reverse Osmosis along with Aquazur V filters.	Episode 2, pages 2, clauses 2.4

Commented [DJ 6]: Clause was not Matching so I have corrected it.It should be 1.4 Please review for correctness. (Yes u are right)

As a profound environmental engineer I designed the entire water treatment plant for treating the distilled water and continuously adding specific chemical solutions by means of dedicated dosing systems in order to make the water quality according to WHO recommendations.	Episode page 1, clauses 3 .2
Being an experienced expert environmental engineer, I was tasked to deal with all customized solutions for the company's customers, and I was given additional duty of setting up chemical dosing system comprising of dedicated dosing systems.	Episode pages 1clauses 3 , .2
I resolved the issue of using disinfecting chemicals. I did my research & decided to use calcium hypo chlorite as the disinfecting chemical.	Episode pages 2, clauses 3 , 3, .4

ELEMENT FIVE

Knowledge that supports engineering design.

Context

The design process – the root of engineering – is the process of devising a system, component or pro cess to meet desired needs. Engineering design is a systematic process that involves problem definition and

scoping, research, analysis, option development and selection, modelling to predict future performa nce,

detailed design and testing. Importantly, it also involves communication of the outcome in a way that

enables the design solution to be realised. s to

Washington Accord graduates are expected to be able to apply this knowledge of the design proce solve complex engineering problems.

Performance Indicators

- Ability to undertake research and analysis to support the design process
- Ability to investigate a situation or the behaviour of a system and identify relevant causes and

effects

- Ability to develop from first principles and construct mathematical, physical and conce tual models of situations, systems and devices, with a clear understanding of the assumptions ade in development of such models
- Application of technical knowledge, design methods and appropriate tools and resource s to design components, systems or processes to meet specified criteria
- Ability to analyse the pros and cons of alternative design options to support the development f an optimised design alternative
- Ability to analyse the constructability or manufacturing feasibility of a project or product
- Experience of personally conducting a significant design exercise, providing evidence of the consideration of various realistic constraints, such as safety, reliability, ethics, economic fac aesthetics and ors, social impact.
- Ability to apply appropriate design methods in solving complex engineering problems

Summarise your knowledge that supports engineering design relevant to your discipline and how it has been developed and applied through formal study, on-job learning and/or continuing professional development. Note: please cross reference to your academic transcript(s) and continuing professional development records, as appropriate.	Provide annotations to your supplementary evidence (document and page number)
I conducted research to find the exact process of leachate formation and applied my knowledge to come to a conclusion that distillation can be a route to handle the ground water pollution.	Episode 1, page 6-7, clause 1.16
I conducted my research keeping in view all the standard methods for the examination of water & waste water & standards addressed by the American Public health association and American Water Works Association.	Episode 1, page 6, clauses 1.13
Based on my deep knowledge and previous development experience, I was able to trouble shoot hindrances in the preliminary calculations for water treatment plant. I successfully deduced the Volume of the underflow sludge i.e. 4064 m3/day.	Episode 2, page 3, clause 2.5
Being an experienced expert in the field, I was tasked to exhibit design calculations for the chlorination design.	Episode 2, pages 3-4, clauses 2.6
I performed designing of the centrifuge for sludge thickening.	Episode 2, pages 4, clauses 2.6
I designed the new potablization plant using calcium hypo chlorite. I recalculated all the computations for using this chemical as disinfectant. I notified the equipment vendors to revise the design of dosing pumps according to the new choice of disinfectant chemical.	Episode 3, pages 2-3, clauses 3.4
I calculated the consumption of the Calcium hypo chlorite solution to be injected in the distilled water. It came out to be1.83 litre/hr	Episode 3, pages 3, clauses 3.6
I prepared key design data for Pre-treatment, Demineralization and Waste water treatment plant.	Episode 4,, page 2, clause 4.3
I drafted the flow charts for the 4500 m3/hr Pre-treatment plant, 80 m3/hr Demineralization plant, 250 m3/hr Waste Water Treatment plant.	Episode 4, page 3-4, clause 4.6
I designed major units for the 4500 m3/hr Pre-treatment plant, 80 m3/hr Demineralization plant, 250 m3/hr Waste Water Treatment plant.	Episode 4, page 5, clause 4.7

ELEMENT SIX

Knowledge of engineering practice in the engineering discipline

Context

Engineers require knowledge of a broad range of tools and techniques relating to technical (measurement, modelling, drawing, design), business (financial management, project management) and interpersonal (communications, teamwork) aspects of modern engineering practice.

Washington Accord graduates are expected to be able to:

- Create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering problems, with an understanding of the limitations.
- Apply knowledge of management principles and economic decision making as part of the management of engineering projects
- Function effectively as an individual and as a member or leader in diverse teams
- Communicate effectively with both technical and non-technical audiences

Performance Indicators

Tools and technologies:

- Awareness of critical issues affecting current technical and professional practice
- Awareness of current tools of analysis, simulation, visualisation, synthesis and design, particularly computer-based models and packages, and competence in the use of a representative selection of these
- Appreciation of the accuracy and limitations of such tools and the assumptions inherent in their use
- Knowledge of materials and resources relevant to the discipline and their main properties and ability to select appropriate materials and techniques for particular objectives
- Knowledge of a wide range of laboratory procedures relevant to the discipline and a clear understanding of the principles and practices of laboratory safety
- knowledge of current types of systems, equipment, information technology, and specifications that accomplish specific design objectives

Communication:

- write correspondence that clearly and concisely communicates facts and circumstances related to a project, product or process
- plan, prepare and deliver an oral presentation, with appropriate visual aids and other supporting materials
- communicate effectively with both technical and non-technical individuals and audiences

Engineering management principles and economic decision making:

- apply appropriate tools and techniques to monitor project schedules and costs

Team work:

- Operate as an effective team member or leader of a multidisciplinary team

ELEMENT SIX Knowledge of engineering practice in the engineering discipline	
Summarise your knowledge in each of these core areas underpinning engineering practice and how it was developed through formal study, on-job learning and/or continuing professional development. Note: please cross reference to your academic transcript(s) and continuing professional development records, as appropriate.	Provide annotations to your supplementary evidence (document and page number)
I followed & reviewed the Material Safety Datasheets of all the chemicals for the design of various equipment.	Episode 2, page 4-5, clause 2.9
I used single line mixer to mix NaOH & calcium hypo chlorite. I reduced the cost by using two line mixers instead of four.	Episode 3, pages 4, clauses 3.7
I calculated the density if the calcium hypo chlorite solution for setting the corresponding flow rate	Episode 3, page 3, clause 3.6
I used dosing tank agitators for ensuring optimum dissolution of solid chemical & optimal homogeneity of chemical solution inside dosing tank.	Episode 3, page 4, clause 3.8
Based on my experience I recommended carrying out raw water analysis for entire one year spectrum in order to have sufficient knowledge of raw water quality in design.	Episode 4, page 3, clause 4.5
I tool reference from standard literature i.e. Water Works Engineering by Syed R. Qasim & Government of India Manual on Water Supply & Treatment for performing proper preliminary water treatment plant design calculations.	Episode 2, pages 3-2, clause 2.5
I used 2 NaOH dosing pumps with no agitators. The reason of using no agitator was that NaOH quickly mixes in water.	Episode 3, page 4, clauses 3.8
I used MS office for making Water Balance Diagram and I used AutoCAD 2011 for making drawings.	Episode 3, pages 4, clause 3.9

Commented [DJ 7]: Clause was not Matching Please review for correctness and mentioned correct reference (Done)

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Element Seven

Comprehension of the role of engineering in society and identified issues in engineering practic e in the discipline: ethics and the professional responsibility of an engineer to public safety; the imp acts of engineering activity: economic, social, cultural, environmental and sustainability

Context

Engineers design artefacts (facilities, structures, systems, products and processes) that are intende d to meet a societal need, but which typically impact on individuals or groups in different ways. As a re sult, design and decision making processes must take account of often conflicting stakeholder needs. An understanding of this societal context and the ethical obligations that the engineer has in service of so ciety are critical components of engineering practice.

Washington Accord graduates are expected to be able to:

- Apply ethical principles and commit to professional ethics and responsibilities and norms of engine ering practice
- Understand and evaluate the sustainability and impact of professional engineering work in the sol ution of complex engineering problems in societal and environmental contexts.

Performance Indicators

- Demonstration of ethical behaviour in accordance with ethical codes of conduct and establi shed norms of professional conduct
- Evidence of making ethical decisions and regulating one's own professional conduc t in accordance with a relevant code of ethical conduct
- Implementation of appropriate health and safety practices
- Application of safe practices in laboratory, test and experimental procedures
- Awareness of the social and environmental effects of their engineering activities
- Awareness of sustainable technologies and sustainable development methodologies
- Ability to identify risks as a consequence of engineering compromises made as a result of pr oject or business constraints, and understanding of techniques to mitigate, eliminate or minimise ris k
- Knowledge of appropriate risk management techniques used to assess the accuracy, relia bility and authenticity of information
- Understanding of the role of quality management systems tools and processes

Summarise your knowledge of the role of engineering in society and how it has been developed through formal study, on-job learning and/or continuing professional development. Note: please cross reference to your academic transcript(s) and continuing professional development records, as appropriate.	Provide annotations to your supplementary evidence (document and page number)
I have followed Weatherford's established procedures and policies in regards to the occupational and environmental safety.	Episode 2, page 5, clause 2.9
I carefully selected the equipment that was to be installed, in the premise to be completely environmental friendly, emitting minimum carbon into the atmosphere.	Episode 2, page 2, clause 2.4

	Episode 3, page clause 3.10	
In order to evade any safety issue I prepared Key technical specifications for all the major equipment like chemical dosing pumps & tanks, agitators & line mixers.	Episode 1, page clause 1.1, 1.2	5,
My research based project can be helpful for future students & they can utilize my developed distillation methodologies as a test bed to test out the learned concepts. I wrote a comprehensive user manual for the distillation of leachate process, this can be useful for immediate overview of the anticipated system.		1,
	Episode 1, page clause 1.11	
I conducted research to find the optimal values of the volume of the underflow sludge by keeping in view the reference material i.e. The Water Works Engineering by Syed Qasim and Govt of India Manual on Water Supply & Treatment.		4,
	Episode 3, page clause 3.11	
I was assigned to the QA/QC role during installation of the line mixers & agitators. I made sure that every step is taken according to the vendor recommendations and are up to international standards.		5,

ELEMENT EIGHT

Engagement with selected knowledge in the research literature of the discipline

Context

Research and broader lifelong learning capabilities are essential if the engineer is to remain up-to-date with rapidly evolving scientific knowledge, technology and engineering tools critical to engineering practice arch

Washington Accord graduates are expected to be able to use research-based knowledge and rese methods as part of the investigation of complex problems in their discipline

Performance Indicators

- Advanced knowledge in at least one area within your discipline, to a level that engages with current developments in that area
- Understanding of how new developments relate to established theory and practice and to ther disciplines with which they interact
- Describe advancements in engineering research and technology and science in a particular ar ea

of engineering practice;

- Review research articles pertaining to a project component typically encountered in a specific area of engineering design;
- Choose topics most appropriate for continuing education to increase depth of technical knowl pertinent to the specific area of engineering practice Commitment to lifelong learning.

dge

Summarise your research knowledge and how it has been developed through formal study, on-job learning and/or continuing professional development. Note: please cross reference to your academic transcript(s) and continuing professional development records, as appropriate. My research based project can be helpful for future students & they can utilize my developed distillation methodologies as a test bed to test out the learned concepts. I wrote a comprehensive user manual for the distillation of leachate process, this can be useful for immediate overview of the anticipated system. I conducted research to find the optimal values of the volume of the underflow sludge by keeping in view the reference material i.e. The Water Works Engineering by Syed. R Qasim and Govt. of India Manual on Water Supply & Treatment.	Provide annota to your supplementary evidence (docu and page numb Episode 1, page clause 1.1, 1.2 Episode 1, page clause 1.11

Section Three - Evidence of Application of Knowledge

In this section you are required to provide evidence of the application of your engineering knowledge using 3-4 engineering projects or activities (Work/Study Episodes) that you have been involved with.

Provide a general overview of the scope or parameters of each project or activity, your role in it and the particular challenges or complexities involved. Then describe, in narrative form, how it provides evidence of the application of different aspects of your engineering knowledge. Cross reference to the relevant elements of the knowledge profile in the right hand column.

You are also required to complete the Knowledge Matrix to summarise the contribution to knowledge demonstration made by each project. The work/study episodes are expected to provide at least 2 examples of the application of each knowledge element.

Study Episode 1	Element
Overview of the project Project Title: Quality Analysis of Landfill leachate treatment & its treatment by Distillation Dates of Project: August 2005 to May 2006 (10 Months) Name of Organization: P.G Environmental Engineering Department, PEC University of Technology, Chandigarh (Formally Punjab Engineering College, Chandigarh) Location: University My Role: Student of Master of Environmental Engineering Background 1.1 As we are progressing thousands of people from villages are migrating to cities. As a result of this population of cities is increasing day by day. A huge amount of solid waste is generated by the daily activities of people. Landfilling is the commonly used process which deals with the disposal of solid wastes on or in the upper layer of earth's mantle .Within a landfill, a complex sequence of physical, chemical, and biological reactions occurs. As a consequence of these processes, refuse is degraded or transformed. Water percolates through the landfill and contaminants are leached from the solid waste. This leads to the formation of thick black colored liquid called Leachate. Leachate is having high Chemical Oxygen Demand (COD), Chloride and Sulphate content. If Leachate is not treated properly then it can cause pollution of groundwater, health problems and can adversely affect the environment.	One Seven
Distillation of the landfill Leachate is the less travelled path. Most of the people reject the idea of distillation of landfill Leachate as it requires large amount of energy for distillation. I have opinion that energy requirement for the Distillation of landfill Leachate can be met with the gas which is generated by the decomposition of the solid waste at the Landfill. Solar energy option can also be used for the above said purpose. But this aspect was beyond the scope study of my Master's thesis. In my study I only concentrated about the technical aspects of the treatment of landfill leachate using distillation process. I collected landfill Leachate from the DadduMajra site which is located in Chandigarh. Chandigarh is a beautiful town of Northern India with a population of nearly 1.5 million. Chandigarh is among the top cities in India based on quality of life index. Solid waste of the town is sent to the DadduMajra site. Leachate collected was analyzed by me in Environment laboratory of my department. I also collected groundwater sample from a Hand pump near to the site to analyze the impact of landfilling on the Ground water Quality. Objective of the Project 1.2 I completed my project under the guidance of Assistant Professor Shakti Kumar. Leachate was tested for various parameters like concentration of Chlorides, Sulphates, Chemical oxygen Demand (COD) and pH using methods given in "Standard Methods for Examination of water and waste water" published by "American Public health Association". One stage distillation was done on Landfill Leachate sample to study the changes in Leachate quality parameters. For examining two stages distillation process, the distillate from the stage one was used as feed to the second stage. With this I have compared the changes that have occurred in Quality parameters of Landfill	

Leachate before and after the treatment of one sage and two stage distillation of landfill leachate. The effect of landfill Leachate on the Ground water Quality was also studied.	One

Roles & Responsibilities

1.3

- Taking permissions from the government department for collecting samples of leachate from DadduMajra Landfill site and Hand pump water from near the landfill site
- Literature survey from the research papers to plan the work to be done for the Master's thesis
- Preparation of the methodology of the experimental work
- Arrangement of experimental setup in the Environmental Engineering Laboratory
- Carrying our experimental runs
- Analyzing the data collected from the experimental runs
- Preparation of the results and discussion chapter based on experimental analysis

Since I was the only project patron so I managed all the project management by myself.

Complexities (using the complexity definitions) and challenges of the project

1.4

Finalization of the Topic for the thesis was important Part. I decided that the topic of my master's research which must have relevance and the major hurdle was to finalize the parameters which we can be analyzed in detail. As India is developing fast so I decided that my research topic should be on the water pollution resulting from the rapid urbanization. It was evident from the following data as solid waste was increasing tremendously in India. India will have around 300 Million Tones/year of solid waste very soon. So I decided I will work on the impact of landfill leachate which is generated in the unlined landfills. This is one of the major concerns in the developing countries where the health budgets are very limited. So I decided to analyze parameters like Chemical oxygen demand (COD), pH value, Sulphates, Chlorides in order to check the quality of Landfill leachate.

I analyzed Chemical oxygen demand (COD), pH value, Sulphates, Chlorides of the landfill leachate before and after distillation process. These are very important parameters and have significant impact on human health. Distillation was carried out in two stages. Initially raw leachate was tested. Two Stage Distillation of landfill leachate was carried out. Distillate from stage one was used as input to the second stage Distillation. I examined the removal of COD, Chlorides, and Sulphate in first & second stage distillation of Landfill Leachate.

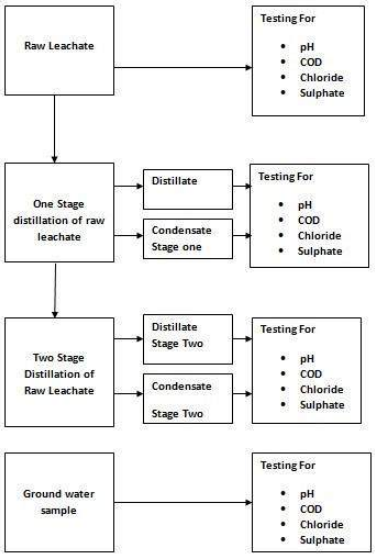
One

1.5

Methodology of Work

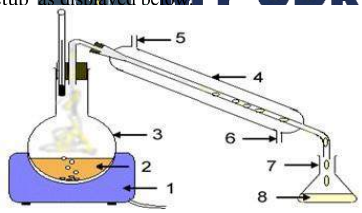
I defined the Methodology of the Work as displayed below

	One



Experimental Setup

Setting up the experimental processing system was a colossal challenge. I implemented my knowledge and made the experimental setup as displayed below.



1.6

In above setup 1. Heating Mental 2 Landfill Leachate 3.Round Bottom flask 4.Condenser 5.Waterout 6.Water in7. Condensate Collector 8.Condensate

How does this project demonstrate application of your engineering knowledge?

One

1.7

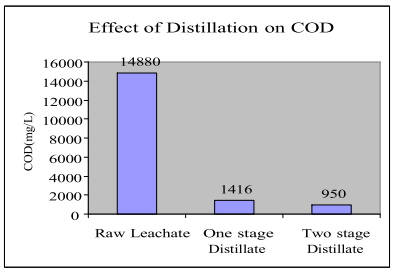
Two

Chemical Analysis

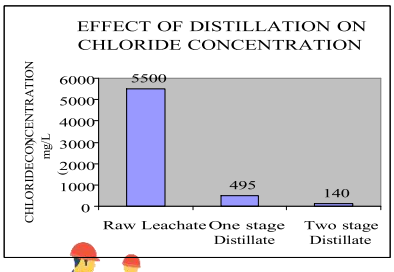
I analyzed Chemical oxygen demand (COD), pH value, Sulphates, Chlorides of the landfill leachate before and after distillation process. Below are the details of the Effect of distillation on Chemical Oxygen Demand of Landfill Leachate

Distillation resulted in the decrease in the Chemical Oxygen Demand. The value of COD decreased from 14880mg/L to 1416mg/L in one stage distillation and it is further decreased to 950 in two stage distillation of landfill leachate

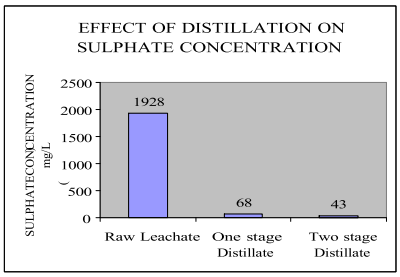
	One Three



Distillation resulted in the decrease in the value of Chloride Concentration. The value of Sulphate concentration decreased from 5500 mg/L to 495mg/L in first stage distillation and it is further decreased to 140 in second stage distillation of landfill leachate.

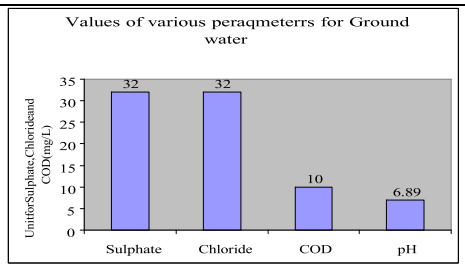


Distillation resulted in the decrease in the value of Sulphate Concentration. The value of Sulphate concentration decreased from 1928 mg/L to 68 mg/L in first stage distillation and it is further decreased to 43 mg/L in second stage distillation of landfill leachate.



Results obtained for Ground water

Groundwater was analyzed for Sulphate, Chloride, COD and pH. The results obtained indicated that groundwater has started being contaminated because of Landfill Leachate. As we can see that the COD of the Ground water is 10mg/L so it simply indicates that leachate has started percolating through soil and has started increasing the pollution in ground water.



1.8

Software Used

Two

Since my project was totally experimental grounded so I used Microsoft Word & Microsoft Power Point in order to prepare the graphs for explaining the trends of the experimental analysis.

1.9

Equipment used

One

I used distillation apparatus to carry out the project & implied Spectro-Photometer for various parameter analyses.

1.10

Resources Usage

I used the library of by PEC university of Technology for the literature survey for my research topic. Internet based literature survey was carried out in the Computer center of PEC University of Technology. My guide for the project Assistant Professor Shashi Kumar always advised me about the direction to be taken in the research work.

The laboratory assistants Mr. Ashok Sharma and Mr. Balak Ram, Staff of Environmental lab of our institute also helped me to arrange the experimental setup.

I also took some research papers for my analysis from Dr. B.J. Alappat of IIT, Delhi. Dr. BJ Alappat has done a lot of work in the field of waste water treatment and solid waste management.

1.11

Implementation of special technique

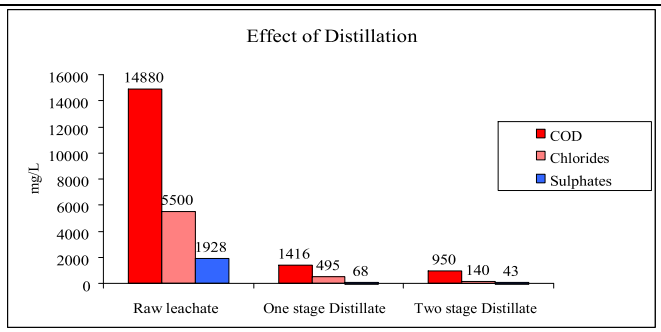
Three

One stage distillation was done on Landfill Leachate sample to study the changes in Leachate quality parameters. For examining two stage Distillation process, the distillate from the stage one was used as feed to the second stage. With this I have compared the changes that have occurred in Quality parameters of Landfill Leachate before and after the Treatment of one sage and two stage distillation of landfill leachate. The effect of landfill Leachate on the Ground water Quality is also studied.

1.12

My Creative innovation

The findings of the project were interesting and indicated that distillation has been effective in reducing the problem of landfill leachate pollution to larger extent. There is significant decrease in quality parameters of landfill leachate. Graph below shows the effect of distillation on landfill leachate. Almost 90% of the landfill leachate was converted to distillate at each stage (i.e. in Single and Double Stage Distillation Experiments).The remaining condensate can be recirculated in to the landfill.



Landfill gas can be used in the process for the distillation of landfill leachate. As a scope for the further research I believe use of gas collected from Landfill which is primarily methane can be used for leachate treatment. In this way further research and development can lead to a situation where distillation route can be viable options reduce ground water pollution near the landfill sites.

1.13

Engineering Standards Followed

I followed standard methods for the examination of water and wastewater derived from American Public Health Association, American Water Works Association, and Water Environment Federation.

1.14

Safety

I used protective goggles and white Lab Coat during my experimental analysis. MSDS of all the chemicals were reviewed in detail before the laboratory analysis

1.15

Presentation & Report Writing

I prepared a presentation and as a part of my thesis defense I presented it to the department fellow students and the external evaluator as a requirement for partial fulfilment of the requirements for the award of degree of Master of ENVIRONMENTAL ENGINEERING degree.

I prepared the report on "QUALITY ANALYSIS OF LANDFILEACHATE AND ITS TREATMENT BY DISTILLATION" and submitted it to PEC University of Technology Chandigarh as an authentic piece of work done by me from August, 2005 – May, 2006.

1.16

Application of Engineering Knowledge

As we are progressing thousands of people from villages are migrating to cities. As a result of this population of cities is increasing day by day. A huge amount of solid waste is generated by the daily activities of people. For the Disposal of solid wastes landfilling of these wastes is the most economical way. Landfilling is the process which deals with the disposal of solid wastes on or in the upper layer of earth's mantle .Within a landfill, a complex sequence of physical, chemical, and biological reactions occurs. As a consequence of these processes, refuse is degraded or transformed. Water percolates through the landfill and contaminants are leached from the solid waste. This leads to the formation of thick black colored liquid called Leachate. Leachate is having high Chemical Oxygen Demand (COD), Chloride and Sulphate content. If Leachate is not treated properly then it can cause pollution of groundwater, health problems and can affect the environment. So I applied my knowledge to come to a

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Five

conclusion that distillation can be a route to handle the ground water pollution.

1.17

Knowledge gained & my personal contribution

As a research student, I was involved in the detailed planning for the thesis work, doing experimental runs and presenting a report which can be helpful in the reduction of ground water pollution.
Learnings from the project are as below

- Planning the experimental analysis work
- Analysis of the experimental data and finding the trends in the experimental data
- I gained confidence that based on my study and with further research, distillation can be sued as a route for handling waste water pollution.
- I gained Master of Engineering (Environmental engineering degree based on my research Work.

Work Episode 2

Element

Overview of the project

Project Title: Technical proposal for making 900 MLD (Million Litre/Day) Water Treatment Plant Dates of Project: April 2007 to December 2007 (Nine Months)
Name of Organization: Suez India (Pvt) Ltd Location: Gurgaon,

My Role: I worked as Engineer for Technical Proposal Manager & my duty included making Technical Proposal & doing calculations along with the design work.

Background

Mumbai, India

2.1

Mumbai is the largest city in India and often called as economic capital of India. Mumbai and surrounding suburbs are home to around 20 million Indians. Population of this city is increasing as more and more people are migrating from smaller town to big cities in India for job opportunities. This has increased the demand of drinking water.

Objective of the Project

2.2

In the year 2007, Municipal Corporation of Mumbai invited bids from water treatment expert companies to construct the 900 Million Liters per day water treatment plant at Bhandup. Suez India made a successful bid and after the technical and commercial negotiations won the project. I and my team played an important role in this project. I worked with my technical manager Mr. Yogesh. D Chaware.

Roles & Responsibilities

2.3

- Preparing the process calculations and checking the calculations for the process design prepared by the Technical Manager — Two
- Development of the P&ID and GA drawings. For the drafting purpose one draftsman was allocated to me. — Two
- Preparing technical specifications for the techno commercial proposals from specialized sub vendors like centrifuge and process equipment suppliers. I was part of the Suez Technical — Three

Expert's team.

- Reviewing the technical proposal submitted by specialized sub-vendors and communicating with their technical staff for the technical correction work.
- Preparing the technical data sheets which are to be submitted with the technical proposal.
- Preparation and correction of the design report to be submitted to the project owner's consultant for review.
- Preparation of the support technical documents to be submitted to owner's engineer for review.
- Preparation of all the documents to handover from Technical proposal side to the Project execution team after we had a successful award of contract.
- I have selected the equipment for the plant which was entirely environmental friendly with Minimum carbon emission in any form.

Two

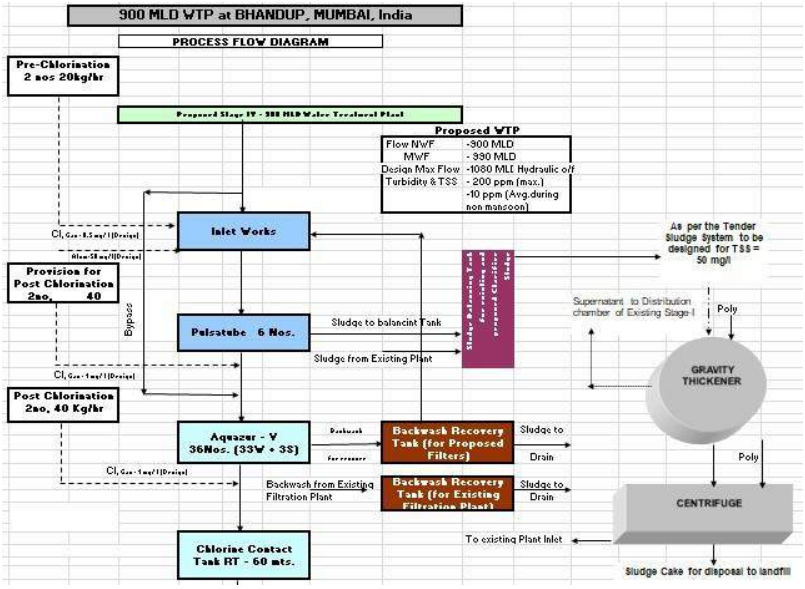
Complexities (using the complexity definitions) and challenges of the project

2.4

Seven

Methodology of Work

Proposals department at Suez India had around 5 months' time to submit the Proposal. My General Manager and I were assigned the task to prepare the technical proposal for this project. This involved the huge task of selecting the right process technology, carrying out ideal design, taking our technical and commercial quotations form the suppliers of the specialized process equipment and preparing the proposal that is technically acceptable to client and commercially profitable for Suez India. I decided to use the Suez's proven technology of Pulsatube clarifies (Up flow Sludge Blanket type clarifiers) along with Aquazur V filters (Sand filters). Please find below the flow diagram of the process selected.



Four

Four

2.5

Preliminary Calculations

It was very important that the technical proposals submitted by the vendors of specialized equipment for water treatment items have to be checked thoroughly for the correctness and the specifications must be similar as requested by the Project owner's consultant. Due to the time constraint I have to cross check all the calculated size and get the revised technical specifications and price. I prepared the preliminary calculation for all major process units and corrected vendor technical proposals. For example

Three

Calculation details for clarifier sludge thickener mechanism required are mentioned as below

Five

Duty=	For thickening the clarifier sludge	
Total Design Flow=	42775	m3/day
Total Solid Loading (for 50 mg/l as Requested by owner)=	171100	kg/day
Solid Loading Rate=	60.00	Kg/m2.day
Surface Area Required=	2852	m2
No of Thickeners provided=	4.0	
		m2
		m
	4	m
Hydraulic Loading=	0.62	m3/hr.m2
Solid Capture=	95	%
Total Underflow Sludge=	162545	kg/day
	40000.0	mg/l
	4064	m3/day
Surface Area for Each=	712.9	
Dia of each thickener provided=	30.1	
SWD Provided=		

TSS=

Volume of the underflow sludge=

Six

I took the reference from our standard literature as mentioned below in the calculation work

- "Water Works Engineering: Planning, Design, and Operation" by Syed R. Qasim, Edward M. Motley, Guang Zhu published by "Prentice Hall PTR"
- Govt. of India's "Manual on Water supply and Treatment", Third Edition May 1999, prepared by "Central Public Health and Environmental Engineering organization"

How does this project demonstrate application of your engineering knowledge?

Seven

2.6

Engineering Design Calculation

Design calculations for Chlorination design	Five

Three

Chlorine dosing at Inlet Bay

Service Fluid =	Chlorine	
Location =	Chlorination building	
Mode of dosing =	Ejector	
Maximum dosing rate =	0.5	g/m^3
No. of hours of operation per day =	24	hrs.
No. of chlorinators =	6	(2 for Raw Water Inlet Bay@20Kg/hr+ 2 at inlet of Filters @ 40 Kg/hr + 2 at inlet of CCT @ 40 Kg/hr = 6nos)

SIZING

Filtered water flow rate =	41250	m^3/hr
Chlorine consumption per hour =	20.63	kg/hr.
Chlorine consumption per day =	495	kg/day
Required capacity of chlorinator =	20.63	kg/hr.
Required capacity of chlorinator =	20.6	kg/hr.
Selected capacity of chlorinstor =	20.0	kg/hr.
Type of chlorinstor =	vacuum	

Design of the centrifuge system for sludge thickening

2.7

Software Used

Five

I worked on Microsoft Office for making Water balance Diagram & for Process calculations.

2.8

Engineering codes & standards followed

I followed all the international & local engineering codes & standards and completed the project accordingly.

2.9

Safety

While deciding the chemical dosing systems for the water treatment plant design I reviewed in detail the Material safety datasheets (MSDS) of all the chemicals. In the design of equipment safety margins are always taken care off. I along with my team strictly followed the Weatherford's established procedures & policies in regards to the occupational & environmental safety.

	Six Seven

2.10

Project Management

Preparation of technical data sheets was very important. Usually with the technical proposal we have to submit the technical data sheets which owners engineer has to review. Owner engineer has the duty that our selected process, process equipment and the specifications of equipment are strictly as per the technical requirements of the owner.

As during the technical evaluation owner engineer can reject any bid if any of the data filled is not strictly according to the owner's requirement. So I prepared the technical datasheets by comparing the ITB requirements, our basic design and technical details submitted by the owner. My work was accepted by the owner's engineer and I got our technical proposal approved from owner side. I got very few technical quarries which we eventually resolved. This way I used my engineering knowledge and delivered the quality technical proposal on time.

After we won the project I have to handover and explain all the technical aspects of the project to the detail design and execution team. I prepared all the reports and design details. I and my technical manager had several meetings with the

I worked with my technical manager. He always guided and advised us the direction to be taken based on his long experience of 20 years in the field of water and waste water treatment. I used to meet him daily at 9 am to brief him about last days work and next day's expected task.

detail design department and successfully handed over the project.

2.11

Technical Specs preparation

I prepared key technical specifications for the major equipment as listed below.

- Raw water pumps
- Chemical dosing pumps Gas chlorinators
- De-watering centrifuges
- Sludge thickeners

2.12

Team leading & Report Writing

I worked as engineer for this project so the engineering drafts man reported to me for drafting GA and PID's.

I know the timely closing of technical tasks was very important so I dealt with our sub vendors in a very polite and dignified way to get the appropriate equipment for our project.

I prepared the design report and submitted to the project owner. I was involved in preparation and correction of the design report to be submitted to the project owner's consultant for review 2.13	Two

Knowledge gained & my personal contribution As an engineer of the project I was deeply involved in basic design, basic design calculation, equipment section and successfully wining the project. After this project Suez promoted me and made me senior engineer and gave me 20% increment in my salary. Learnings from the project are as below • Developed expertise to handle the design calculations of big capacity project • I gained confidence that based on my study I can work successively on live project.	

Work Episode 3	Element
Overview of the project Project Title: 40 m3/hr. Potable water Treatment Plant for 2800 MW Gas based Rabigh Power Plant Dates of Project: June 2011 to December 2012 Name of Organization: Doosan Heavy Industries & Construction Co. Ltd(DHI), EPC Business group (Water Treatment Section) Location: Saudi Arabia My Role: Environmental Engineering Background 3.1 In the year 2011 DHI won 4 billion USD Project for the construction of 2800 MW gas based power plant. This was one of the biggest projects constructed by DHI. Before the start of the , Power production it was important that we have an up to date new potable water treatment plant in order to fulfil the requirements of the drinking water for the staff and the colony people working in the power plant. I calculated that 40 m3/hr Potable water treatment plants will be required for the potable water requirement of the power plant staff and the colony. I handed complete potable water project from basic design till the handover to the owner.	Three
Objective of the Project 3.2 The 40 m3/hr Potable water Treatment plant was designed by me designed to treat distilled water, continuously adding specific chemical solutions by means of dedicated dosing systems, in order to make the water potable according to WHO recommendations. Characteristics of inlet distilled water are in the following table.	Four

Characteristics of inlet Distilled Water

Parameter	Unit	value
Flow rate	mc/h	40
TDS	mg/l	5
pH		6.2

Guarantee of produced Potable Water

Parameter	Unit	value
Residual chlorine	ppm	0.2 – 0.5
TDS	mg/l	lower than 450
pH		7.4 – 8.4

The potabilization plant shall comprise dedicated dosing systems for following chemical solutions:

1. NaHCO3 to increase alkalinity of water to around 40 ppm as CaCO3;

2. CaCl2 to increase hardness of water to around 40 ppm as CaCO3;
3. Ca(OCl)2 to disinfect the potable water in order to have a residual chlorine content of 0.2 - 0.5 ppm;
4. NaOH to increase the pH of water to 7.4 - 8.4.

Your role and responsibilities

3.3

I worked as responsible Engineer for the handling the complete potable water treatment system from concept development to the handover of the project. In detail my responsibility included calculating the Potable water demand for the complete power plant, Basic design, Detailed design, selection of vendor for supply of the tanks, Pumps and package vendor selection, handling design activities , finalization of specification of mechanical equipment, process design and submission to the owner for approvals, incorporating Owner's comments. O&M documents preparation. I also have to interact with Electrical, I&C, architectural and Procurement teams for carrying out the associated activates of the Package items.

My roles & responsibilities were as following

- Preparing the Potable water demand calculations
- Preparing the process calculations and dosing rates for various chemicals to make water fit for drinking as per WHO recommendation.
- Preparing initial documents for submittal like PID for potable water treatment plant, Process Flow Diagram, Mass Balance , GA drawing, System description, etc.
- Performing detailed engineering and submitting the documents for approval and incorporating the comments by client and revising submittals for approval.
- Planning and carrying out meetings for the interface check with Architecture, Piping, Plumbing, utility departments for smooth interface at the terminal points.
- Preparation of drawings for client submittal after the completion of the project
- Handling selection and handling of sub vendor who supplied tanks, pumps and agitators and control Panel.
- Preparation of the operation and maintenance manual for the Potable water treatment system for the operator of the plant before the handover of the plant.

Complexities (using the complexity definitions) and challenges of the project

3.4

During the execution of project one of the major hurdles which I encountered was the use of chemicals for disinfection. I designed the Potabilization Plant using sodium Hypo chlorite (NaClO) as a disinfectant chemical to be added to water. Even as per world health organization WHO sodium Hypo chlorite NaClO is acceptable chemical. Our client for the project was from Saudi Arabia and they rejected the plan to use sodium Hypo chlorite (NaClO) as disinfecting chemical. My project was at very advanced stage and I was almost ready to place the order for the dosing pumps for the sodium Hypo chlorite (NaClO). I was in a tense situation to replace sodium Hypo chlorite. I did the literature

	Four Five

survey and decided to use calcium hypo chlorite Ca(OCl)2as the disinfecting chemical. Calcium hypo chlorite Ca(OCl)2 is much stable chemical for potable water disinfection. But this change resulted in loss of almost 15 man days as I needed to revise calculation, General arrangement, PID etc. Also I have to notify our supplier for pumps and tanks to revise the chemical to be handed by the Chemical dosing pumps. To manage the time loss I spend almost 2 hours extra for a month every day. Luckily I was able to revise all the documents in time and got the preliminary approval from the client.

3.5

As a requirement of the project it was mandatory to install the safety shower in the potable water treatment system room. As this area had a lot of exposure to chemicals so for the safety of the plant operator, safety shower was important to be installed. Unfortunately the eye washer cum safety shower selected was not having the inbuilt pressure regulator. The main line of the potable water utility line had pressure in the range of 5 bars. This much high pressure is very harmful for human eye. So instead of replacing the entire safety shower I recommended to install the inline pressure reduction wall. This way we were able to reduce the pressure in the line around 1 bar to save the operator.

How does this project demonstrate application of your engineering knowledge?

3.6

Engineering Calculations

The basic Calculation for of Ca(OCl)2 in the plant which is treating 40 m3/h (by design data) is as shown below

10 ppm * 40 m3/h = 10 g/m3 * 40 m3/h = 400 g/h = 0.400 kg/h (Ca(OCl)2 100%)

Being Ca(OCl)2 available for dosing in the dedicated tank as solution 20% by weight, there shall be the following consumption of Ca(OCl)2 solution injected in the distilled water:

0.400 kg/h / 20 * 100 = 2.000 kg/h (Ca(OCl)2 20%)

Density of Ca(OCl)2 solution 20% by weight is equal to 1.09 kg/dm3 so that the corresponding flow rate to above consumption of Ca(OCl)2 solution shall be the following:

2.000 kg/h / 1.09 kg/l = 1.83 l/h (Ca(OCl)2 20%)

Required Ca(OCl)2 dosing pump flow rate is the following:

1.83 l/h + 50% = 2.7 l/h (Ca(OCl)2 20%)

Ca(OCl)2 dosed volume in 24 hours operation under above dosing conditions (10 ppm Ca(OCl)2 100%) shall be the required Ca(OCl)2 dosing tank volume:

1.83 lt/h * 24 h = 43.9 l (Ca(OCl)2 20%)

The selected Ca(OCl)2 dosing tank volume is 500 l (Ca(OCl)2 20%).

3.7

Cost Reducing Activity

Proper mixing of the dosing chemicals in the distilled water line is very important. The dosing chemical is well dispersed in distilled water before it is sent to the potable water storage Tank. To save the cost I decided to use single line mixer to mix NaOH and Ca(OCl)2. As the four chemicals Namely

Five

Six

	Six

NaOH and Ca (OCl) 2, NaHCO3, CaCl2 are being dosed into the distilled water line .so I saved the cost by using only two line mixers instead of four.

3.8

My Creative innovation

In this project I designed the potabilization system which had following skids.

- NaHCO3 dosing system which had two.NaHCO3 Dosing Pumps to perform chemical solution injection into distilled water header, 2 no. (2x100%) NaHCO3 Dosing Tanks each one equipped with 1 no.NaHCO3 Dosing Tank Agitator, , to ensure optimal dissolution of solid chemical and optimal homogeneity of chemical solution inside dosing tank;
- CaCl2 Dosing system which had two CaCl2 Dosing Pumps, to perform chemical solution injection into distilled water header, 2 no. (2x100%) CaCl2 Dosing Tanks each one equipped with 1 no. CaCl2Dosing Tank Agitator, , to ensure optimal dissolution of solid chemical and optimal homogeneity of chemical solution inside dosing tank;
- NaOH Dosing system which had two NaOH Dosing Pumps, to perform chemical solution injection into distilled water header, 2 no. (2x100%) NaOH Dosing Tanks. Agitator was not required as NaOH readily mixes in water.
- Ca(OCl)2 Dosing system which had two Ca(OCl)2 Dosing Pumps, to perform chemical solution injection into distilled water header, 2 no. (2x100%) Ca(OCl)2 Dosing Tanks each one equipped with 1 no. Ca(OCl)2 Dosing Tank Agitator, , to ensure optimal dissolution of solid chemical and optimal homogeneity of chemical solution inside dosing tank;

Six

3.9

Six

Software Used

I used Microsoft Office for making Water Balance Diagram & doing process calculation. I used AutoCAD 2011 for making drawings.

3.10

Technical Specs preparation

I prepared key technical specifications for major equipment such as

- Chemical dosing pumps
- Chemical dosing tanks
- Agitators
- Line Mixers

3.11

Engineering Standards Followed

I followed all the international & local engineering codes & standards and completed the project	Six Seven Seven

accordingly. I was assigned the QA/QC role during installation of the line mixers & agitators. I made sure that every step is taken according to the vendor recommendations and are up to international standards.

3.12

Safety

While deciding the chemical dosing systems for the water treatment plant design I reviewed in detail the Material safety datasheets (MSDS) of all the chemicals. In the design of various equipment safety margins were always taken care off.

3.13

Project Management

I worked with my In charge of water treatment at DHI for all projects. He always guided and advised us the direction to be taken based on his long experience of 25 years in the field of water and waste water treatment. I worked as engineer for this project so the engineering drafts man reported to me for drafting GA and PID's etc.

I prepared the all design reports, PIDs and datasheets submitted to the project owner.

I know the timely closing of technical tasks was very important so I had dealt with our sub vendors in a very polite and dignified way to get the appropriate equipment for our project.

3.14

Knowledge gained & my personal contribution

I worked as responsible Engineer for the handling the complete potable water treatment system from Concept development to the handover of the project. In detail my responsibility included calculating the Potable water demand for the complete power plant, Basic design, Detailed design, selection of vendor for supply of the tanks, Pumps and package vendor selection, handling design activities , finalization of specification of mechanical equipment's, process design and submission to the owner for approvals, incorporating Owner's comments. O&M documents preparation. I also have to interact with Electrical, I&C, architectural and Procurement teams for carrying out the associated activates of the Package items.

Learnings from the project are as below

- Developed expertise in handling the design and engineering of water treatment project of big capacity.
- I gained confidence that based on my study I can work successively on live project.

Work Episode 4	Element

Overview of the project

Project Title: Technical proposal making & basic design for Pretreatment, Demineralization & waste water treatment Plants for 2X660 MW ‘’Jawaharpur Super thermal Power Pant’’
Dates of Project: October 2015 to October 2017 (24 months)
Name of Organization: Doosan heavy Industries & Construction Co. Ltd, EPC Business Group. (Water Treatment Section)
Location: Seoul, South Korea
My Role: Environmental Engineer

Background

4.1

In the year 2015 Uttar Pradesh Rajya Vidyut Utpadan Nugam Limited floated the tender for the construction of 2x660 MW “Jawaharpur Super thermal Power Plant”, Uttar Pradesh, India. Doosan decided to make the Bid for this project. I was tasked to prepare the technical proposal and basic design was assigned to water treatment section. I was selected by my Team Head as responsible engineer to prepare the technical proposal and to carry out the basic design (in case Doosan wins the Project). In the year 2016 Doosan won the multimillion dollar project. I carried out work related to Technical proposal making and thereafter and basic design for 4500 m3/hr Pretreatment Plant (PT) Plant, 80m3/hr. Demineralization Plant (DM), and 250 m3/hr waste water treatment Plant.

Objective of the Project

4.2

The project was divided into three phases as written below:

- Technical proposal making & basic design for the 4500 m3/hr Pre-treatment Plant (PT Plant)
- Technical proposal making & basic design for the 80 m3/hr Demineralization Plant (DM)
- Technical proposal making & basic design for the 250 m3/hr Waste Water Treatment Plant (WWTP)

Your role and responsibilities

4.3

I worked as responsible Engineer for the Technical proposal making and Basic design for Pretreatment (PT), Demineralization Plant (DM) and waste water treatment Plants (WWTP) for 2x660 MW “Jawaharpur Super thermal Power Plant”, Uttar Pradesh, India. Responsibilities included calculating Pre-treatment water, Demineralized water, waste water requirements including Basic design, Detailed design review, selection of vendor for supply of package items, finalization of specification of process equipment, process design and submission of preliminary documents to owner. I also interacted with Electrical, I&C, architectural and Procurement teams for carrying out the associated activates of the Package items.

Detailed engineering was done by Doosan’s Indian subsidy (Doosan Power system India). As a responsible engineer of Head office for water Treatment section, I also have the responsibility of the detailed design review to check for any technical issues and to avoid any cost impact to the company. I have the responsibility to report to head of engineering that this project will be completed on time without any delay.

Commented [DJ 9]: Is being done
(Its grammatically correct, I have checked the same)

- Preparing the water balance of biding stage to calculate water demand for Pretreatment Plant

(PT Plant), Demineralization Plant (DM), Waste water Treatment Plant (WWTP) • Preparing the Key design data for Pretreatment Plant (PT Plant), Demineralization Plant (DM), Waste water Treatment Plant (WWTP) to float the material Purchase specifications for key process equipment • Preparing the preliminary process calculations for various units. • Reviewing the technical proposal submitted by specialized sub vendors and coordinating with water treatment engineer in the Indian branch office of Doosan. • Doing the Basic engineering and submitting the documents to client for approval • After the award of the contract; I carried out detailed technical review of the initial documents for client submittal like PID, Process Flow Diagram, Mass Balance, GA drawing, System description, etc. for Pretreatment Plant (PT Plant), Demineralization Plant (DM), Waste water Treatment Plant (WWTP) • Supporting the engineer in Doosan Power system India in arranging the technical meetings with the vendors and providing all the technical support from head office • Planning and carrying out meetings for the interface check with Architecture, Piping, Plumbing, Utility departments for smooth interface at the terminal points. • Keeping the project deadline and reporting to the head of water treatment section on weekly basis about the status of technical document submittals for Pretreatment Plant (PT Plant), Demineralization Plant (DM), Waste water Treatment Plant (WWTP).	One Five

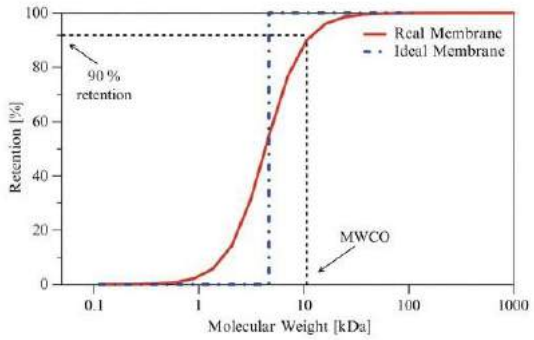
Complexities (using the complexity definitions) and challenges of the project

4.4

One part of the waste water treatment Plant is the design of the reuse system. In the reuse system I have to treat the waste water using UF and RO membranes. So the selection of UF membranes was critical important factor.

Molecular weight Cut off (MWCO) is one of the most important factors for the selection of UF membranes. MWCOis defined as the lowest molecular weight (in Daltons) at which greater than 90% of a solute with a known molecular weight is retained by the membrane

UF membranes come in various Dalton ranges but as per the study conducted by “Cheryan, M” UF membranes at 100,000 Daltons are giving satisfactory performance.



Literature Reference

- Cheryan M (1998) Ultrafiltration and microfiltration handbook, 2nd edition. CRC Press LLC, Boca Raton, USA. ISBN: 1-56676-598-6
- Page 978, Chapter 12- Membrane Filtration, Water Treatment Principals and Design, Second edition /MWH, Jhon Wiley & Sons USA. ISBN: 0-471-11018-3

Three

to much better retention.

Design of Solution

So based on the Literature reference I advised to use UF membranes with 100,000 Daltons. This lead

4.5

In the design of the Pre-treatment system raw water quality played an important role in design. Client provided with only one set of water analysis. Raw water for this project was taken from Ganges River. North India has high rain for at least 4 months from July to October. So I discussed with the head of water treatment section and recommend that we should carry out raw water analysis for entire one year spectrum to have sufficient knowledge of raw water quality in the design. I prepared the specifications and the parameters to be tested for 1 full year. Doosan's India office was handling the on the ground sample collection and analysis work.

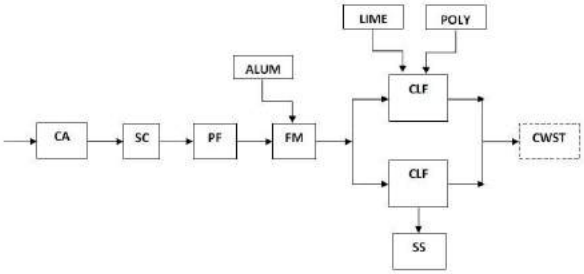
Six

4.6

Design Flow Charts

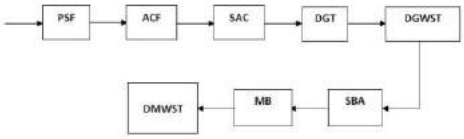
- I drafted the flow chart of the 4500 m3/hr Pre-treatment Plant

	Five



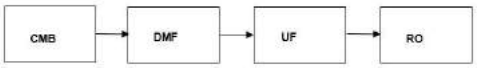
CA	: CASCADE AERATOR
SC	: STILLING CHAMBER
PF	: PARSHALL FLUME
CLF	: CLARIFLOCCULATOR
CWST	: CLARIFIED WATER STORAGE TANK
SS	: SLUDGE SUMP

- I drafted the flow chart of the 80 m3/hr Demineralization Plant



PSF	: PRESSURE SAND FILTER
ACF	: ACTIVATED CARBON FILTER
SAC	: STRONG ACID CATION EXCHANGER
DGT	: DEGASSER TOWER
DGWST	: DEGASSED WATER STORAGE TANK
SBA	: STRONG BASE ANION EXCHANGER
MB	: MIXED BED EXCHANGER

- I drafted the flow chart of the 250 m3/hr Waste Water Treatment Plant



CMB:	COMMON MONITORING BASIN
DMF:	DUAL MEDIA FILTERS
UF:	ULTRA FILTERATION SYSTEM
RO:	REVERSE OSMOSIS

How does this project demonstrate application of your engineering knowledge?

4.7

Designed Units

Major units designed for 4500 m3/hr Pretreatment plant are as mentioned below -1 no. Cascade Aerator -1 no. Stilling Chamber -1 no. Flow measuring Element -1 no Flash Mixer -2 no clarifiers -Dosing system for Coagulant, Lime and Coagulant Aid -sludge handling system 1 no. Sludge sump with 2 no. sludge transfer pumps Major units designed for 80 m3/hr DM Plant are mentioned as below -3 no. Pressure sand filters -2 no Activated Carbon Filters -2 strong Base Cations -1 Degasser Unit -2 Strong Base Anion Exchanger -2 Mixed Bed Exchanger -1 no. DM water storage Tank Major units designed for 250 m3/hr waste water treatment Plant are -3 No. Dual media Filters - 3 no UF Skids -3 no RO Skids 4.8 <u>Engineering Calculations</u> In the design of clarifiers overflow rate (Critical settling Velocity) is one of the preliminary factor. This equation is used in clarifier design (OR)*= overflow rate, m3/m2.h A= Area of the settling Zone.m2 Q= Process flow Rate, m3/h So empirical relationship is as mentioned below OR=Q/A * Page 791, “Chapter 10- Gravity Separation”, Water Treatment Principals and Design, Second edition /MWH, Jhon Wiley & Sons USA. ISBN: 0-471-11018-3 4.9 <u>Software Used</u> I used Microsoft Office for making Water Balance Diagram, design reports, process calculation. I used AutoCAD for maing drawings. 4.10 <u>Resources Usage</u> I referred to following books for project consultation. • “Chemistry for environmental engineering and Science” by “Clair N,Sawyer”& “Perry L.McCarthy”, “Tata McGraw-Hil Publishing company limited. New Delhi” • “The Nalco Water Handbook”, Third Edition, by “Daniel J.Flynn” “McGraw-Hil Publishing	<u>Five</u> <u>Two</u>

company limited"

- Cheryan M (1998) Ultrafiltration and microfiltration handbook, 2nd edition. CRC Press LLC, Boca Raton, USA. ISBN: 1-56676-598-6

- Water Treatment Principals and Design, Second edition /MWH, Jhon Wiley & Sons USA. ISBN: 0-471-11018-3

4.11

My Creative innovation

Waste water treatment system has very high design capacity .The reason of higher capacity of waste water treatment system is that cooling tower blowdown is sent to the waste water treatment system. This leads to increase in the waste water treatment size and downstream units for making waste water fit for reuse using UF and RO. I prepared a clarification to the client with a request that the boiler cooling tower blowdown water was very pure quality of water so this can be directly moved to Ash water sump(open air sump for evaporation) without treatment in Waste water treatment system. This has resulted in significant reduction in the capacity of UF and RO units. Now this project was at detail design stage and client agreed & accepted this proposal.

One

While deciding the chemical dosing systems for the water treatment plants I studied in detail the Material safety datasheets (MSDS) of all the chemicals. In the design of various equipment safety margins were always taken care off.

4.12

Safety

4.13

Report Writing & Project Management

I have reported the progress of project on weekly basis to the head of water treatment section. I worked as engineer for this project so the engineering drafts man reported to me for drafting GA and PID's etc. We prepared Basic design reports, Preliminary PIDs to be submitted to the project owner.

I know the timely closing of technical tasks was very important so I had dealt with our sub vendors/coordinate with Doosan's India office in a very polite and dignified way to get the appropriate equipment for our project.

4.14

Knowledge gained & my personal contribution

I worked as responsible Engineer for the Technical proposal making and Basic design for Pretreatment (PT), Demineralization Plant (DM) and waste water treatment Plants (WWTP) for 2x660 MW "Jawaharpur Super thermal Power Plant", Uttar Pradesh, India. Responsibilities included calculating Pre-treatment water, Demineralized water, waste water requirements including Basic design, Detailed design review, selection of vendor for supply of package items, finalization of specification of process equipment, process design and submission of preliminary documents to

owner. I also interacted with Electrical, I&C, architectural and Procurement teams for carrying out the associated activates of the Package items.	

Detailed engineering is to be done by Doosan's Indian subsidy (Doosan Power system India). As a responsible engineer of Head office for water Treatment section, I also have the responsibility of the detailed design review to check for any technical issues and to avoid any cost impact to the company. Project was successfully completed by DHI. Doosan won this project in the year 2016 and now the detailed design is carried out by the Doosan's India office (Doosan Power systems India) As a part of the head office technical support. We review and advice all the changes etc. which are required in documents and design. Learnings from the project are as below • Developed expertise the handle the design and engineering of Pre-treatment project, waste water treatment project. • I gained confidence that based on my study to work successively on live project.	

Knowledge Matrix

Knowledge Element	W/S Episode 1	W/S Episode 2	W/S Episode 3	W/le Episo
1. Application of knowledge from one or more of the natural sciences	1.1	2.3	3.2	4.2
2. Application of knowledge of mathematics	1.3	2.3	3.2	4.3
3. Application of knowledge of engineering fundamentals	1.5	2.4	3.3	4.3
4.	1.4	2.5	3.4	4.4
5. Application of knowledge of design methods to solve complex problems	1.6	2.6	3.5, 3.8	4.5, 4.7
6. Application of knowledge of key elements of engineering practice	1.7	2.9	3.6	4.6, 4.11
7. Role of Engineering in Society	1.16	2.1	3.1	4.14
8. Application of advanced knowledge in an area of your discipline	1.12	2.3	3.7	4.8

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SECTION FOUR – SUPPLEMENTARY EVDENCE

Academic Transcript(s)

Please attach a certified copy of your academic transcript(s) if you have not already supplied one to IPENZ

WORK HISTORY SUMMARY

List your employment history starting from your most recent employment and then chronologically back to the start of your first job.

Ref No	Name of Employing Organisation	Position Title	End mm/yy Start mm/yy	Key responsibilities, activities undertaken, major achievements and/or projects. These should relate to your practice area description.
1.	Doosan Heavy Industries & Construction (EPC Business Group), Seoul, South Korea	Assistant Manager, Water Treatment section	Present Start at 05/11	pecifications for water waste water treatment ners ITB (Invitation of al requirements for the ELP sessment To prepare the key technical specification for the Basic design of water treatment Plant ,waste water treatment plant, sewage treatment Plant • Preparing the Material purchase specifications for taking the technical and price quotations from the vendors of specialized equipment like chemical dosing pumps, UF and RO membrane. • Taking part in the Cost review meetings before the cost is finalized for the water treatment Plant ,waste water treatment plant, sewage treatment Plant packages • After the award of the contract carrying out detailed design and submitting documents to owner PID, Process Flow Diagram, Mass Balance, GA

				drawing, System description, etc. for Pretreatment Plant (PT Plant), Demineralization Plant (DM), Waste water Treatment Plant (WWTP).

Ref No	Name of Employing Organisation	Position Title	End mm/yy Start mm/yy	Key responsibilities, activities undertaken, major achievements and/or projects. These should relate to your practice area description.

				• Selection of sub vendor for specialized process equipment like chemical dosing pumps, UF and RO membrane which included technical review of the items, Project Kick-off meetings (KOM), Design review meetings with vendors • Submitting the documents to the project owner for review and incorporating the owner technical comments in the design documents • Attending design review meetings with owner Regular Basis. • Planning and carrying out meetings for the interface check with Architecture, Electrical, Piping, Plumbing, Utility departments smooth interface and efficient design at the terminal points. • Keeping the project deadline and reporting to the head of water treatmer section on weekly basis about the status of technical document submitta for Pretreatment Plant (PT Plant), Demineralization Plant (DM), Was water Treatment Plant (WWTP), Sewage Treatment Packages (STP)etc. Preparation of AS Built drawings and documents after the approval and installation of water treatment Packages on project site. • Preparation of the operation and Maintenance O&M) Manuals for the smooth operation of the Pretreatment Plant (PT Pl Demineralization Plant (DM), Waste water Treatment Plant (WWTP), Sewage Treatment Packages (STP) etc. • Preparation of "AS BUILT" drawings and documents after the approval and installation of water treatment Packages on project • Investing at least 4 man hours every week in the library of the office to keep my knowledge updated about the recent trends ir water and waste water treatment industry by reviewing professional publications

Ref No	Name of Employing Organisation	Position Title	End mm/yy Start mm/yy	Key responsibilities, activities undertaken, major achievements and/or projects. These should relate to your practice area desc

				related to water treatment industry. Achievements in this organization • Rated as Best Foreign Engineer working in the Doosan EPC BG for consecutive two years • Played a key role in winning many projects in water treatment section of Doosan Heavy Industries & Const • Trained Fresh recruited engineers of Doosan Heavy Industries & Construction about doing business in India
2.	Dohwa Engineering Company Limited, Seoul, South Korea	Assistant Manager, Water Supply and sewerage design department	End date:05/11 Start date:05/10	 To prepare the feasibility report documents for projects to assist owner when the project is at concep Review of the environmental Impact Assessment (EIA) reports before the finalization of the treatment pro facilities. • To visits the project site to carry out the preliminary site survey for water treatment facilities • To finalize the major treatment process to be adopted in water treatment facility • To carry out raw water analysis before finalization of the process technology for the water treatment facilit • Finalization of the Major process equipment to be installed in the water treatment process • To prepare design reports and presentations to explain the project owner

Ref No	Name of Employing Organisation	Position Title	End mm/yy Start mm/yy	Key responsibilities, activities undertaken, major achievements and/or projects. These should relate to your practice area description.

				about the treatment technology to be adopted for the project • To prepare the technical contracts documents (contract technical Specifications) which are issued by project ow contractors for the constriction of water treatment facilities • To prepare the presentation for Korean engineering staff members about Business English communication and report writing Achievements in this organization • Worked as first Foreign Engineer Dohwa Engineering Co. Ltd., Seoul, South Korea and fulfilled my duties as an Ass • Worked as an integral part of the team and won the pro feasibility study of water supply and sewerage system construc for Navoi Fiez,Uzbekistan. in water supply and sewage department of the company and successfully completed my term.
3.	Doosan Heavy Industries & Construction, (water Business Group) Seoul, South Korea	Engineer, Water Treatment Engineering Team	End date:04/10 Start date:04/09	• To Prepare the vendor data base for sub vendors for the specialized process equipment from India and regularly up • To Prepare the Techno-Commercial proposal for the water reuse projects for which Doosan was submitting the Tech • To arrange and conduct technical meetings with the suppliers of specialized equipment • To carryout technical analysis of various membrane systems for large and medium scale waste water treatment proje • To advice junior engineers regarding the water treatment process design

Ref No	Name of Employing Organisation	Position Title	End mm/yy Start mm/yy	Key responsibilities, activities undertaken, major achievements and/or projects. These should relate to your practice area description.
				related issues. • To prepare the technical references from standard literature of water and waste water treatment systems for communication to owners engineer Achievements in this organization • Successfully submitted the technical Bid for the large scale waste water reuse project (50,000 m3/day waste water reuse Plant at Darsait Oman). Due to some commercial issues owner scrapped the project at a later stage.
4.	Suez Environment , Gurgaon ,India	Senior Proposal Engineer	End date:04/09 Start date:04/07	Preparing the process calculations and checking the calculations for the process design prepared by the Technical Manager Preparing the P&ID and GA drawings. For the drafting purpose one draftsman was allocated to me. Preparing technical specifications for the techno commercial proposals from specialized sub vendors like centrifuge and process equipment suppliers. • Reviewing the technical proposal submitted by specialized sub vendors and communicating with their technical staff for the technical correction work. • Preparing the technical data sheets which are to be submitted with the technical proposal • Preparation and correction of the design report to be submitted to the project owner's consultant for review.

Ref No	Name of Employing Organisation	Position Title	End mm/yy Start mm/yy	Key responsibilities, activities undertaken, major achievements and/or projects. These should relate to your practice area description.
				• Preparation of the support technical documents to be submitted to owner's engineer for review. • Preparation of all the documents to handover from Technical proposal side to the Project execution team after we had a successful award of contract. Achievements in this organization • Suez India promoted me from Engineer to Senior Engineer in small duration of time based on my hard work and commitment to work. • Developed expertise the handle the design calculations of big capacity water treatment Project
5.	UEM India Limited, Subsidiary of UEM Inc, USA, New Delhi, India	Engineer	End date:03/07 Start date:08/06	• To carry out technical coordination with the site engineer to explain him about design details • To carry out detailed engineering and design for water Pre-treatment Project. • Worked in Project Execution department and communicated regularly with the sub vendors of Pumps ,Valves and process equipment for timely delivery of items to the project site • Visited the owners office for the design review meetings on regular basis • To maintain the record of document submittals to owner and revise the documents based on the comments from owner Achievements in this organization
Ref No	Name of Employing Organisation	Position Title	End mm/yy Start mm/yy	Key responsibilities, activities undertaken, major achievements and/or projects. These should relate to your practice area description.

				• Gained confidence to work in the water treatment industry. • Gained first hand experience as a fresh engineer for the design and engineering work.
6.			End date: Start date:	
7.			End date: Start date:	

CONTINUED PROFESSIONAL DEVELOPMENT (CPD) ACTIVITIES SUMMARY

DESCRIPTION OF ACTIVITY AND LEARNING. Please record all relevant CPD activities (eg. short course, conference, reading, technical lectures, formal study towards qualification, research, discussion groups, workshops, symposia, voluntary service roles) that have extended your professional engineering knowledge and have assisted you to develop the knowledge profile of a professional engineer. Describe the learning outcomes and how these have contributed to your acquiring a Washington Accord level of knowledge..	Was Formal Assessment involved? What was the outcome?

Date(s)	Actual Hours	Form of Activity	Title of activity	What was the knowledge you acquired? How have you applied this knowledge in your engineering practice?	
I have to check the date and Add	6	Program	Education Program on Suez's Technologies water and waste water treatment ,by Director Technical, Suez, Gurgaon India	• Basic and design details of Pulsator (sludge Blanket clarifier) • Basic and design details of Aquazur V filters Benefits to my work Developed an understanding of the advanced clarification and filtration technologies used by Suez for various water treatment facilities Developed understanding of standing of Suez technology in the Indian water Market.	
29/Aug/2007	8	Program	Training program on "Ultrafiltration and MBR membrane systems" by "Mr. Satish Chilekar" New Delhi ,India	• Fundamentals of UF membrane ,MBR systems • Membrane Construction features • Membrane Performance • Membrane design parameters • Scaling and Fouling in membrane systems • Membrane cleaning processes Benefits to my work • Developed an in-depth understanding about the design and working of Membrane systems used in the water Treatment Industry. • Had good interactions with other water professionals in the same field from various companies at the training programme and expanded my network	No.

DESCRIPTION OF ACTIVITY AND LEARNING. Please record all relevant CPD activities (eg. short course, conference, reading, technical lectures, formal study towards qualification, research, discussion groups, workshops, symposia, voluntary service roles) that have extended your professional engineering knowledge and have assisted you to develop the knowledge profile of a professional engineer. Describe the learning outcomes and how these have contributed to your acquiring a Washington Accord level of knowledge..	Was Formal Assessment involved? What was the outcome?

Date(s)	Actual Hours	Form of Activity	Title of activity	What was the knowledge you acquired? How have you applied this knowledge in your engineering practice?	
15/Oct/ 2013	8	Program	1 day Team Building Program at Doosan Leadership Institute Seoul, South Korea	• Effective business communication • Methods and parameters to asses performance and development of team spirit • Characteristics of effective team player Benefits to my work Learned the characteristics of good team player Learned to develop the understanding to perform in the better in a team	No.
I have to check the date and Add	4	Training	Basic course on Cardiopulmonary Resuscitation (CPR) Training	• Introduction to the CPR technique • Expected behaviour and right posture in case of conformation with unconscious co-worker situation • Techniques used for successful CPR procedure Benefits to my work • I gained preliminary knowledge and awareness to handle a situation when one has confrontation with the situation in which CPR is required	No
16/March / 2015	8	Training	Environment Health and Safety Training Program	• To develop health and safety attitude during working in common workplace • To aware oneself about the possible health and safety risks at the common workplace • To carry out emergency evacuation in case of emergency	No

DESCRIPTION OF ACTIVITY AND LEARNING. Please record all relevant CPD activities (eg. short course, conference, reading, technical lectures, formal study towards qualification, research, discussion groups, workshops, symposia, voluntary service roles) that have extended your professional engineering knowledge and have assisted you to develop the knowledge profile of a professional engineer. Describe the learning outcomes and how these have contributed to your acquiring a Washington Accord level of knowledge..					Was Formal Assessment involved? What was the outcome?
Date(s)	Actual Hours	Form of Activity	Title of activity	What was the knowledge you acquired? How have you applied this knowledge in your engineering practice?	
				• To understand the financial implications to self and the company in case of ignorance towards Health and safety Benefits to my work • I implemented the skills learnt in the EHS workshop  overall safety I implemented the traits learned in the training program and incorporated these in the design of water facilities like mandatory implementation of safety shower in any facility where chemicals are involved in my work to improve the working conditions and	
20/March/ 2013	8	Program	Review of the plant design and interface check during design using Intergraph Smart Plant 3D , Doosan Heavy Industries and Co. Ltd.'s Office, Seoul, South Korea	• Studied to review various units using Smart Plant 3D • Studied to review interface and clash at various process units using Smart Plant 3D Benefits to my work • I developed better skills to conduct 3 D review meetings to avoid any possible clash with process units with HVAC equipment, firefighting equipment, Piping etc.	No

13/June/ 2013	5	Visit to water exhibition	ENVIX2013 International Exhibition on Environmental Technology and	Interacted with various suppliers of Valves Pumps ,Tanks, Instruments ,analysers and Membranes used in water and waste water treatment	No

DESCRIPTION OF ACTIVITY AND LEARNING. Please record all relevant CPD activities (eg. short course, conference, reading, technical lectures, formal study towards qualification, research, discussion groups, workshops, symposia, voluntary service roles) that have extended your professional engineering knowledge and have assisted you to develop the knowledge profile of a professional engineer. Describe the learning outcomes and how these have contributed to your acquiring a Washington Accord level of knowledge..					Was Formal Assessment involved? What was the outcome?
Date(s)	Actual Hours	Form of Activity	Title of activity	What was the knowledge you acquired? How have you applied this knowledge in your engineering practice?	
			Green Energy		
21/Sep/ 2017	6	Visit to water exhibition	Korea International Water Week 2017 – Expo, Gyeongju, Korea	Interacted with various suppliers of Pumps and Membranes used in water and waste water treatment	No

SECTION FIVE - PAYMENT

KNOWLEDGE ASSESSMENT (LEVEL 2) FEE PAYMENT

ASSESSMENT FEE (INCL GST) IN NZD | **NZ$1,351.25** | Please send a receipt ☐

CREDIT CARD DETAILS:

Visa ☐ Bankcard / Mastercard ☐ American Express ☐ Diners Card ☐

Credit Card Number ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐

Name on card _____ **Expiry Date** _____ **CVV** _____

Cardholders Signature _____

WHERE TO SEND COMPLETED DOCUMENTS

Send the completed form and associated documents to the **IPENZ Membership Manager** at one of the addresses below.

Courier Address:
IPENZ National Office,
Level Three
50 Customhouse Quay
Wellington 6011
New Zealand

Postal Address:
IPENZ National Office
PO Box 12-241
Wellington 6144
New Zealand

Appendix One

COMPLEXITY DEFINITIONS

COMPLEX ENGINEERING PROBLEMS

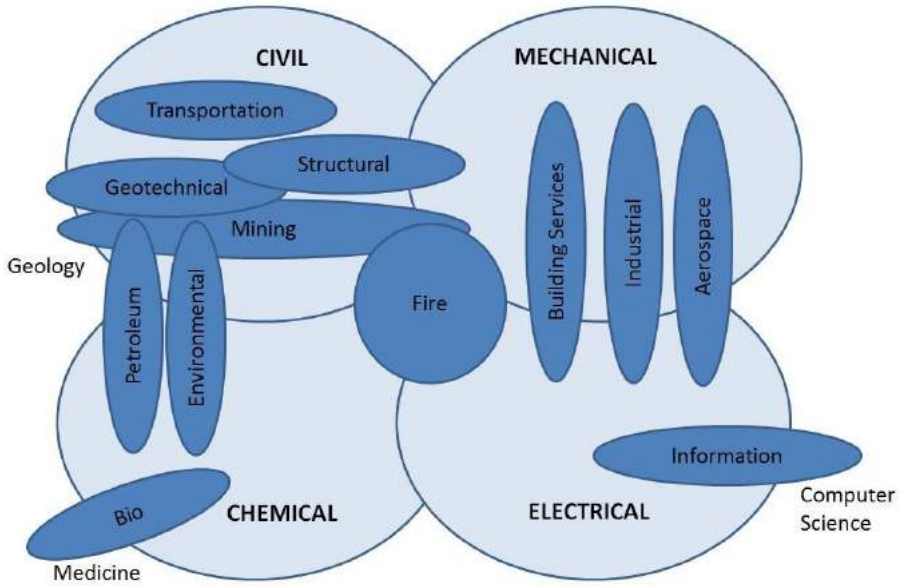
Complex engineering problems have some or all of the following characteristics:

- Involve wide-ranging or conflicting technical, engineering, and other issues;
- Have no obvious solution and require originality in analysis;
- Involve infrequently encountered issues;
- Are outside problems encompassed by standards and codes of practice for professional engineering;
- Involve diverse groups of stakeholders with widely varying needs;
- Have significant consequences in a range of contexts;
- Cannot be resolved without in-depth engineering knowledge

APPENDIX TWO

DISCIPLINES AND FIELDS OF ENGINEERING

Engineering practice fields are loosely defined terms and are used as an indication of the nature of engineering work carried out by engineers practising in an engineering field of practice. The following diagram is a graphical display of the relationships between the various fields and the four core disciplines. Some fields may extend into other fields of scientific endeavour.



AEROSPACE ENGINEERING

Aerospace engineering is the design, development, and production of aircraft (aeronautical engineering), spacecraft (astronautical engineering) and related systems. Aerospace engineers may specialise in aerodynamics, avionics, structures, control systems or propulsion systems. It may involve planning maintenance programmes, designing repairs and modifications and exercising strict safety and quality controls to ensure airworthy operations.

BIO ENGINEERING

Bioengineering draws heavily on the Chemical Engineering discipline and involves the engineered development of raw materials to produce higher value products, using biological systems (biological catalysts). The description also encompasses the general application of engineering to biological systems to develop new products or solve problems in existing production processes. As examples, bioengineers are found in medical research, genetic science, fermentation industries and industries treating biological wastes.

BUILDING SERVICES

Building Services engineering is the application of mechanical or electrical engineering principles, and an understanding of building structure, to enhance all aspects of the built environment from air conditioning and mechanical ventilation, electrical light and power, fire services, fire safety engineering, water and waste services, data and communications, security and access control, vertical transportation, acoustics and energy management.

CHEMICAL ENGINEERING

Chemical engineering is concerned with the ways in which raw materials are changed into useful and commercial end products such as food, petrol, plastics, paints, paper, ceramics, minerals and metals. Often these processes are carried out at large scale plants. Research of raw materials and their properties, design and development of equipment and the evaluation of operating processes are all part of chemical engineering.

CIVIL ENGINEERING

Civil engineering is a broad field of engineering concerned with the design, construction, operation and maintenance of structures (buildings, bridges, dams, ports) and infrastructure assets (road, rail, water, sewerage). The Civil engineering discipline underpins several engineering fields such as Structural, Mining, Geotechnical and Transportation engineering, in which civil engineers often specialise. General Civil engineers are likely to be competent to undertake work that relates to one or more of these areas.

ELECTRICAL ENGINEERING

Electrical engineering is the field of engineering which deals with the practical application of electricity. It deals with the aspects of planning, design, operation and maintenance of electricity generation and distribution, and use of electricity as a source of energy within major buildings, industrial processing complexes, facilities and transport systems. It includes the associated networks and the equipment involved such as switchboards, cabling, overhead lines/catenaries, earthing, control and instrumentation systems.

Areas of specialisation within the wider electrical engineering discipline, such as electronics and telecommunications are usually concerned with using electricity to transmit information rather than energy. For this reason electronics and radiocommunications/telecommunications are captured under the field of Information Engineering.

ENGINEERING MANAGEMENT

The Engineering Management practice field is used by engineers who manage multi-disciplinary engineering activities that are so multi-disciplined that it is difficult to readily link their engineering practice with any other specific practice field. Project managers, asset managers and engineers working in policy development are likely to use the 'Engineering Management' field.

ENVIRONMENTAL ENGINEERING

Environmental engineering draws on the Civil and Chemical engineering disciplines to provide healthy water, air and land to enhance human habitation. Environmental engineers devise, implement and manage solutions to protect and restore the environment, within an overall framework of sustainable development. The role of the environmental engineer embraces all of the air, water and soil environments, and the interactions between them.

FIRE ENGINEERING

Fire engineering draws on knowledge from the range of engineering disciplines to minimise the risk from fire to health and safety and damage to property through careful design and construction. It requires an understanding of the behaviour of fires and smoke, the behaviour of people exposed to fires and the performance of burning materials and structures, as well as the impact of fire protection systems including detection, alarm and extinguishing systems.

GEOTECHNICAL ENGINEERING

Geotechnical engineering involves application of knowledge of earth materials in the design of structures, such as foundations, retaining walls, tunnels, dams and embankments. Geotechnical engineers assess the properties and performance of earth materials such as their stability and strength, and the impact of groundwater.

INDUSTRIAL ENGINEERING

Industrial engineering is the application of mechanical and electrical engineering principles to the design and operation of production equipment, production lines and production processes for the efficient production of industrial goods. Industrial engineers understand plant and procedural design, the management of materials and energy, and human factors associated with worker integration with systems. Industrial engineers increasingly draw on specialised knowledge of robotics, mechatronics, and artificial intelligence.

INFORMATION ENGINEERING

The field of Information engineering is based on the Electrical engineering discipline but also draws heavily from Computer Science. Three areas of further specialisation can be identified:

Software engineering - The development and operation of software-intensive systems that capture, store and process data.

Telecommunications engineering - The development and operation of systems that encode, transmit and decode data via cable systems (including fibre optics) and wireless systems (radiocommunications).

Electronics engineering - The design, development and testing of electronic circuits and networks that use the electrical and electromagnetic properties of electronic components integrated circuits and microprocessors to sense, measure and control processes and systems.

MECHANICAL ENGINEERING

Mechanical Engineering involves the design, manufacture and maintenance of mechanical systems. Mechanical engineers work across a range of industries and are involved with the design and manufacture of a range of machines or mechanical systems, typically applying principles of hydraulics (fluid control), pneumatics (air pressure control) or thermodynamics (heat energy transfer). Mechanical engineers may specialise in the Building Services or Industrial engineering field.

MINING ENGINEERING

Mining engineering involves extracting and processing minerals from the earth. This may involve investigations, design, construction and operation of mining, extraction and processing facilities.

PETROLEUM ENGINEERING

Petroleum engineering is a field of engineering relating to oil and gas exploration and production. Petroleum engineers typically combine knowledge of geology and earth sciences with specialised Chemical engineering skills, but may also draw on Mechanical engineering expertise to design extraction and production methods and equipment. Petroleum engineering activities are divided into two broad categories:

Upstream - locating oil and gas beneath the earth's surface and then developing methods to bring them out of the ground.

Downstream - the design and development of plant and infrastructure for the refinement and distribution of the mixture of oil, gas and water components that are extracted

STRUCTURAL ENGINEERING

Structural Engineering is a specialised field within the broader Civil engineering discipline that is concerned with the design and construction of structures. Structures might include buildings, bridges, in-ground structures, footings, frameworks and space frames, including those for motor vehicles, space vehicles, ships, aeroplanes and cranes, composed of any structural material including composites and novel materials.

TRANSPORTATION

Transportation engineering is a specialised field of practice in the civil engineering discipline relating to the movement of goods and people by road, water, rail and air.

A Transportation engineer might specialise in one or more of: pavement design, asset maintenance/management, construction/project management, traffic operations and control, transportation planning and systems analysis, freight transportation and logistics, road safety, railways or public transport systems.