

## **CIVE 480B – Design Project and Final Report and Presentation**

*This assignment is provided to you at the beginning of semester in order to provide context for everything that we will be doing. The goal of each stage of learning, both content and process, is to help you build the tools, skills, and knowledge that will allow you and your team to build these final deliverables. Reading this at the outset, you will probably not have all of the skills and knowledge you need, and that is okay. We will build these tools together over the course of the semester.*

*This course follows the arc of an environmental consultancy, with the final deliverable being your consulting written report and oral presentation. Every interim deliverable is designed to serve the goal of creating successful final outputs. This means that, if done well, the content of all written and oral assignments (excepting pre-class reading questions) can directly become part of this final deliverable. While there is no external “client”, colleagues from industry will be invited to your final presentations. You should consider your final report and presentation not just as a course assignment, but as an opportunity to pitch yourselves and your ideas to future employers.*

*Uncertainty, and making decisions to go forward in the absence of complete information, will be part of the course, and this will sometimes be uncomfortable and scary. You will be uncovering new information and synthesizing it in news ways, which means you will come across questions to which your instructors do not know the answers. Our goal is to guide you through this and encourage you to think big while using technical understanding to evaluate the limitations and opportunities of your ideas.*

### **Design Challenge: Chemistry and Toxicology of Trace Metals in Drinking Water**

*Your Mission:*

Your team has been assigned a metal that has been known to turn up in drinking water as a result of human activity. Your goal, as consultants, is to propose interventions that will, firstly, minimize hazard to human health through the consumption of this metal in drinking water, and secondly, reduce hazard to both human health and the environment in a broader sense. Consider your audience to be professional engineers, environmental chemists, public health experts, and policy makers; you can assume they have professional training and understand complex ideas, but they are not all experts on drinking water treatment or on metal chemistry.

To accomplish these goals, and to communicate the rationale of your proposed interventions, you will need to establish an understanding of: the source of your metal; its function in current industrial processes; the chemical interactions and transformations your metal undergoes during its intended use; how it is released into the environment; the regulations governing its release into the environment; the chemical interactions and transformations your metal undergoes in water and elsewhere in the environment; the human and environmental health effects of your metal in relevant chemical forms; the regulations and guidelines around safe drinking water as pertaining to your metal; and any other relevant information. Based on this information, you should then be able to communicate the current state-of-the-art in removing your metal from

drinking water (along with its limitations). All of this background will give you the tools to propose sound ideas, and for your reader/listener to understand the basis of your proposals.

For the design of interventions, you are asked to identify three different points along the material flow of your metal where you could intervene. The points of intervention will be your choice, and I recommend choosing opportunities at different stages with different limitations. Take the opportunity to think big and disrupt entire industries. With each proposal, you should think through the human health and environmental impacts of the alternatives you suggest, using the same tools you have applied to the existing materials and technologies. Finally, you should evaluate your proposed interventions, identifying data gaps, contexts in which they might be appropriate, constraints on their potential application, and the scale of benefits that might be achieved if your intervention was adopted in an appropriate context.

*Your Report (20% of Final Grade):*

I will leave it to your group to determine the organization of ideas within your report, however, the following elements of a consulting report should be included (all sections 12-point Times New Roman font single spaced, with a single line gap between paragraphs, 1 inch margins):

- Title Page with names and affiliations of all contributors
- 1 Page Executive Summary outlining the scope of the work, the main ideas, and the conclusion
- <250 word Abstract and Graphical Abstract
- List of Figures and Tables (all figures and tables should have captions that allow them to stand alone)
- List of Abbreviations (all abbreviations should be defined the first time they are used in the text)
- Introduction
- *The organization of the body of the report is up to you; organizing based on the topics/ideas/interim assignments from the course may be a useful way to think about this. You should be using ideas and content that you generate during the semester, however note that this does not mean you can copy-paste your assignments without further thought – you need to synthesize the ideas from various sections and connect them to one another.*
- *I do recommend that everything that is background research be clearly separated from your proposed design ideas. If a reader is an expert on the metal, they will still want to read your new ideas, but may want to skip the background.*
- Conclusion
- References in IEEE format (throughout the text and as a section at the end of the report)
- Appendices (not required, but if there is supplementary information not readily contained in a reference, these may be appropriate)

Your total report will probably be between 20-25 pages (all sections 12-point Times New Roman font single spaced, with a single line gap between paragraphs, 1 inch margins, align justified), plus figures, tables, appendices, references, title page, etc. If it is longer, you need to edit for

conciseness. If it is shorter, do not fill space. We should discuss whether you are covering topics in sufficient depth.

**Graduate Students:** In addition to your report formatted as a consultancy recommendation, you will also format your findings as a critical review for submission to a special issue of the journal *Water-Energy Nexus* entitled “Roles of Energy and Food Elements in Water Security and Sustainability” or in WIREs Water another journal of your choosing.

(<http://www.keaipublishing.com/en/journals/water-energy-nexus/guide-for-authors/#2041567>)

(<https://onlinelibrary.wiley.com/journal/20491948>)

*Your Presentation (15% of Final Grade):*

The goal of a final presentation is to teach your audience something they don't already know. Convince them that what you have done all semester is worthwhile (in a consulting context, convince your client that hiring you was a good use of their resources), by imparting new understanding and new ideas. You need to share the highlights of your content, and you can do this in an engaging way. Your audience should walk away understanding the importance of the challenges of the status quo with regards to your metal, and with realistic optimism about the paths forward that you have proposed. You have **really** succeeded if they mention your presentation to someone they know who works in water treatment, city planning, international development, public health... and recommends that person look up your report or get in touch.

More specifically, your presentation should include the following elements (the order is just an example, use whatever flow makes the most sense for you to tell the story):

1. Introduce the challenge
2. Explain why it is an important problem (toxicology, context and scale of impacts)
3. Explain how the challenge comes to be (industrial process, chemical processes in the industrial process, release into the environment, chemical processes after release, interaction with water treatment if relevant)
  - Highlight the **function** of the metal in the industrial process
4. Explain your process for identifying possible intervention points
5. **Describe your proposed interventions** – you should mention all three at least briefly on one slide; it is up to you how much detail you dive into each one. This is the meat of your presentation and your chance to show your team's creative capacity.
6. Conclusions and recommendations (who might find your information useful?)
7. Acknowledgements

All members of your group should speak similar amounts in the final presentation; decide as a team how to organize your information and your speakers to play to your strengths.

Each group will have [TBD] minutes total: allocate time for presentation and for questions from the audience.