

Design Criteria and Target Specification Report

Course: GNG1103–Engineering Design

Team Name: Five Alive

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Team Members: Sam Stano, Owen Kaine, Aidin Moradi, Ziyi Wang

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Introduction:

This document outlines the development process for the CNL x uOttawa Design Challenge, focusing on the identification and prioritization of measurable design criteria, benchmarking analysis, and target specifications. The goal is to establish clear, quantifiable goals that guide the design process.

1. Prioritized Design Criteria

Functional Requirements

1. The tool must be able to give feedback to the user. The user needs to know what the machine is doing and have control over it.
2. The tool should be retrievable in case of failure
3. The tool must work in both vertical and horizontal orientations.
4. The tool needs quantifiable units of measurement, such as size and weight. This makes it easy to determine the size of an item.
5. The tool should have a lightweight and compact design for easy demonstration.
6. The tool should be simple to use.

Non-Functional Requirements

1. The tool must be operated without any direct contact from the user to ensure safety and no radioactive contamination.
2. The tool must be reusable for long-term use at a nuclear facility.
3. The tool must be durable and not easily damaged in harsh environments.

Constraints and Metrics:

1. The tool must fit inside a 101.6 mm (4 in) diameter tube, reaching 4.572 m (15 ft) deep.
2. The sample collected must be between 30-80mg in mass.
3. The tool must be cost-effective, it should be around the budget of 100 dollars.

2. Technical Benchmarking

In this section, we compare existing products that meet similar needs and identify key features, strengths, and weaknesses.

Product	Functionality	Performance	Strengths	Weaknesses	Priority
Circumferential Wet Scraper Tool (CWEST)	Enables monitoring of deuterium uptake in pressure tubes of CANDU reactors by collecting samples during shutdowns.	Performs efficiently in retrieving samples with integration into station interfaces and reduces operational downtime.	Reduces radiation exposure, improves outage duration, and integrates new software and hardware for increased scope and reliability. Reduction in dose to staff for scrape campaigns	Limited availability (restricted sale outside Canada until after November 30, 2027) Must be operated by trained professionals.	1
Fusion QLD Uniprep Pipe Scraping Tool	Works as a handheld scraping tool, able to scrape pipes from the full inner circumference.	It has a 4-sided, tungsten, scraping tip and can precisely remove material from the inside of a pipe.	It can account for irregularities in pipes with a spring-loaded tip. It has a decent range that can be controlled by a screw mechanism.	It is handheld. The scrapings are left in the tube, there is nothing to collect or measure them.	3

			Lightweight, aluminum design.		
Anemone Retrieval and Sampling Tool by Orano	Anemone has been designed to grip any solid element, whether for sampling purposes or more generally for recovery and removal.	It comprises a rigid body and a flexible head equipped with tentacles designed to grip and trap any type of object or material. The anemone is also controlled by a pneumatic air supply	<p>Adaptability: Tool adjusts to the size of objects for secure gripping.</p> <p>Ease of Use: User-friendly design, powered by compressed air.</p> <p>Versatility: Suitable for handling various objects and materials.</p> <p>Safety & Radiation Protection: Minimizes radiation exposure with rapid and remote implementation.</p>	<p>Designed mainly for solid object retrieval, it may not perform well for liquids, powders, or highly fragmented materials.</p> <p>Moving parts and pneumatic components might require regular maintenance or cleaning to prevent malfunction, especially after extended use in contaminated or high-debris environments.</p>	2

3. Target Specifications

Target specifications define the ideal and marginal product attributes for measurable design evaluation.

Design Criterion	Ideal Specification	Marginal Specification	Measurement Method	Priority
Weight	Ideally under 2kg	Less than 5kg	Using a scale and general feedback for weight and maneuverability of prototype	3
Sensor accuracy	Accurately determine the weight of a collected sample in milligrams precision	The sample must be between 30-80mg	Lab testing under various conditions	1
Size	Can be broken into pieces 3ft long for transport.	Max length of modular piece 5 ft and minimum 1ft since in total the tool should be 15 feet	Ensuring that the prototypes are portable and can be broken down easily to be carried	2

4. Reflection on Client Meeting

We have reflected on the impact of the client meeting and updated our design criteria and target specifications accordingly. The client specified the requirements for the product and the assumptions that can be made. For this product, steel or iron will be an acceptable metal and the effects of radiation can be ignored for the project's purposes. The tool can be manually controlled or automated and must incorporate feedback in the design.

5. Task Plan Update

Updated Task Board

1. **New or Updated Tasks/Subtasks**

- We added subtasks and checklist under the Trello- Deliverable C - Design Criteria.

2. **Updated Task Start and End Dates**

- The tasks for deliverable C have a due date of February 2nd.

Project Planning and Task Assignment:

Team Member	Tasks Completed Last Week	Current Tasks (In Progress)	Tasks On Hold or Canceled	Estimated task duration
Aidin	Deliverable B	Deal with any group issues or disagreements and develop strategies to help with conflicts.	None	2 Days
Owen	Deliverable B	Determine what tasks have been finished, what upcoming tasks are and if anything needs to be put on hold or cancelled.	None	2 Days
Ziyi	Deliverable B	Verify and update task start dates and consider everyone's availability over the next two weeks.	None	2 Days
Sam	Deliverable B	Update Trello to account for Deliverable D and create more detailed sub tasks for	None	2 Days

		upcoming weeks.		
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The estimated task duration was achievable within the time constraints, and the team was able to finish Deliverable C by the due date of February 2nd.

6. Conflict Resolution and Issues

We have addressed any conflicts or issues encountered during this phase.

7. Conclusion

The client meeting went well, and we were able to define important criteria for the design of our product. In this deliverable we were able to find relevant and helpful benchmarks that we were able to use to come up with tentative, target specifications. They meet the needs of what has been defined by the client as necessary for the tool. We updated our Trello board with new tasks and deadlines and assigned future tasks as well. Overall, we believe this week was successful and we made reasonable progress that aligns with our goals.

8. Reference

Anemone: Recovery and Sampling Tool. (2021). Orano Group. Retrieved February 1, 2025, from

https://www.orano.group/docs/default-source/default-document-library/wne-2021/nuclear-waste-management/an%C3%A9mone-recovery-and-sampling-tool.pdf?sfvrsn=2cd17ebe_5

Uniprep pipe scraping tool. (n.d.). Fusion QLD Pty Ltd. Retrieved February 1, 2025, from

<https://www.fusionqld.com.au/product/uniprep-1-pipe-scraping-tool-for-pipe-sizes-110-400mm/>

Custom Circumferential Wet Scrape Tool (CWEST) Design & Supply. (n.d.). Kinectrics. Retrieved February 1, 2025, from <https://www.kinectrics.com/projects/updated-design-supply-of-a-custom-circumferential-wet-scrape-tool>

