Project Deliverable B:

Needs Identification

Group 16: The Sample Snatchers

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Abstract

This document analyzes the process Group 16 used to determine Canadian Nuclear Laboratories' (CNL) client needs. The group developed the problem statement:

“Operators that service nuclear reactors need a device to collect metal samples from pressure tubes while minimizing exposure to contaminated material. The solution should be compact and completely removable from the pressure tube while also being able to report the stage of operation within a limited timeframe.”

The team identified the client’s needs, such as safety and operational feedback. Significant user statements from the first client meeting were extrapolated and conveyed as interpreted need statements. A central list of needs has been organized into a hierarchy to prioritize critical features. The problem statement clearly defines the assignment objective so team members can focus on ideations and concepts toward a solution.

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1.0 Introduction

In the course, GNG1103 - Engineering Design (Section F), our team has been assigned to design a device capable of retrieving metal samples from a pressure tube wall in a nuclear reactor to be further tested for hydrogen embrittlement for Canadian Nuclear Laboratories(CNL). The project objective is to develop a novel design that meets user needs.

Through the various stages of Design Thinking, which include empathizing, defining, ideating, prototyping, and testing– this iterative process acknowledges all key aspects needed to achieve a successful solution. In the scope of the course, this procedure acts as a critical approach to solving design problems. The content presented throughout this document aims to focus on the empathize stage. This foundational stage highlights clients' needs to determine their expectations and perceptions.

This report aims to provide a foundation for the empathize stage, expressing key points to formulate a problem statement capturing the importance of the task.

2.0 Empathizing with the Client

Raw data was gathered from the first meeting to identify the client's needs and to understand their problems, limitations, frustrations, desires, and needs. This data has been further refined and interpreted into needs statements to aid in determining the importance of each need.

2.1 Client Needs Identification

At the first meeting, the team individually took notes as the client provided technical information about the project. This raw data was further analyzed to highlight key user statements. Using this data, the group created the following table, Table 2.1, to demonstrate the corresponding statements from the client with a corresponding interpreted need statement.

Table 2.1 - Needs Identification from Client Interview

Questions	User Statement	Interpreted Need
Typical Uses	To take a sample from the inside of a tube	The sample collected can be varied
	Limits exposure to the operator	The sample is contained to limit exposure
Likes - Current Tool	All parts can be removed from the tube	The design can be completely removed
	Can be moved around by one individual	Should be modular/lightweight
	The device is able to be powered with available resources	Necessary power sources should be included
	The operator is informed of the status of the machine	The design can report the current stage in its process
Dislikes - Current Tool	The client loves many things about the existing device	Is a novel creative solution
Suggestions	Russian nesting doll the sample	The sample is contained in multiple layers
	Your device must operate within the timeframe on design day	The device is reasonably fast

2.2 Client Needs Hierarchy

As the gathered interpreted need statements were identified, the group reorganized the needs. The group then independently ranked the importance of each to determine a hierarchy of the needs as seen in Table 2.2. The average value from the team members was used to clarify group coordination on the most crucial needs.

Table 2.2 - Hierarchy of Needs

Number	Need	Importance (average team response)	
1	The sample collected can be varied	3.8	5 - critical
2	The sample is contained to limit exposure	5.0	4 - highly desirable
3	Design can be completely removed	4.8	3 - nice
4	Should be modular/lightweight	3.6	2 - not important
5	Necessary power sources should be included	3.4	1 - undesirable
6	The design can report the current stage in its process	3.8	
7	Is a novel creative solution	3.2	
8	Sample is contained in multiple layers	3.4	
9	The device is reasonably fast	2.0	

2.3 Problem Definition

Operators that service nuclear reactors need a device to collect metal samples from pressure tubes while minimizing exposure to contaminated material. The solution should be compact and completely removable from the pressure tube while also being able to report the stage of operation within a limited timeframe.

2.4 Outstanding Objectives for Research

The group has sent a request for information to Kinetrics in the hopes of having an interview with an onsite worker who could further detail their experiences in operating the CWEST device. Some general details that are looking to be clarified are:

- Number of tubes sampled in a session
- Number of operators required
- Operator frustrations with the CWEST device

3.0 Conclusion

In summary, the empathize stage provided insights into the safety requirements and technical constraints, enabling the team to develop a targeted problem statement. After reflecting on these findings, we determined that additional research, such as the Kinectrics interview mentioned in Section 2.4 - Outstanding Research Objectives, may be necessary. The client's needs will be further validated through technical benchmarking as we proceed toward Deliverable C - Design Criteria. As the subsequent stages of the design process arise, the identified needs and the problem statement will act as the guiding framework for any future work.

4.0 Citations

Cotterill, P. (n.d.). *The hydrogen embrittlement of metals*. Progress in Materials Science, 9(4), 205-250. https://doi.org/10.1016/0079-6425(61)90005-6

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