PROGRESS REPORT

FAILURE ANALYSIS SIMULATION MODEL FOR THE APMRD–II (Phase 1)

Progress Report – March 2016

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As of the end of March 2016, the amended first phase of the Failure Analysis Simulation Model for the APRMD – II is on track to be completed by the end of June 2016.

In this short progress report, we list the general tasks that have been completed to-date on the original project (as per CQADS Project #15-001-01, cf. Proposal of February 20, 2015) and on the amendment requested by the NWMO (as per CQADS Project #15-001-01, cf. Amendment of December 9, 2015, finalized on February 9, 2016); provide a look ahead to the final three months of the project, and summarize the project's financial and logistic details, as of March 31, 2016. Whenever possible, we highlight the results of the tasks in the form of documents that have been delivered to the NWMO, discussions with the NWMO team of SMEs, or CQADS internal documents.

1. Timeline of Major Tasks Completed To-Date

May
- Original project quality plan (PQP) sent to NWMO (May 19, CQADS-15-001-01-PQP-R000.pdf)
- Initial theoretical considerations (internal to CQADS)

June
- Analysis of simple study system (internal to CQADS)
- PQP returned by NWMO with requested revisions (June 11, APM Project Quality Plan Checklist for CQADS PAH.pdf)
- Set up file system (internal to CQADS)
- Project planning and ontology discussions (internal to CQADS)
- Preparation for first quarterly meeting in Toronto: review of NWMO system documents (internal to CQADS)
- Toronto Meeting: met with NWMO SMEs, presentation of methodology, met with quality assurance specialist
- Upon request from NWMO, sent a simple tutorial illustrating the method (June 24, Data Collection Tutorial (with Demo).pdf)

July
- Develop tagging scheme (internal to CQADS)
- Start of revisions on PQP to meet the ISO-standard requirements requested by NWMO (internal to CQADS)

August (Centre closed for Summer holidays)
- Continuing work on PQP (internal to CQADS)

September
- Initial discussions on system data extraction and visualization (internal to CQADS)
- Initial discussions on causal chain implementation and visualization (internal to CQADS)
- Created object model/hierarchy (internal to CQADS)
- Second version of PQP sent to, and accepted by, NWMO (May 19, CQADS-15-001-01-PQP-R01.pdf)

October
- Start of sentence tagging in NWMO documents (internal to CQADS)
- Visualization of sentence tagging (internal to CQADS)
- PQP compliance - procedural and temporal reports (internal to CQADS)
- Package sent to NWMO with deliverables (Oct 29, CQADS-15-001-01-HTML1-StructRepository-R00.html, CQADS-15-001-01-TREE1-SysComponents-R00.pdf, CQADS-15-001-01-MEMO1-PrepChecklist-R00.docx, CQADS-15-001-01-FIG1-StructRepositoryInfoViz-R00.png)

November
- Preparation for second quarterly meeting in Toronto: selection of pre-prototype chain to suggest to NWMO SMEs (internal to CQADS)
- Toronto Meeting: met with NWMO SMEs, gathered a large amount of datum regarding the system, settled on prototype causal chain
- NWMO need for re-scoping in re: manufacturing process made evident (see discussion in CQADS-15-001-01-PR-Dec-2015.pdf)

December
- Re-scoping of project to include process-mapping of container manufacturing (Dec. 9, Proposal - [15-001-1] NWMO (Phase 1) – Amendment.pdf)
- Settled on final Prototype Causal Chain, including a node on manufacturing containers and limitations of such an approach (email exchange between Alan M. and Patrick B)
- Sent progress report for 2015 (CQADS-15-001-01-PR-Dec-2015.pdf)

January

- Provision of additional support documentation to NWMO for contract amendment (QP_noncomprehensiveselectionfiles.xlsx, NWMO_QP_selectionelevantemails.pdf)
- Additional research on minimum knowledge requirements for predictability to be successful (internal to CQADS)
- Additional research review (ongoing) on relevant existing models (internal to CQADS)
- Developed syntax and description language for causal chain data collection (internal to CQADS)
- Using causal chain data collected in November, developed a more rigorous description of the current causal chain (internal to CQADS)
- Background research on radiation (CQADS_Radiation_Sources_in_Nuclear_Waste_and_Their_Properties.pdf, internal file)

February

- Re-scoping amendment of project to include process-mapping of container manufacturing agreed by Carleton and the NWMO (NWMO_CU_BoilyP_Amdmt No1 to agrmt-PO #01190A-TDS_signed by Carleton_20160209 (002).pdf)
- Background work on manufacturing chain (using internal CQADS files as well as NWMO file VLN_CB_2015.pdf and notes from discussion with NWMO SMEs in November 2015)
- Worked on defining probability specifically in the context of the NWMO model, with considerations on how people perceive and report probability (internal to CQADS)
- Began developing the conceptual model for the causal chain (internal to CQADS)

March [slower month due to fiscal end-of-year commitments, (see email exchange between Patrick B. and Alan M. on March 3, 2016)]

- Started MATLAB implementation of manufacturing chain (internal to CQADS)
- Sent progress report for the first quarter of 2016 (this file)

2. Look-Ahead to 2nd Quarter of 2016

From this point forward, a large proportion of our activities will revolve around the implementation of the prototype chain and the manufacturing process chain. In particular, we plan to

- Wrap-up the gathering of data specific to the proposed prototype causal chain and manufacturing process chain;
- Incorporate it into the model-structure and setting the parameters to create the implemented prototypes;
- Write a first iteration of the input and output parts of the implemented prototype;
- Run a series of functional tests on the implemented prototype to confirm that it is operating as expected;
- Consider some simple behaviour analysis scenarios, and finally
- Write a simple report of the results of the analysis of the implemented prototype, as well as appropriate next steps.

3. Project Logistics

Financial Details: The value of the work completed as of March 31, 2016 on the Failure Analysis Simulation Model is shown in the table below:

Invoiced to date		
Quality Plan	$	5,760.00
Components of Structured Data Repositories	$	40,320.00
Causal Chain and Conceptual Prototype Model	$	7,200.00
Prototype Creation	$	70,560.00
Travel (2 trips + cancelled meeting)	$	2,770.91
Total:	**$**	**126,610.91**

Worked to date (hours)	**Projected**	**Actual**
Quality Plan	72	312
Data Collection/Conceptual Analysis	580	925
Implementation	590	45
Total:	**1242**	**1282**

Invoicing: an invoice for 14,400.00$ in advance of Deliverable 5: Demo Analysis and Report will be sent in April; the invoice for 38,000.00$ for the amendment will be sent at the end of June (see Deadline below).

Team Composition: As of January 2, 2016, Dr. Roger-Stewart has left CQADS to pursue opportunities in the Canadian public service. After some consideration, Dr. Boily and Dr. Schellinck concluded that it would be simpler for them to take over Dr. Rogers-Stewart's assigned tasks in 2016 than to hire a new consultant and to train him or her in the details of the NWMO's fairly complex system. All files have been transferred, as has all relevant knowledge.

Independently of Dr. Rogers-Stewart's departure or of this particular project, CQADS had hired two consultants (Korey MacDougall, who is defending his Ph.D. thesis in cognitive science in April 2016, and Dong Liu, a statistician with an M.Sc.). Mr. MacDougall is helping Dr. Schellinck study the possibility of developing a tool that would facilitate automated data extraction from research papers; if needed, Ms. Liu will assist Dr. Boily with statistical inference and modeling for the manufacturing process chain and the statistical analysis of the causal chain simulation results.

Schedule: In spite of the lull that came with the month of March, the number of actual worked hours is still ahead of the projected number of hours at this point. Dr. Schellinck and Dr. Boily have cleared their schedule in April, May, and June in order to concentrate mostly on this project, and to accommodate the expanded number of hours brought about by the amendment.

Deadline: The amended deadline is May 31, but the monitoring of our current progress suggests that the final deliverable date should be pushed back to June 30 to allow for some back and forth between CQADS and the NWMO on the final product, in spite of the total number of actual hours spent on the project being in line with the projected number of hours. The reason for this delay is two-fold: it was originally projected that we would spend 580 hours on the Data Collection/Conceptual Analysis stage; but the complexity of the system, coupled with the amendment for the manufacturing process, pushed this number to (at least) 925 hours as of March 31. This in turn has delayed the start of the Implementation stage. We will be discussing this in detail with the NWMO in April.

Next Meeting: We'd like to suggest that the next meeting take place at the end of April or early in May. At that meeting, we would like to present the model that we will use for the manufacturing process chain, and show the NWMO the first implementation steps in order to get buy-in and a chance for any last-second modifications to the complete prototype chain before the implementation makes it difficult to do so.