



## Advance Contract Award Notice

### 1.0 Introduction

The Canadian Nuclear Safety Commission (CNSC) has a requirement for a generic guidance document on Human Reliability Assessment (HRA) in an existing Multi-unit Probability Safety Assessment (PSA). The purpose of this advance contract award notice (ACAN) is to signal the CNSC's intention to award a contract for these services to:

Shawn St. Germain, Principal Investigator

Idaho National Laboratory (INL)  
2525 Fremont Ave  
Idaho Falls, ID 83402  
United States

Before awarding a contract, however, the CNSC would like to provide other suppliers with the opportunity to demonstrate that they are capable of satisfying the requirements set out in this ACAN, by submitting a statement of capabilities within the posting period for this ACAN, which is twenty calendar days.

If, during the posting period, other potential suppliers submit a statement of capabilities that meets the requirements set out in this ACAN, the CNSC may proceed to a full tendering process via the Government Electronic Tendering Service or by inviting bids directly from suppliers.

If no other supplier submits, on or before the closing date, a statement of capabilities meeting the requirements set out in the ACAN, a contract will be awarded to the above-noted supplier.

### 2.0 Background

In today's international nuclear industry, the Probabilistic Safety Assessment (PSA) is an essential component of regulatory and utility decision-making process. Human Reliability Analysis (HRA) provides a set of inputs to PSA and produces insights useful for nuclear power plant safety. HRA is used to account for possible human errors introduced by a nuclear power plant operating crew both prior and during postulated accidents. Studies and operating experience have shown that human errors have significant impact on the likelihood of accidents occurrence and mitigation.

Human error can occur at every stage of a nuclear facility life and thus a variety of methods must be used to detect and prevent it. Among the most important aspects of operator error prevention are operator training and written procedures. The lack of proper training, as well as operational procedures and lack of mature accident management procedures have been identified as some of the major causes of human error in the nuclear industry, like Three Mile Island (TMI) in the U.S. (1979) and Chernobyl in the USSR (1986). Therefore, the need to give more consideration to the form and content of the procedures provided to operators, to cope with emergency situations was recognised.



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The 2011 nuclear power plant event at Fukushima Daiichi Power Plant observed the most significant importance of operator actions in stopping the event progression.

One of the lessons learned from the Fukushima event, is that operational events can occur at more than one unit at the same time. The operating crew of Main Control Room (MCR) was facing the challenge of stopping the progression of fuel degradation in all 6 units.

Under the development of PSA studies, it is important to have good prescriptive operating procedures, targeting a specific sequence of events in order to have a realistic PSA. Also, an accurate estimation of human error probabilities, using a selected HRA method, is important for a realistic PSA of plant safety systems.

While the safety analysis is developed to evaluate event progression in one unit at a time, the operating experience showed another possibility that was not considered yet, multi-unit event. Therefore, the PSARD has defined the need for a project to re-evaluate the human error probabilities, credited in the PSA, specific for MU events. Such a project will be beneficial for CNSC to develop guidance for MU-HRA to provide confirmatory evaluation. This capability and expertise by the regulator is fundamental to gain public confidence as well as contributing to safety by enhancing the efficiency and effectiveness of regulatory programs.

CNSC staff will publish the project general recommendations to the national and international HRA nuclear community workshops.

The work will involve the following:

### **3.0 Objectives**

The objective of the project is to provide information on generic guidance on Human Reliability Analysis HRA evaluation in PSA for multi-unit event. The guidance will include a minimal set of conditions needed to credit MU human actions. As far as practical, specific requirements of Level 1 and Level 2 PSA, including SAMGs operation during a multi-unit event progression will be investigated. As a continuation of previous two HRA projects developed for current PSA practice, the SPAR-H methodology will be the basis for this project.

### **4.0 Scope of Work**

This project addresses the following tasks:

#### **4.1 Assessment of MU human interactions credited in Level 1 PSA**

The scope of the work in this phase includes the following:

- Identify the initiating events that affect more than one unit [shared systems/MCR/inter tie, one unit+adjacent unit, MU IE]



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- Select dedicated HRA related to MU Initiating Events [shared systems/MCR/inter tie, one unit + adjacent unit, MU IE], including EME deployment
- Re-evaluate and examine the MU human interactions credited in Level 1 PSA to mitigate the initiating event using SPAR-H HRA quantification
- Provide insights gained by using SPAR-H HRA methods for MU events.
- Evaluate the descriptions of PSF SPAR-H and tailor them for Level 1 MU HRA
- Evaluate the multipliers of PSF and tailor them for Level 1 MU HRA
- Develop a dedicated table in SPAR-H method with PSF and related multipliers for MU-HRA calculation
- Provide insights gained by using MU PSF

**4.2 Report** – As guidance, below is a suggested table of content for Level 1 MU-HRA report.

Table of Content TOC:

1. State of Art SOA
2. State of Practice SOP
3. Selection of Level 1 MU-IE
4. Selection of MU-HRA
5. Evaluation of HRA using SPAR-H
6. Tailor PFS descriptions to MU HRA
7. Tailor PSF multipliers to MU HRA
8. Develop a new MU-HRA dedicated table similar to existing SPAR-H method
9. References

### **4.3 Tasks to be Performed**

#### **Assessment of human interactions detailed in Level 1 PSA.**

The first phase of the project will cover the following tasks:

- A plan to describe the scope, general approach, work break and schedule of the assessment
- Re-evaluate and examine the human interactions credited in Level 1 PSA to mitigate the event using alternate HRA quantification methods.
- Provide insights gained by using the recommended HRA method.
- Prepare an assessment that includes interpretation of the results and recommendations. The results of this phase will be presented in a technical report and will include information such as:
  - Identification of the alternate HRA methods used in the assessment of human interactions credited in level 1 PSA.



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- Comparison of the new results using the alternate HRA methods with the current results of Pickering NPP.
- Recommendation and insights gained by using other HRA method.

### Case Study

CNSC will provide the supplier with a Canadian multi-unit PSA study to be used as the case study.

#### 5.0 Deliverables

##### 5.1 Start-up Meeting

date: Within one month of contract award

location: The CNSC Head Office, Ottawa.

purpose: To discuss and clarify the proposed approach, work plan and schedule (Tasks 4.1 to 4.4) to ensure achievement of the contract objectives. The supplier shall make a presentation with the above purpose in mind;

##### 5.2 Progress Meetings

dates: Progress meeting within 2 months from contract award

location(s): Video conference meetings - as many as necessary.

purpose: To assess the degree to which the agreed phase 1 objectives are being achieved as planned and thus to facilitate timely adjustments (if necessary) to ensure the project success;

##### 5.3 Draft Report

dates: 3 months from contract award

copies: 1 - Format and style requirements: The progress reports should follow the requirements set out for the Final Report and outcome of Tasks;



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### 5.4 Seminar

dates: 4 months from contract award

location: Video conference meeting

Purpose: To present the project findings, conclusions and recommendations documented in the Draft Report to the CNSC staff and invited guests.

### 5.5 Final Report Task 5.4

date: 5 months from contract award

copies: One electronic copy on a 3.5" diskette or CD to the CNSC Project Manager.

format and style requirements: To be specified by the CNSC Representative.

### 5.6 Final Reports Tasks 5.5

date: within 8 months from contract award

Purpose: Revise the draft reports to address the written comments received from the CNSC's Technical staff

Format & style requirements:

To be specified by the Project Authority. The font Times New Roman 12 is to be used. Electronic copies must be provided in a format readable by Word 2003 with minor formatting changes. Any electronic files that cannot be read or require major formatting changes when opened are not acceptable and may be returned to the supplier for correction. The CNSC reserves the right, at its own discretion, to have the final report printed under CNSC cover, and to distribute it publicly. Translation of the abstract into French or English, CNSC report covers and the publication number will be provided by the CNSC.



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### 6. Optional Work: MU-HRA Level 2 PSA Scope of Work

This project addresses the following tasks:

#### 6.1 Assessment of MU human interactions credited in Level 2 PSA

The scope of the work in this phase comprises the following:

- Identify the initiating events that affect more than one unit [shared systems/MCR/inter tie, one unit+adjacent unit, MU IE]
- Select dedicated HRA related to MU Initiating Events [shared systems/MCR/inter tie, one unit + adjacent unit, MU IE]
- Re-evaluate and examine the MU human interactions credited in Level 2 PSA to mitigate the initiating event using SPAR-H HRA quantification
- Provide insights gained by using SPAR-H HRA methods for MU events.
- Evaluate the descriptions of PSF SPAR-H and tailor them for Level 2 MU HRA
- Evaluate the multipliers of PSF and tailor them for Level 2 MU HRA
- Develop a dedicated table in SPAR-H method with PSF and related multipliers for MU-HRA calculation
- Provide insights gained by using MU PSF

**6.2 Report** – As guidance, below is a suggested table of content for Level 2 MU-HRA report.

Table of Content TOC:

1. State of Art SOA
2. State of Practice SOP
3. Selection of L2 MU-IE
4. Selection of MU-HRA
5. Evaluation of HRA using SPAR-H
6. Tailor PFS descriptions to MU HRA
7. Tailor PSF multipliers to MU HRA
8. Develop a new MU-HRA dedicated table similar to existing SPAR-H method
9. References



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### 6.3 Tasks to be Performed

#### Assessment of human interactions detailed in Level 2 PSA.

The first phase of the project will cover the following tasks:

- 6.4.1 A plan to describe the scope, general approach, work break and schedule of the assessment
- 6.4.2 Re-evaluate and examine the human interactions credited in Level 2 PSA to mitigate the event using alternate HRA quantification methods
- 6.4.3 Provide insights gained by using the recommended HRA method
- 6.4.4 Prepare an assessment that includes interpretation of the results and recommendations. The results of this phase will be presented in a technical report and will include information, such as:
  - Identification of the alternate HRA methods used in the assessment of human interactions credited in Level 2 PSA
  - Comparison of the new results using the alternate HRA methods with the current results of Pickering NPP
  - Recommendation and insights gained by using other HRA method

#### Case Study

CNSC will provide the supplier with a Canadian multi-unit PSA study to be used as the case study.

### 7. Deliverables

#### 7.1 Start-up Meeting

date: Within one month of contract award

location: The CNSC Head Office, Ottawa.

purpose: To discuss and clarify the proposed approach, work plan and schedule (Tasks 7.4.1 to 7.4.4) to ensure achievement of the contract objectives. The supplier shall make a presentation with the above purpose in mind;

#### 7.2 Progress Meetings

dates: Progress meeting within 2 months from contract award

location(s): Video conference meetings - as many as necessary.



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purpose: To assess the degree to which the agreed phase 1 objectives are being achieved as planned and thus to facilitate timely adjustments (if necessary) to ensure the project success; Tasks 6.4.2, 6.4.3.

7.3 Draft Report Task 6.4.4

dates: 3 months from contract award

copies: 1

format and style requirements: The progress reports should follow the requirements set out for the Final Report; outcome of Tasks 7.4.2, 7.4.3, 7.4.4

7.4 Seminar

dates: 4 months from contract award

location: Video conference meeting

Purpose: To present the project findings, conclusions and recommendations documented in the Draft Report to the CNSC staff and invited guests.

7.5 Final Report Task 7.4.4

date: 5 months from contract award

copies: One electronic copy on a 3.5" diskette or CD to the CNSC Project Manager.

format and style requirements: To be specified by the CNSC Representative.

7.6 Final Reports tasks 7.4.4

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The estimated value of the contract, including the option period, is ***\$100,000 USD***.

### 8.0 Minimum Mandatory Requirements

Any interested supplier must demonstrate by way of a statement of capabilities that it meets the following requirements:

- A minimum of five years' experience with PSA development and interpreting HRA results in support of a nuclear regulatory body function.
- Graduate degree from a recognized university in the field of nuclear science or engineering.
- Knowledge and understanding of SPAR-H methodology for HRA quantification.
- Minimum of five years' experience as a nuclear power-plant control room operator (training & operation).
- The supplier (resource) must have a valid government security clearance at ACAN closing.

### 9.0 Justification for the Pre-selected Supplier

- Supplier being the only one with the requisite background and combination of knowledge and extensive experience related to SPAR-H methodology to quantify HRA in PSA, as the originator of the methodology.
- Supplier being recognized as the subject matter expert in the field of Human Reliability Analysis.

### 10. Intellectual Property

Canada intends to retain ownership of any foreground intellectual property arising out of the proposed contract on the basis that the main purpose of the contract is *exception to Contractor ownership 6.4.1 from the Treasury Board Policy on Title to Intellectual Property Arising under Crown Procurement Contracts; to generate knowledge and information for public dissemination. Refer to section 6 of the Treasury Board Policy on Title to Intellectual Property Arising under Crown Procurement Contracts, at: [tbs-sct.gc.ca/pol/doc-eng.aspx?id=13697&section=text](https://tbs-sct.gc.ca/pol/doc-eng.aspx?id=13697&section=text)*



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### 11. Statement of Capabilities

Suppliers who consider themselves fully qualified and available to meet the specified requirements may submit a statement of capabilities in writing to the contracting authority identified in this notice on or before the closing date of this notice. The statement of capabilities must clearly demonstrate how the supplier meets the advertised requirements.

The closing date and time for accepting statements of capabilities is January 4 2016 at 2:00 p.m. EST).

### 12. Contact Information

Inquiries and statements of capabilities are to be directed in writing via electronic mail to:

Alex Cassol, Senior Contracting Officer  
Telephone: 613-996-6638  
Fax: 613-995-5086  
Email: [alex.cassol@canada.ca](mailto:alex.cassol@canada.ca)

### 13. Policy Information

*Government Contracts Regulations*: section 6(d): “only one person is capable of performing the contract.”

Subject to the North American Free Trade Agreement (NAFTA) – (Article 1016.2 a, b, c)

Subject to the Agreement on Internal Trade (AIT) – (Article 506.12 a, b, c)