

ORDER FOR SUPPLIES OR SERVICES

PAGE OF PAGES

1

29

IMPORTANT: Mark all packages and papers with contract and/or order numbers.

1. DATE OF ORDER 06/10/2019		2. CONTRACT NO. (If any) 31310018D0001		6. SHIP TO: a. NAME OF CONSIGNEE NUCLEAR REGULATORY COMMISSION	
3. ORDER NO. 31310019F0034		4. REQUISITION/REFERENCE NO. NMSS-19-0054		b. STREET ADDRESS NUCLEAR REGULATORY COMMISSION	
5. ISSUING OFFICE (Address correspondence to) US NRC - HQ ACQUISITION MANAGEMENT DIVISION MAIL STOP TWFN-07B20M WASHINGTON DC 20555-0001				c. CITY WASHINGTON	e. ZIP CODE 20555-0001
7. TO: PAUL MALDONADO				f. SHIP VIA	
a. NAME OF CONTRACTOR SOUTHWEST RESEARCH INSTITUTE				8. TYPE OF ORDER	
b. COMPANY NAME				<input type="checkbox"/> a. PURCHASE REFERENCE YOUR: <input checked="" type="checkbox"/> b. DELIVERY Except for billing instructions on the reverse, this delivery order is subject to instructions contained on this side only of this form and is issued subject to the terms and conditions of the above-numbered contract.	
c. STREET ADDRESS 6220 CULEBRA RD				Please furnish the following on the terms and conditions specified on both sides of this order and on the attached sheet, if any, including delivery as indicated.	
d. CITY SAN ANTONIO		e. STATE TX	f. ZIP CODE 782385166		
9. ACCOUNTING AND APPROPRIATION DATA See Schedule				10. REQUISITION NG OFFICE OFFICE OF NUCLEAR MATERIAL	

11. BUSINESS CLASSIFICATION (Check appropriate box(es)) <input type="checkbox"/> a. SMALL <input checked="" type="checkbox"/> b. OTHER THAN SMALL <input type="checkbox"/> c. DISADVANTAGED <input type="checkbox"/> d. WOMEN-OWNED <input type="checkbox"/> e. HUBZone <input type="checkbox"/> f. SERVICE-DISABLED VETERAN-OWNED <input type="checkbox"/> g. WOMEN-OWNED SMALL BUSINESS (WOSB) ELIGIBLE UNDER THE WOSB PROGRAM <input type="checkbox"/> h. EDWOSB				12. F.O.B. POINT	
13. PLACE OF a. INSPECTION Destination		14. GOVERNMENT B/L NO.		15. DELIVER TO F.O.B. POINT ON OR BEFORE (Date) 06/09/2020	
b. ACCEPTANCE Destination				16. DISCOUNT TERMS 30	

17. SCHEDULE (See reverse for Rejections)

ITEM NO. (a)	SUPPLIES OR SERVICES (b)	QUANTITY ORDERED (c)	UNIT (d)	UNIT PRICE (e)	AMOUNT (f)	QUANTITY ACCEPTED (g)
	The Contractor shall provide services in accordance with the Statement of Work entitled, "International Programs and Activities Related to Geological Disposals of Spent Nuclear Fuel and High-Level Waste"					
	Continued ...					

SEE BILLING INSTRUCTIONS ON REVERSE	18. SHIPPING POINT		19. GROSS SHIPPING WEIGHT		20. INVOICE NO.		17(h) TOTAL (Cont. pages)
	21. MAIL INVOICE TO:						
	a. NAME FISCAL ACCOUNTING PROGRAM						\$0.00
	b. STREET ADDRESS (or P.O. Box) ADMIN TRAINING GROUP AVERY STREET A3-G BUREAU OF THE FISCAL SERVICE PO BOX 1328						\$985,351.00
c. CITY PARKERSBURG			d. STATE WV	e. ZIP CODE 26106-1328		17(i) GRAND TOTAL	

22. UNITED STATES OF AMERICA BY (Signature)

06/10/2019

23. NAME (Typed)
JENNIFER A. DUDEK
TITLE: CONTRACTING/ORDER NG OFFICER

ORDER FOR SUPPLIES OR SERVICES
SCHEDULE - CONTINUATION

PAGE NO
2

IMPORTANT: Mark all packages and papers with contract and/or order numbers.

DATE OF ORDER	CONTRACT NO.	ORDER NO.
06/10/2019	31310018D0001	31310019F0034

ITEM NO. (a)	SUPPLIES/SERVICES (b)	QUANTITY ORDERED (c)	UNIT (d)	UNIT PRICE (e)	AMOUNT (f)	QUANTITY ACCEPTED (g)
	Task Order Base and All Options: \$985,351.00 Task Order Exercised Amount: XXXXXXXXXX Task Order Obligation Amount: \$180,000.00 Accounting Info: 2019-X0200-INTLACT-50-50D007-1061-33-3-159-2 53D-33-3-159-1061 Period of Performance: 06/10/2019 to 06/09/2020					

TOTAL CARR ED FORWARD TO 1ST PAGE (ITEM 17(H))



\$0.00

CONTRACTOR ACCEPTANCE OF TASK ORDER 31310019F0034

Acceptance of Task Order No. 31310019F0034 under contract No. 31310018D0001 should be made by having an official, authorized to bind your organization, execute two copies of this document in the space provided and return one copy to the Contracting Officer. You should retain the other copy for your records.

Accepted Task Order No. 31310019F0034 under Contract No. 31310018D0001:

Name

Title

Date

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SECTION B - Supplies or Services/Prices

B.1 BRIEF DESCRIPTION OF WORK

(a) The title of this project is:

International Programs and Activities Related to Geological Disposal of Spent Nuclear Fuel and High-Level Waste

(b) Summary work description:

The objective of this task order is to obtain technical assistance with the identification and analysis of technical and regulatory information and strategic insights obtained from international nuclear waste disposal programs and international research and development (R&D) activities related to the management and disposal of SNF and HLW. A secondary objective is to apply key insights obtained from international SNF and HLW disposal programs and R&D to update NRC's performance assessment knowledge base, supplemented by R&D results on alternative disposal concepts from the Department of Energy.

B.2 CONSIDERATION AND OBLIGATION— TASK ORDERS (AUG 2011)

(a) The total ceiling of this contract for the products/services under this contract is [REDACTED] for the base period. The amount will increase upon exercise of Option Periods as shown in Section B.3.

(b) This order is subject to the minimum and maximum ordering requirements set forth in the contract.

(c) The amount presently obligated with respect to this order is **\$180,000** of which [REDACTED] represents Costs and [REDACTED] represents Fixed-Fee. The obligated amount shall, at no time, exceed the order ceiling as specified in paragraph (a) above. When and if the amount(s) paid and payable to the Contractor hereunder shall equal the obligated amount, the Contractor shall not be obligated to continue performance of the work unless and until the Contracting Officer shall increase the amount obligated with respect to this order, in accordance with FAR Part 43 - Modifications. Any work undertaken by the Contractor in excess of the obligated amount specified above is done so at the Contractor's sole risk and may not be reimbursed by the Government.

(d) The Contractor shall comply with the provisions of FAR 52.232-22 - Limitation of Funds, for incrementally-funded delivery orders or task orders.

(e) In accordance with FAR 52.216-8 - Fixed Fee, it is the policy of the NRC to withhold payment of fee after payment of 85 percent of the fee has been paid in order to protect the Government's interest. The amount of fixed-fee withheld from the contractor will not exceed 15 percent of the total fee or \$100,000, whichever is less. Accordingly, the maximum amount of fixed-fee that may be held in reserve is [REDACTED]

B.3 PRICE/COST SCHEDULE

Total Estimated Cost and Fixed-Fee breakdown by CLIN is presented below.

Item	Description	Quantity	Unit Price	Total Price
1	Item 1	10	5.00	50.00
2	Item 2	5	10.00	50.00
3	Item 3	2	25.00	50.00
4	Item 4	1	50.00	50.00
5	Item 5	1	50.00	50.00
6	Item 6	1	50.00	50.00
7	Item 7	1	50.00	50.00
8	Item 8	1	50.00	50.00
9	Item 9	1	50.00	50.00
10	Item 10	1	50.00	50.00

Total Estimated Cost and Fixed-Fee breakdown by cost element per period is presented below.

[illegible]

SECTION C – Descriptions/Specifications/Statement of Work

PROJECT TITLE: INTERNATIONAL PROGRAMS AND ACTIVITIES RELATED TO GEOLOGICAL DISPOSAL OF SPENT NUCLEAR FUEL AND HIGH-LEVEL WASTE

1.0 BACKGROUND

Since the publication of the final recommendation of the Blue Ribbon Commission on America's Nuclear Future in January 2012, national spent nuclear fuel (SNF) and high-level waste (HLW) geological disposal programs in countries such as Sweden, Finland, Japan, Canada, and France have continued to advance. Internationally, technical and regulatory progresses also result in the accumulation of a large amount of knowledge in design, development, implementation and regulation of deep geological repositories (DGR). In the United States, the Department of Energy (DOE) released a new waste management strategy in 2013, which endorses a system containing a pilot interim storage facility; a larger, full-scale interim storage facility; and a geologic repository. In 2015, DOE also noted its intent to pursue separate defense and commercial HLW disposal facilities. To this date, DOE continues its generic research and development programs for a potential DGR in the future. To remain positioned to support national policy changes in areas associated with its regulatory purview, NRC staff also identified and has continued to analyze key regulatory and technical issues associated with HLW and SNF disposal in a variety of potential repository designs and geologic media.

The U.S. Nuclear Regulatory Commission (NRC) has identified actions from regulatory, environmental, and technical perspectives that will improve the ability of the Agency to quickly adapt to changes in national policy. Because all plausible alternative scenarios for the back end of the nuclear fuel cycle produce residual waste, it is assumed that geological isolation will be a component of any new national policy. Regardless of the direction of national policy, it is imperative that NRC staff continue to stay abreast with technical and regulatory advances and with emerging issues both domestically and internationally. An awareness of international programs with similar aims in foreign countries is thus critical to support the Agency's mission under a range of potential policy outcomes.

The overarching goal of this work is to support NRC's preparations to address ongoing revisions to the U.S. national strategy for regulating and managing nuclear wastes through the collection and analysis of technical and regulatory information produced by international programs and activities, which will then be assimilated with information obtained independently by NRC staff. A secondary goal is to use the information to continue to support NRC's development and maintenance of in-house DGR performance assessment capability to align the staff's activity to NRC's risk-informed, performance-based regulatory approach.

This task order will build on the work completed in this area in FY12 through FY19 (Task Orders 7 and 9 under contract NRC-HQ-12-C-02-0089, and Task Order 31310018F0061 under contract 31310018D0001).

2.0 OBJECTIVE

The objective of this task order is to obtain technical assistance with the identification and analysis of technical and regulatory information and strategic insights obtained from international nuclear waste disposal programs and international research and development (R&D) activities related to the management and disposal of SNF and HLW. A secondary objective is to apply key insights obtained from international SNF and HLW disposal programs and R&D to update

NRC's performance assessment knowledge base, supplemented by R&D results on alternative disposal concepts from the Department of Energy.

3.0 SCOPE OF WORK

3.1 TASK 1: DEGRADATION OF CANDIDATE WASTE PACKAGE MATERIALS

3.1.1. Base Period

The HLW disposal programs from countries such as Canada, Sweden, Finland, France, Germany, and Japan, in addition to the U.S., have accumulated a large amount of technical data in waste package material degradation, through laboratory experiments, field tests, analysis of natural analogues, or theoretical predictions. The NRC staff, in collaboration with the Center for Nuclear Waste Regulatory Analysis (CNWRA), has independently obtained a large amount of laboratory results on copper, carbon steel, and titanium corrosion. Utilizing this data, the contractor shall analyze and compare copper, carbon steel, and titanium corrosion rates under various nuclear waste disposal environments from different DGR designs.

The expected outcomes of this task are the quantification of: (1) environmental variables affecting waste package material corrosion, including the effects of the fate and transport of chemical species in the near field of a repository; (2) controlling mechanisms, e.g., electrochemical versus chemical dissolution, affecting waste package material degradation; and (3) uncertainty of measured/theoretical corrosion rates with respect to repository environmental variables. The results will be used to update the NRC's performance assessment knowledge base, including the in-house Scoping of Options and Analysis of Risk (SOAR) model.

Deliverable: The contractor shall develop a technical report that documents the pertinent findings. The technical report shall include summary tables of the obtained information and data in such a format as to facilitate its potential incorporation into the SOAR model.

3.1.2 Option Year 1

The contractor shall collect and analyze data from the most recent results from international HLW disposal programs and related R&D activities. The contractor shall compare these results from those produced by the R&D programs for alternative disposal concepts sponsored by DOE. The contractor shall review the existing implementation of waste package degradation module in the SOAR model and implement necessary updates to the module as approved by the COR.

Deliverable: The contractor shall develop a technical report that updates the knowledge base from the base year. The shall technical report shall document pertinent findings and include summary tables of the obtained information and data in such a format as to facilitate its incorporation into the SOAR model.

3.1.3 Option Year 2

The contractor shall update the knowledge base collected and analyzed in Option Year 1 with the most recent results from international nuclear waste disposal programs and related R&D activities. The contractor shall compare these results from those produced

by the R&D programs for alternative disposal concepts sponsored by DOE. The contractor shall review the existing implementation of waste package degradation module in the SOAR model and implement necessary updates to the module as approved by the COR.

Deliverable: The contractor shall develop a technical report that updates the knowledge base from Option Year 1. The technical report shall document pertinent findings and include summary tables of the obtained information and data in such a format as to facilitate its incorporation into the SOAR model.

3.1.4 Option Year 3

The contractor shall update the knowledge base collected and analyzed in Option Year 2 with the most recent results from international nuclear waste disposal programs and related R&D activities. The contractor shall compare these results from those produced by the R&D programs for alternative disposal concepts sponsored by DOE. The contractor shall review the existing implementation of waste package degradation module in the SOAR model and implement necessary updates to the module as approved by the COR.

Deliverable: The contractor shall develop a technical report that updates the knowledge base from Option Year 2. The technical report shall document pertinent findings and include summary tables of the obtained information and data in such a format as to facilitate its incorporation into the SOAR model.

3.2 TASK 2: DISSOLUTION OF SPENT NUCLEAR FUEL AND HLW GLASS

3.2.1. Base Period

The HLW disposal programs from countries such as Canada, Germany, Korea, France, and Japan, in addition to the U.S., have accumulated a large amount of data in this regard, through laboratory experiments or theoretical predictions. Additionally, there is a significant inventory of HLW glass worldwide, particularly France, Japan, and the U.S. The NRC staff, in collaboration with the CNWRA, has independently obtained a large amount of data regarding SIMFUEL dissolution from laboratory tests under oxic and anoxic conditions. Utilizing this data, the contractor shall analyze and compare HLW and SNF, including SIMFUEL, dissolution rates obtained from deep geologic disposal environments in various DGR programs.

The expected outcomes of this task are the quantification of: (1) environmental variable affecting SNF dissolution, including the effects of fate and transport of chemical species in the near field of a repository; (2) controlling mechanisms, e.g., electrochemical versus chemical dissolution, affecting HLW and SNF dissolution; and (3) uncertainty of measured/theoretical dissolution rates with respect to repository environmental variables. The results will be used to update the NRC's performance assessment knowledge base, including the NRC Scoping of Options and Analyzing Risk (SOAR) model.

Deliverable: The contractor shall develop a technical report that documents the pertinent findings. The technical report shall include summary tables of the information in such a format as to facilitate its potential incorporation into the SOAR model.

3.2.2 Option Year 1

The contractor shall update the knowledge base collected and analyzed in the Base Year with the most recent results from international nuclear waste disposal programs and related R&D activities. The contractor shall compare these results from those produced by the R&D programs for alternative disposal concepts sponsored by DOE. The contractor shall review the existing implementation of SNF and HLW degradation module in the SOAR model and implement necessary update to the module.

Deliverable: The contractor shall develop a technical report that documents the pertinent findings. The technical report shall include summary tables of the information in such a format as to facilitate its potential incorporation into the SOAR model.

3.2.3 Option Year 2

The contractor shall update the knowledge base collected and analyzed in Option Year 1 with the most recent results from international nuclear waste disposal programs and related R&D activities. The contractor shall compare these results from those produced by the R&D programs for alternative disposal concepts sponsored by DOE. The contractor shall review the existing implementation of SNF and HLW degradation module in the SOAR model and implement necessary updates to the module as approved by the COR.

Deliverable: The contractor shall develop a technical report that documents the pertinent findings. The technical report shall include summary tables of the information in such a format as to facilitate its potential incorporation into the SOAR model.

3.2.4 Option Year 3

The contractor shall update the knowledge base collected and analyzed in Option Year 2 with the most recent results from international nuclear waste disposal programs and related R&D activities. The contractor shall compare these results from those produced by the R&D programs for alternative disposal concepts sponsored by DOE. The contractor shall review the existing implementation of SNF and HLW degradation module in the SOAR model and implement necessary updates to the module as approved by the COR.

Deliverable: The contractor shall develop a technical report that documents the pertinent findings. The technical report shall include summary tables of the information in such a format as to facilitate its potential incorporation into the SOAR model.

3.3 TASK 3: MODEL AND DATA TO ASSESS THE PERFORMANCE OF NEAR FIELD BUFFER AND BACKFILL MATERIALS

3.3.1(a) Base Period – xFlo-FLAC Model Updates

The xFlo-FLAC model is a numerical computer code that simulates the coupled hydrological-thermal-mechanical processes of subsurface and geological media. It was used to model laboratory and field experiments during the NRC and CNWRA staff's participation of the DECOVALEX-2015 project. During the subsequent years since 2015, the CNWRA staff continued to improve the physics and the capability of the coupled

model and to broaden the applicability of the model to near surface nuclear waste disposal facilities, owing to similar physical processes that are applicable to a range of subsurface and geological materials.

The contractor shall update the coupled-processes model xFlo-FLAC and document the databases obtained during NRC and CNWRA's participation of the DECOVALEX-2015 international project. The contractor shall capture improvements and experience to date with the xFlo-FLAC model in order to maintain NRC's in-house DGR performance assessment capability.

Deliverables: The contractor shall deliver a computational package containing the xFlo-FLAC coupled model, the supporting documents, including but not limited to the user guide of xFlo and its interface with FLAC (a commercial computer code), and documented database of the DECOVALEX-2015 experimental results and input files to the xFlo-FLAC model.

3.3.1(b) Base Period – xFLO-FLAC Model Workshop

The contractor shall conduct a workshop for NRC and CNWRA staff on the use of the XFLO-FLAC model. The one-day workshop will be held at NRC Headquarters in Rockville, Maryland and is anticipated be participated by up to 25 NRC and CNWRA staff members, including those participating remotely. The contractor shall organize, prepare for, and conduct the workshop. Workshop presentations shall be streamed live over the internet with the ability to obtain real-time response to presentations from remote workshop participants. Potential workshop topics include: the DECOVALEX project; modeling of coupled processes; application of xFlo-FLAC to the near-field of alternative SNF and HLW disposal concepts; and application of xFlo-FLAC to near surface or intermediate depth disposal of nuclear wastes. Final workshop topics are subject to COR approval.

Deliverable: The contractor shall prepare a summary report of the workshop with all workshop presentation materials (e.g. presentation slides and handouts) attached as an appendix.

3.3.2 Option Year 1

The contractor shall apply the fully coupled xFlo-FLAC model to study the effects of coupled thermal-hydrological-mechanical processes on near field components of alternative HLW and SNF disposal concepts. The near field design shall focus on copper waste packages and bentonite buffer in crystalline host rocks similar to those of Sweden and Finland. The contractor shall utilize and apply the data and models collected and developed in the base year, particularly those related to the disposal concepts of Sweden and Finland. The contractor shall identify potential knowledge gaps with regard to disposal of high-temperature SNF and HLW in such disposal concepts and update the xFlo-FLAC model accordingly.

Deliverables: The contractor shall deliver an updated computational package containing the xFlo-FLAC coupled model, and the supporting documents, including but not limited to the userguide of xFlo and its interface with FLAC. The contractor shall also deliver a technical report documenting the near-field model and modeling results of high-temperature SNF and HLW disposal in a crystalline host rock.

3.3.3 Option Year 2

The contractor shall apply the fully coupled xFlo-FLAC model to study the effects of coupled thermal-hydrological-mechanical processes on near field components of alternative HLW and SNF disposal concepts. The near field design shall focus on carbon steel canister and bentonite buffer and/or bentonite plug in clay host rocks similar to those proposed in France and Switzerland. The contractor shall utilize and apply the data and models collected and developed in the base year, particularly those related to the disposal concepts of France and Switzerland. The contractor shall identify potential knowledge gaps with regard to disposal of high-temperature SNF and HLW in such disposal concepts and update the xFlo-FLAC model accordingly.

Deliverables: The contractor shall deliver an updated computational package containing the xFlo-FLAC coupled model, and the supporting documents, including but not limited to the userguide of xFlo and its interface with FLAC. The contractor shall also deliver a technical report documenting the near-field model and modeling results of high-temperature SNF and HLW disposal in a clay host rock.

3.3.4 Option Year 3

The contractor shall apply the fully coupled xFlo-FLAC model to study the effects of coupled thermal-hydrological-mechanical processes on near field components of alternative HLW and SNF disposal concepts. The near field design shall focus on titanium canister in salt host rocks similar to those proposed in Germany. The contractor shall utilize and apply the data and models developed previously by CNWRA staff, particularly those related to the experiments and models for the Waste Isolation Pilot Plant. The contractor shall identify potential knowledge gaps with regard to disposal of high-temperature SNF and HLW in such disposal concepts and update the xFlo-FLAC model accordingly.

Deliverables: The contractor shall deliver an updated computational package containing the xFlo-FLAC coupled model, and the supporting documents, including but not limited to the userguide of xFlo and its interface with FLAC. The contractor shall also deliver a technical report documenting the near-field model and modeling results of high-temperature SNF and HLW disposal in a salt host rock.

3.4 TASK 4: CEMENTITIOUS MATERIAL DEGRADATION

3.4.1. Base Period

The contractor shall collect and analyze available cementitious material degradation data from various international DGR programs. Cementitious materials, such as concrete and grouts, have been used for various international HLW and SNF disposal programs for various purposes. For example, concrete containers were proposed to support waste package emplacement in soft clay host rocks in Belgium. Grouts and shotcrete are routinely used to provide structural support of DGR access tunnels. The degradation of these cementitious materials and its byproducts may affect barrier performance in the near field of a DGR in various ways. The NRC staff, in collaboration with the CNWRA, has accumulated a large amount of information regarding cementitious material degradation in various DGR environments.

The expected outcomes of this task is a technical report that documents: (1) the state-of-the-art understanding of effects of cementitious material degradation on performance of DGR engineered barriers (e.g., high pH effects); (2) uncertainty associated with the effects; (3) gaps in understanding of the effects, including degradation mechanisms and the uncertainty; and (4) the state-of-the art practices in cementitious barrier performance analysis, including modeling approaches and technologies.

The results of this research and analysis will be used to update the NRC's performance assessment knowledge base and to help assessing gaps in the current performance assessment approach.

Deliverable: The contractor shall develop a technical report analyzing the collected information and documenting any pertinent findings. In the report, the contractor shall identify knowledge gaps with respect to the degradation of cementitious materials and the effect on barrier performance in various DGR concepts. The contractor shall also discuss potential approaches to integrate the collected knowledge into the NRC SOAR model.

3.4.2 Option Year 1

On the basis of the information gathered in the Base Year and those previously in the Task Order 31310018F0061, the contractor shall conduct a feasibility study of developing SOAR model components that may be applied to SNF and HLW disposal concepts similar to those proposed in Belgium, namely the super-container concept in soft clay host rock. The contractor shall identify potential knowledge gaps that may require further R&D, development of knowledge base, or modification of the SOAR model.

Deliverable: The contractor shall deliver a technical report documenting the outcome of the feasibility study and any pertinent findings.

3.4.3 Option Year 2

On the basis of the information gathered in the Base Year and Option Year 1, the contractor shall either develop a SOAR model component prototype that may be applied to SNF and HLW disposal concepts similar to those proposed in Belgium or conduct further analyses of international performance assessment (PA) results with respect to use of cementitious materials in DGR settings as directed by the COR. The contractor shall identify potential knowledge gaps that may require further R&D, development of knowledge base, or modification of the SOAR model.

Deliverable: The contractor shall either deliver a SOAR model component prototype or a technical report documenting the outcome of the analyses of international PA results and any pertinent findings.

3.4.4 Option Year 3

On the basis of the information gathered in the Base Year and Option Years 1 and 2, the contractor shall either develop a SOAR model component that may be applied to SNF and HLW disposal concepts similar to those proposed in Belgium or conduct further analyses of international performance assessment (PA) results with respect to use of cementitious materials in DGR settings as directed by the COR. The contractor shall identify potential knowledge gaps that may require further R&D, development of

knowledge base, or modification of the SOAR model.

Deliverable: The contractor shall deliver either a SOAR model component or a technical report documenting the update to the analyses of international PA results in Option Year 2 and any pertinent findings.

4.0 REPORTING REQUIREMENTS

All technical reports are to be developed in the contractor (CNWRA) SharePoint system. Submittals for all task deliverables shall be submitted via electronic mail with electronic attachments consistent with the word processor in use at the NRC or in portable document format (*i.e.*, *.pdf), as appropriate to the COR and the relevant NRC technical staff. Reports by the contractor shall be in letter report form. The deliverables shall attribute work to both NRC and CNWRA when the outcome is a result of joint effort between NRC and CNWRA.

For all draft and final technical reports under this task order, the contractor shall assure that an independent review of numerical computations, mathematical equations, and derivations is performed by qualified technical contractor staff other than the original author(s) of the technical reports and other than the person who performed the original calculation. If the contractor proposes to check less than 100 percent of all computations, mathematical equations, and derivations in the technical report(s) (such as may be the case when there is many routine, repetitive calculations), the contractor must first obtain written approval from the COR. In addition, the contractor must review all technical reports, including those which do not contain numerical analyses for consistency and readability in accordance with the procedures outlined in the CNWRA Quality Assurance Manual (QAM, transmitted to NRC on September 27, 2018, for Contract No. 31310018D001, Task Order 31310018F0053, or subsequent updated version of the QAM). Informal submittals/deliverables must be reviewed and forwarded from at least the Project Manager level.

5.0 DELIVERABLES AND DELIVERY SCHEDULE

Project deliverables are listed in the table below.

TASK/SUBTASK	DELIVERABLE	DUE DATE
3.1.1 (Base Year)	Technical Report: International research, activities, and key findings on waste package material degradation	November 28, 2019
3.1.2 (Option Year 1)	Technical Report: Update on International research, activities, and key findings on waste package material degradation	November 27, 2020 [#]
3.1.3 (Option Year 2)	Technical Report: Update on International research, activities, and key findings on waste package material degradation	November 26, 2021 [#]
3.1.4 (Option Year 3)	Technical Report: Update on International research, activities, and key findings on waste package material degradation	November 25, 2022 [#]
3.1.4 (Base Year)	Technical Report: International research, activities, and key findings on HLW and SNF degradation	October 31, 2019

TASK/SUBTASK	DELIVERABLE	DUE DATE
3.2.1 (Option Year 1)	Technical Report: Update on International research, activities, and key findings on HLW and SNF degradation	October 30, 2020 [#]
3.2.3 (Option Year 2)	Technical Report: Update on International research, activities, and key findings on HLW and SNF degradation	October 29, 2021 [#]
3.2.4 (Option Year 3)	Technical Report: Update on International research, activities, and key findings on HLW and SNF degradation	October 28, 2022 [#]
3.3.1a (Base Year)	xFlo-FLAC computational package and documentation and documented DECOVALEX-2015 database and input files	December 15, 2019
3.3.1b (Base Year)	xFlo-FLAC Workshop Summary Report	January 17, 2020
3.3.2 (Option Year 1)	Updated xFlo-FLAC computational package and documentation	December 14, 2020 [#]
3.3.2 (Option Year 1)	Technical Report: Modeling the near-field environment of a DGR in a crystalline host rock	December 14, 2020 [#]
3.3.3 (Option Year 2)	Updated xFlo-FLAC computational package and documentation	December 13, 2021 [#]
3.3.3 (Option Year 2)	Technical Report: Modeling the near-field environment of a DGR in a clay host rock	December 13, 2021 [#]
3.3.4 (Option Year 3)	xFlo-FLAC computational package and documentation	December 16, 2022 [#]
3.3.4 (Option Year 3)	Technical Report: Modeling the near-field environment of a DGR in a salt host rock	December 16, 2022 [#]
3.4.1 (Base Year)	Technical Report: Degradation of cementitious materials and its effect on barrier performance	January 24, 2020
3.4.2 (Option Year 1)	Technical Report: Feasibility study of implementing cementitious material degradation components in SOAR	January 22, 2021 [#]
3.4.3 (Option Year 2)	SOAR model component prototype or a technical report on international performance assessment activities	January 24, 2022 [#]
3.4.4 (Option Year 3)	SOAR model component or a technical report with updates on international performance assessment activities	January 23, 2023 [#]
All	*Monthly Letter Status Report (MLSR) per Section F.2 of the Base Contract	20th day of the following month

After comments from NRC staff are provided to the contractor for the above technical reports, the contractor shall deliver a revised technical report incorporating the comments within 15 business days.

*If no work was performed during the prior month, the contractor shall not prepare and submit an MLSR.

#Option year deliverable, applicable only if the option year exercised by NRC.

6.0 QUALITY ASSURANCE

The contractor shall identify and describe in the task order proposal any applicable quality assurance (QA) program, using as the basis the CNWRA Quality Assurance Manual (QAM, transmitted to NRC on September 27, 2018, for Contract No. 31310018D001, Task Order 31310018F0053, or subsequent updated version of the QAM). For, this task order, the QA program shall address the criteria of 10 CFR Part 63, Subpart G. Quality assurance comprises of all those planned and systematic actions necessary to provide adequate confidence that the assessments have been satisfactory performed. Quality assurance shall include verification for completeness, accuracy, consistency, and sufficient documentation to assure the reproducibility of the results of all calculations, laboratory experiments (if any), or modeling.

7.0 PERSONNEL QUALIFICATIONS

Professional staff for the effort shall possess technical expertise in the following disciplines: geology; seismology and volcanology; hydrology, including coupled thermal-hydrology-geochemical processes; materials science and corrosion; geochemistry; engineered barrier systems, including cementitious materials; mechanical or mining engineering familiarity with a variety of disposal media and depths, including salt and deep boreholes; nuclear engineering; waste form; source term (thermal loads, inventory as function of different waste streams, burn-ups, and storage times); radionuclide release; radionuclide transport; performance assessment, and health physics. Expertise in preclosure safety analysis expertise is needed to address specific aspects of operational safety issues associated with very long-term storage and deferred transportation of fuel that could be handled in different potential waste disposal systems.

The Contractor shall provide a Program Manager who shall be responsible for the performance of work identified in this SOW. The Program Manager shall have experience with generic nuclear waste disposal.

8.0 TRAVEL

The following travel is anticipated under this task order:

Base Year, FY 20, one (1) trip to NRC Headquarters in Rockville MD, for a one-day workshop, for one contractor staff members.

The contractor shall be authorized travel expenses consistent with the Federal Travel Regulation (FTR) and the limitation of funds for this task order. All travel requires prior written COR approval.

To enhance integration and support the collaborative effort expected between the staffs of the NRC and the contractor (Center) on this task, the NRC staff may participate in staff exchanges with the Center, subject to prior approval by the NRC Division Director of Spent Fuel Management and the Director of the Center.

9.0 SECURITY

Work performed under this task order will be unclassified and unsensitive. This task order does not involve contractor contact with or production of any of the following types of information: Classified Information; Safeguards Information; Sensitive Unclassified Information (SUNSI); Export Control Information (SCI); Controlled Unclassified Information (CUI).

10.0 LICENSE FEE RECOVERABLE

All the tasks listed in Section 3 of this SOW are NOT license fee recoverable.

11.0 NRC FURNISHED MATERIAL

The COR will provide the necessary information to conduct the activities for each topic to the pertinent, identified, Center staff.

12.0 CONTRACTOR ACQUIRED MATERIAL

No materials are expected to be acquired.

SECTION D - Packaging and Marking

D.1 BRANDING

The Contractor is required to use the statement below in any publications, presentations, articles, products, or materials funded under this contract/order, to the extent practical, in order to provide NRC with recognition for its involvement in and contribution to the project. If the work performed is funded entirely with NRC funds, then the contractor must acknowledge that information in its documentation/presentation.

Work Supported by the U.S. Nuclear Regulatory Commission (NRC), Office of Nuclear Material Safety and Safeguards, under Contract number 31310018D0001/31310019F0034.

(End of Clause)

D.2 PACKAGING AND MARKING

(a) The Contractor shall package material for shipment to the NRC in such a manner that will ensure acceptance by common carrier and safe delivery at destination. Containers and closures shall comply with the Surface Transportation Board, Uniform Freight Classification Rules, or regulations of other carriers as applicable to the mode of transportation.

(b) On the front of the package, the Contractor shall clearly identify the contract number under which the product is being provided.

(c) Additional packaging and/or marking requirements are as follows: Not Applicable.

(End of Clause)

SECTION E - Inspection and Acceptance

E.1 INSPECTION AND ACCEPTANCE BY THE NRC (SEP 2013)

Inspection and acceptance of the deliverable items to be furnished hereunder shall be made by the NRC Contracting Officer's Representative (COR) at the destination, in accordance with FAR 52.247-34 - F.o.b. Destination.

(End of Clause)

SECTION F - Deliveries or Performance

F.1 TASK/DELIVERY ORDER PERIOD OF PERFORMANCE (SEP 2013)

This task order shall commence on the effective date of the task order and will expire on June 6, 2020. The term of this task order may be extended at the option of the Government for additional Option Periods. If exercised Section I.8 Clause 52.217-9 OPTION TO EXTEND THE TERM OF THE CONTRACT. (MAR 2000) is applicable.

Base Period: June 10, 2019 - June 9, 2020

Option Period(s):

Option Period One: June 10, 2020 - June 9, 2021

Option Period Two: June 10, 2021 - June 9, 2022

Option Period Three: June 10, 2022 - June 9, 2023

(End of Clause)

F.2 PLACE OF DELIVERY-REPORTS

The items to be furnished hereunder shall be delivered, with all charges paid by the Contractor, to:

a. Contracting Officer Representative:

Refer to Section G.1 CONTRACTING OFFICER'S REPRESENTATIVE AUTHORITY

b. Contracting Officer (CO) (1 electronic copy):

(End of Clause)

SECTION G - Contract Administration Data

G.1 CONTRACTING OFFICER'S REPRESENTATIVE AUTHORITY

a) The contracting officer's authorized representative hereinafter referred to as the COR for this contract is:

Name: Jin-Ping (Jack) Gwo

Address:

U.S. Nuclear Regulatory Commission

Office of Nuclear Material Safety and Safeguards

Washington, DC 20555

Mail Stop: TWFN 4B34

Phone: 301-415-8736

E-mail: Jin-Ping.Gwo@nrc.gov

(b) Performance of the work under this contract is subject to the technical direction of the NRC COR. The term technical direction is defined to include the following:

(1) Technical direction to the contractor which shifts work emphasis between areas of work or tasks, authorizes travel which was unanticipated in the Schedule (i.e., travel not contemplated in the Statement of Work or changes to specific travel identified in the Statement of Work), fills in details, or otherwise serves to accomplish the contractual statement of work.

(2) Provide advice and guidance to the contractor in the preparation of drawings, specifications, or technical portions of the work description.

(3) Review and, where required by the contract, approve technical reports, drawings, specifications, and technical information to be delivered by the contractor to the Government under the contract.

(c) Technical direction must be within the general statement of work stated in the contract. The COR does not have the authority to and may not issue any technical direction which:

(1) Constitutes an assignment of work outside the general scope of the contract.

(2) Constitutes a change as defined in the "Changes" clause of this contract.

(3) In any way causes an increase or decrease in the total estimated contract cost, the fixed fee, if any, or the time required for contract performance.

(4) Changes any of the expressed terms, conditions, or specifications of the contract.

(5) Terminates the contract, settles any claim or dispute arising under the contract, or issues any unilateral directive whatever.

(d) All technical directions must be issued in writing by the project officer or must be confirmed by the COR in writing within ten (10) working days after verbal issuance. A copy of the written direction must be furnished to the contracting officer. A copy of NRC Form 445,

Request for Approval of Official Foreign Travel, which has received final approval from the NRC must be furnished to the contracting officer.

(e) The contractor shall proceed promptly with the performance of technical directions duly issued by the COR in the manner prescribed by this clause and within the COR's authority under the provisions of this clause.

(f) If, in the opinion of the contractor, any instruction or direction issued by the COR is within one of the categories defined in paragraph (c) of this section, the contractor may not proceed but shall notify the contracting officer in writing within five (5) working days after the receipt of any instruction or direction and shall request that contracting officer to modify the contract accordingly. Upon receiving the notification from the contractor, the contracting officer shall issue an appropriate contract modification or advise the contractor in writing that, in the contracting officer's opinion, the technical direction is within the scope of this article and does not constitute a change under the "Changes" clause.

(g) Any unauthorized commitment or direction issued by the COR may result in an unnecessary delay in the contractor's performance and may even result in the contractor expending funds for unallowable costs under the contract.

(h) A failure of the parties to agree upon the nature of the instruction or direction or upon the contract action to be taken with respect to the instruction or direction is subject to 52.233-1 - Disputes.

(i) In addition to providing technical direction as defined in paragraph (b) of the section, the COR shall:

(1) Monitor the contractor's technical progress, including surveillance and assessment of performance, and recommend to the contracting officer changes in requirements.

(2) Assist the contractor in the resolution of technical problems encountered during performance.

(3) Review all costs requested for reimbursement by the contractor and submit to the contracting officer recommendations for approval, disapproval, or suspension of payment for supplies and services required under this contract.

(End of Clause)

G.2 2052.215-78 TRAVEL APPROVALS AND REIMBURSEMENT - ALTERNATE 1 (OCT 1999)

(a) Total expenditure for travel may not exceed [REDACTED] without the prior approval of the contracting officer.

(b) All foreign travel must be approved in advance by the NRC on NRC Form 445, Request for Approval of Official Foreign Travel, and must be in compliance with FAR 52.247-63 Preference for U.S. Flag Air Carriers. The contractor shall submit NRC Form 445 to the NRC no later than 30 days prior to the commencement of travel.

(c) The contractor will be reimbursed only for travel costs incurred that are directly related to this contract and are allowable subject to the limitations prescribed in FAR 31.205-46.

(d) It is the responsibility of the contractor to notify the contracting officer in accordance with the FAR Limitations of Cost clause of this contract when, at any time, the contractor learns that travel expenses will cause the contractor to exceed the travel ceiling amount identified in paragraph (a) of this clause.

(e) Reasonable travel costs for research and related activities performed at State and nonprofit institutions, in accordance with Section 12 of Pub. L. 100-679, must be charged in accordance with the contractor's institutional policy to the degree that the limitations of Office of Management and Budget (OMB) guidance are not exceeded. Applicable guidance documents include OMB Circular A-87, Cost Principles for State and Local Governments; OMB Circular A-122, Cost Principles for Nonprofit Organizations; and OMB Circular A-21, Cost Principles for Educational Institutions.

(End of Clause)

SECTION H - Special Contract Requirements

H.1 2052.209-72 CONTRACTOR ORGANIZATIONAL CONFLICTS OF INTEREST. (JAN 1993)

(a) Purpose. The primary purpose of this clause is to aid in ensuring that the contractor:

(1) Is not placed in a conflicting role because of current or planned interests (financial, contractual, organizational, or otherwise) which relate to the work under this contract; and

(2) Does not obtain an unfair competitive advantage over other parties by virtue of its performance of this contract.

(b) Scope. The restrictions described apply to performance or participation by the contractor, as defined in 48 CFR 2009.570-2 in the activities covered by this clause.

(c) Work for others.

(1) Notwithstanding any other provision of this contract, during the term of this contract, the contractor agrees to forego entering into consulting or other contractual arrangements with any firm or organization the result of which may give rise to a conflict of interest with respect to the work being performed under this contract. The contractor shall ensure that all employees under this contract abide by the provision of this clause. If the contractor has reason to believe, with respect to itself or any employee, that any proposed consultant or other contractual arrangement with any firm or organization may involve a potential conflict of interest, the contractor shall obtain the written approval of the contracting officer before the execution of such contractual arrangement.

(2) The contractor may not represent, assist, or otherwise support an NRC licensee or applicant undergoing an NRC audit, inspection, or review where the activities that are the subject of the audit, inspection, or review are the same as or substantially similar to the services within the scope of this contract (or task order as appropriate) except where the NRC licensee or applicant requires the contractor's support to explain or defend the contractor's prior work for the utility or other entity which NRC questions.

(3) When the contractor performs work for the NRC under this contract at any NRC licensee or applicant site, the contractor shall neither solicit nor perform work in the same or similar technical area for that licensee or applicant organization for a period commencing with the award of the task order or beginning of work on the site (if not a task order contract) and ending one year after completion of all work under the associated task order, or last time at the site (if not a task order contract).

(4) When the contractor performs work for the NRC under this contract at any NRC licensee or applicant site,

(i) The contractor may not solicit work at that site for that licensee or applicant during the period of performance of the task order or the contract, as appropriate.

(ii) The contractor may not perform work at that site for that licensee or applicant during the period of performance of the task order or the contract, as appropriate, and for one year thereafter.

(iii) Notwithstanding the foregoing, the contracting officer may authorize the contractor to solicit or perform this type of work (except work in the same or similar technical area) if the contracting officer determines that the situation will not pose a potential for technical bias or unfair competitive advantage.

(d) Disclosure after award.

(1) The contractor warrants that to the best of its knowledge and belief, and except as otherwise set forth in this contract, that it does not have any organizational conflicts of interest as defined in 48 CFR 2009.570-2.

(2) The contractor agrees that if, after award, it discovers organizational conflicts of interest with respect to this contract, it shall make an immediate and full disclosure in writing to the contracting officer. This statement must include a description of the action which the contractor has taken or proposes to take to avoid or mitigate such conflicts. The NRC may, however, terminate the contract if termination is in the best interest of the Government.

(3) It is recognized that the scope of work of a task-order-type contract necessarily encompasses a broad spectrum of activities. Consequently, if this is a task-order-type contract, the contractor agrees that it will disclose all proposed new work involving NRC licensees or applicants which comes within the scope of work of the underlying contract. Further, if this contract involves work at a licensee or applicant site, the contractor agrees to exercise diligence to discover and disclose any new work at that licensee or applicant site. This disclosure must be made before the submission of a bid or proposal to the utility or other regulated entity and must be received by the NRC at least 15 days before the proposed award date in any event, unless a written justification demonstrating urgency and due diligence to discover and disclose is provided by the contractor and approved by the contracting officer. The disclosure must include the statement of work, the dollar value of the proposed contract, and any other documents that are needed to fully describe the proposed work for the regulated utility or other regulated entity. NRC may deny approval of the disclosed work only when the NRC has issued a task order which includes the technical area and, if site-specific, the site, or has plans to issue a task order which includes the technical area and, if site-specific, the site, or when the work violates paragraphs (c)(2), (c)(3) or (c)(4) of this section.

(e) Access to and use of information.

(1) If, in the performance of this contract, the contractor obtains access to information, such as NRC plans, policies, reports, studies, financial plans, internal data protected by the Privacy Act of 1974 (5 U.S.C. Section 552a (1988)), or the Freedom of Information Act (5 U.S.C. Section 552 (1986)), the contractor agrees not to:

(i) Use this information for any private purpose until the information has been released to the public;

(ii) Compete for work for the Commission based on the information for a period of six months after either the completion of this contract or the release of the information to the public, whichever is first;

(iii) Submit an unsolicited proposal to the Government based on the information until one year after the release of the information to the public; or

(iv) Release the information without prior written approval by the contracting officer unless the information has previously been released to the public by the NRC.

(2) In addition, the contractor agrees that, to the extent it receives or is given access to proprietary data, data protected by the Privacy Act of 1974 (5 U.S.C. Section 552a (1988)), or the Freedom of Information Act (5 U.S.C. Section 552 (1986)), or other confidential or privileged technical, business, or financial information under this contract, the contractor shall treat the information in accordance with restrictions placed on use of the information.

(3) Subject to patent and security provisions of this contract, the contractor shall have the right to use technical data it produces under this contract for private purposes provided that all requirements of this contract have been met.

(f) Subcontracts. Except as provided in 48 CFR 2009.570-2, the contractor shall include this clause, including this paragraph, in subcontracts of any tier. The terms contract, contractor, and contracting officer, must be appropriately modified to preserve the Government's rights.

(g) Remedies. For breach of any of the above restrictions, or for intentional nondisclosure or misrepresentation of any relevant interest required to be disclosed concerning this contract or for such erroneous representations that necessarily imply bad faith, the Government may terminate the contract for default, disqualify the contractor from subsequent contractual efforts, and pursue other remedies permitted by law or this contract.

(h) Waiver. A request for waiver under this clause must be directed in writing to the contracting officer in accordance with the procedures outlined in 48 CFR 2009.570-9.

(i) Follow-on effort. The contractor shall be ineligible to participate in NRC contracts, subcontracts, or proposals therefor (solicited or unsolicited) which stem directly from the contractor's performance of work under this contract. Furthermore, unless so directed in writing by the contracting officer, the contractor may not perform any technical consulting or management support services work or evaluation activities under this contract on any of its products or services or the products or services of another firm if the contractor has been substantially involved in the development or marketing of the products or services.

(1) If the contractor under this contract, prepares a complete or essentially complete statement of work or specifications, the contractor is not eligible to perform or participate in the initial contractual effort which is based on the statement of work or specifications. The contractor may not incorporate its products or services in the statement of work or specifications unless so directed in writing by the contracting officer, in which case the restrictions in this paragraph do not apply.

(2) Nothing in this paragraph precludes the contractor from offering or selling its standard commercial items to the Government.

(End of Clause)

H.2 2052.215-70 KEY PERSONNEL. (JAN 1993)

(a) The following individuals are considered to be essential to the successful performance of the work hereunder:



The contractor agrees that personnel may not be removed from the contract work or replaced without compliance with paragraphs (b) and (c) of this section.

(b) If one or more of the key personnel, for whatever reason, becomes, or is expected to become, unavailable for work under this contract for a continuous period exceeding 30 work days, or is expected to devote substantially less effort to the work than indicated in the proposal or initially anticipated, the contractor shall immediately notify the contracting officer and shall, subject to the concurrence of the contracting officer, promptly replace the personnel with personnel of at least substantially equal ability and qualifications.

(c) Each request for approval of substitutions must be in writing and contain a detailed explanation of the circumstances necessitating the proposed substitutions. The request must also contain a complete resume for the proposed substitute and other information requested or needed by the contracting officer to evaluate the proposed substitution. The contracting officer and the project officer shall evaluate the contractor's request and the contracting officer shall promptly notify the contractor of his or her decision in writing.

(d) If the contracting officer determines that suitable and timely replacement of key personnel who have been reassigned, terminated, or have otherwise become unavailable for the contract work is not reasonably forthcoming, or that the resultant reduction of productive effort would be so substantial as to impair the successful completion of the contract or the service order, the contract may be terminated by the contracting officer for default or for the convenience of the Government, as appropriate. If the contracting officer finds the contractor at fault for the condition, the contract price or fixed fee may be equitably adjusted downward to compensate the Government for any resultant delay, loss, or damage.

(End of Clause)

H.3 ANNUAL AND FINAL CONTRACTOR PERFORMANCE EVALUATIONS

Annual and final evaluations of contractor performance for this task order under this contract will be prepared in accordance with FAR Subpart 42.15, "Contractor Performance Information," normally at or near the time the contractor is notified of the NRC's intent to exercise the contract option. If the multi-year contract does not have option years, then an annual evaluation will be prepared. Final evaluations of contractor performance will be prepared at the expiration of the contract during the contract closeout process.

The Contracting Officer will transmit the NRC Contracting Officer's Representative's (COR) annual and final contractor performance evaluations to the contractor's Project Manager, unless otherwise instructed by the contractor. The contractor will be permitted thirty days to review the document and submit comments, rebutting statements, or additional information.

Where a contractor concurs with, or takes no exception to an annual performance evaluation, the Contracting Officer will consider such evaluation final and releasable for source selection purposes. Disagreements between the parties regarding a performance evaluation will be referred to an individual one level above the Contracting Officer, whose decision will be final.

The Contracting Officer will send a copy of the completed evaluation report, marked "Source Selection Information", to the contractor's Project Manager for their records as soon as practicable after it has been finalized. The completed evaluation report also will be used as a tool to improve communications between the NRC and the contractor and to improve contract performance.

The completed annual performance evaluation will be used to support future award decisions in accordance with FAR 42.1502 and 42.1503. During the period the information is being used to provide source selection information, the completed annual performance evaluation will be released to only two parties - the Federal government personnel performing the source selection evaluation and the contractor under evaluation if the contractor does not have a copy of the report already.

(End of Clause)

SECTION J – List of Documents, Exhibits and Other Attachments

The following attachments were provided under the Base Contract and are applicable to this task order:

- Template Contractor Spending Plan
- Monthly Letter Status Report Instructions for Contracts and Orders
- Billing Instructions Cost Reimbursement Type Contracts
- Organizational Conflicts of Interest