RCloud Tasking Form – Part B: Statement of Requirement (SoR)

Title of Requirement	Eddy diffusion coefficient Redacted under FOI Exemption
Requisition No.	**RQ0000025123**
SoR Version	**0.1**

1.	**Statement of Requirements**
1.1	**Summary and Background Information**

Aim: To improve our ability to carry out rapid Redacted under FOI Exemption hazard assessment modelling in indoor spaces.

This will be done by expanding the usability and applicability of eddy diffusion modelling through an improved understanding of how the eddy diffusion coefficient, *K*, varies in a variety of indoor spaces.

Objectives of this specific work are: To parameterise the eddy diffusion coefficient Redacted under FOI Exemption Redacted under FOI Exemption in large indoor spaces. Then to produce a relationship that can be used to calculate *K* in real scenarios using easy to measure/estimate parameters, e.g. area of openings and wind speed local to the building, number of people in the room and ambient temperature.

The mandated tasks in this contract are to study Redacted under FOI Exemption people movement in large indoor spaces. It is anticipated that techniques developed in this project could equally be applied to other indoor spaces.

Background

Mathematical models are used to calculate the exposure of individuals to airborne toxic material in indoor environments to provide advice to protect civilian populations. Redacted under FOI Exemption

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Eddy diffusion models provide spatially resolved concentrations/exposures while being simple to set up and quick to run. These models have advantages over simpler spatially averaged approaches, which can significantly over or under-predict exposures.

In eddy diffusion models, a single parameter governs mixing, the eddy diffusion coefficient, *K*. Some relationships that enable the eddy diffusion coefficient to be calculated have been described in the open literature. However, approaches taken to derive these relationships have so far been simplistic.

It is proposed that work is undertaken to produce new relationships between the eddy diffusion coefficient and room ventilation parameters based on fundamental fluid dynamics. These relationships would take account of a range of processes that affect mixing such as the movement of people, heat sources and thermal stratification.

Improved eddy diffusion modelling would enable more accurate and timely prediction of the hazard from airborne toxic material in a range of indoor environments of interest for national security.

	Examples of the eddy diffusion models used by Dstl and the existing relationships used to calculate the eddy diffusion coefficient are given in Foat et al. (2020) (https://doi.org/10.1016/j.buildenv.2019.106591).
1.2	**Requirement**
	Tasks 1. To undertake a study to parameterise the eddy diffusion coefficient, *K*, in the large open spaces Redacted under FOI Exemption Redacted under FOI Exemption o By using experimentation (a water-tank model) and fluid dynamics theory, produce a relationship to calculate *K* Redacted under FOI Exemption o The relationship is to take account of changes in the key parameters, which control eddy diffusion in the space. The contractor will suggest what the key parameters are in their proposal. o Static heat sources representative of people and solar loading are to be included. o The effect of [redacted] movement does not need to be considered. o Deliverables from Task 1: D1 to D7. 2. To undertake a study to parameterise the effects of people movement on the eddy diffusion coefficient, *K*, in large (i.e. approximately greater than 1000 m^3) indoor spaces. o By using experimentation (a water-tank model) and fluid dynamics theory, produce a relationship for the additional (i.e. in addition to that produced the room ventilation) eddy diffusivity produced by people movement in a large indoor space. o The large indoor space should be representative of a mechanically ventilated space. o Include the movement of multiple people (i.e. hundreds or thousands of people). o ▪ The number of people should be representative of peak (rush-hour) and off-peak Redacted under FOI Exemption o Deliverables from Task 2: D1 to D7. **General points that apply to both tasks** 1. The parameterisations are to be physics based, as opposed to purely empirical. 2. The source of contaminant (the spread of which will be used to calculate the eddy diffusion coefficient) could be anywhere in the space, but we are primarily interested in releases in the lower part of the room (below 2 m). 3. The contaminant source is to be a passive release, both in terms of buoyancy and momentum. Either a continuous or an instantaneous release can be considered. 4. The research can explore non-isotropic and spatially varying eddy diffusion coefficients. o However, *K* would ideally be isotropic and globally constant. o Demonstrate how the simplifying assumption of isotropic or globally constant *K* would affect the concentration predictions. 5. The quality of the relationship must be assessed using an experimental data set that was not used to develop the relationship. 6. Produce relationships for *K* that could be used in real scenarios using easy to measure/estimate parameters, e.g. area of openings and wind speed local to the building, number of people in the room, ambient temperature. **Deliverables -** The details of all seven deliverables are given in the table in Section 1.6.

1.3	**Options or follow on work** *(if none, write 'Not applicable')*
	1. In addition to the Research and Development Services detailed above, the Contractor hereby grants to the Authority the irrevocable option to undertake additional Research and Development Services with a maximum limit of liability of £250k in accordance with the terms and conditions set out in this contract, it being agreed that the Authority has no obligation to exercise such options. 2. The Authority shall have the right to exercise the options detailed by 15th Apr 2025. Should the Authority wish to exercise the option, the Authority's Representative (Commercial Services) shall approach the Contractor requesting a quotation for the additional Research and Development Services. Following agreement of pricing and dates, the Authority's Representative (Commercial Services) will issue a formal Contract Amendment. The Authority shall not be obliged to exercise the option(s).
1.4	**Contract Management Activities**
1.5	**Health & Safety, Environmental, Social, Ethical, Regulatory or Legislative aspects of the requirement**

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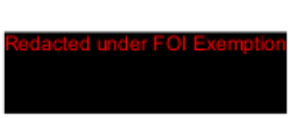
1.6	Deliverables & Intellectual Property Rights (IPR)				
Ref.	**Title**	**Due by**	**Format**	**Expected classification (subject to change)**	**What information is r deliverab**
D1	Start-up meeting. (Face-to-face at Contractor's premises)	In 1st month of contract.	Presentation (PowerPoint or PDF)	Official	Presentation to include but • Detailed plans • Review of required deliver • Risks/issues
D2	Final meeting. (Face-to-face at Contractor's premises)	In final month of contract	Presentation (PowerPoint or PDF)	Official	Presentation to include but • Discussion of deliver • Recommendation fo
D3	Regular meetings (MS Teams or Zoom meeting)	Fortnightly	Presentation (PowerPoint or PDF)	Official	Informal presentations to in limited to: • Update on technical progr schedule. • Commercial aspects. • Review of deliverables. • Risks/issues. The fortnightly meetings ca updates if little has changed meeting.
D4	Experimental data	By end of contract	See details on right	Official	Experimental data for a sub (.csv, txt file, or equivalent)

					Include details of the set-up Authority can fit an eddy dif data (MS Word, PDF or Pov Include details of the set-up can use this for CFD model Word, PDF or PowerPoint).
D5	Relationship to calculate the eddy diffusion coefficient in a generic terminus train station concourses and due to people movement	By end of contract	See D1 & D7	Official	Relationship to calculate *K* for each of the cases Redacte [redacted] in r using easy to measure/estir Delivered as part of the tech and the final meeting (D2)
D6	Application of deliverable D5	By end of contract	See D1 & D7	Official	Demonstration of deliverabl an eddy diffusion model for interest to the Authority Delivered as part of the tech and the final meeting (D2)
D7	Technical report	By end of contract	MS Word or PDF	Official	Report to include, but not lir • Details of the experimenta • Summary of results from t • Details of how the parame relationships for the eddy di have been developed • Details of how the relation been validated using the ex • Examples of the calculate coefficient being used in an model for a scenario of inter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1.7	Deliverable Acceptance Criteria
	The report will be reviewed by the project manager and the work package technical lead against the stated requirements. The report should be written in good English.

2	Evaluation Criteria
2.1	Method Explanation
	This Tender will be evaluated on the basis of: Most Economically Advantageous Tender (MEAT) – Highest combined technically and financially scored Tender and meets the Commercial and Technical Criteria as detailed below. This is a comparative score and the scoring method is worked out using the ratio and calculation below. The optimum is the highest technical score and lowest price, this together would get the highest total score. This shall be calculated using the Weighted Value for Money Index, where a weighting of 60% shall be applied to technical score, and 40% shall be applied on firm price. The overall tenderers score is calculated as follows: $$Tenderers\ Score = \frac{Non-Cost\ Score\ \frac{Technical\ weight(60\%)}{Firm\ Price\ weight(40\%)}}{Firm\ Price} \text{ x } 10{,}000 *$$ *The unit denomination is a multiplier used to ensure that the Tenderers scores are presented as double digit numbers, rounded to 2 decimal points. A worked example can be found below. **In the event of two or more Tenders being awarded the same total score the Authority shall choose the Tender with the highest Technical score.** Tenderers are to provide responses to all award criteria questions. Please note it is vital that the evaluation scoring guide is taken into account when considering a response to a particular question.

Technical Score calculation Example

An illustrative example is outlined below for reference purposes only:

The following evaluation calculation shall be used for the Tenderers' Technical responses. The score for each question shall be added together to give the Tenderer their final score out of 100. An example of this calculation can be found below.

Tenderers Technical Score = Sum of (Marks Awarded x Weighting)

Question	Marks Awarded	Weighting %	Total Score
1	50	50	25
2	75	12.5	9.38
3	100	37.5	37.5
Tenderers Technical Score			**71.88**

Tender Evaluation Result Example

$$\frac{71.88 \ \frac{Technical\ weight(60\%)}{Firm\ Price\ weight(40\%)}}{£100{,}000} \text{ x } 10{,}000 = 60.94 \text{(Final score)}$$

Notes:

- The Tenderer with the highest final score shall be awarded the contract.
- Scores shall be rounded to 2 decimal places

2.2	Technical Evaluation Criteria

The proposals will be evaluated by suitably qualified personnel and will be evaluated both technically and commercially according to the criteria below.

Technical Compliance

Criteria	**Pass (Compliant) / Fail (Non-Compliant)**
The proposal must include both experimental and theoretical components.	Pass / Fail
The Centre (research group or research centre etc.) must have proven expertise in indoor airflows & dispersion.	Pass / Fail
The Centre must have access to experimental capabilities/facilities for the study of dispersion in indoor spaces.	Pass / Fail
The Centre must have experience in the experimental and theoretical techniques they are proposing.	Pass / Fail

A fail on any of the above questions will result in your proposal being excluded from further evaluation and consideration

ID	Criteria	Score	Weighting %
1	Scientific Quality: • Please demonstrate in your proposal how your chosen methodology is likely to deliver the required output.	0-100	50
2	Project Management/Risk Management: • The proposal should include a project plan for the work. • The proposal should include a list of all key risks and for each risk, a risk management and mitigation plan. • The proposal should state whether government furnished equipment or information (GFE, GFI) is required. Ideally no GFE or GFI will be required	0-100	12.5
3	The Centre (research group or research centre etc.). This section should address the following: • Please demonstrate in your proposal how the Group's or Centre's expertise aligns with the topic of the call. • Please demonstrate in your proposal how the Centre is leading in the proposed field. Including a description of the Centre's contribution to the UK and international research landscape in this field.	0-100	37.5

Marking Scheme: No intermediate scores will be permitted. Each individual question will be evaluated against the following scoring mechanism. Any individual scores of 0 will result in a fail.

Rating	Characteristic	Score
Excellent	The response addresses all elements of the requirement, or exceeds it, and provides a comprehensive, unambiguous and thorough explanation of how the requirement will be fulfilled.	100
Good	The response addresses all of the elements of the requirement and provides sufficient detail and explanation of how the requirement will be fulfilled.	75
Adequate	The response addresses the majority of elements of the requirement but is weak in some areas and does not fully detail or explain how the requirement will be fulfilled.	50
Inadequate	The response does not address or explain how the requirement will be fulfilled and fails to demonstrate the ability to meet the requirement.	0

2.3 Commercial Evaluation Criteria

The commercial evaluation shall be based on the following Pass / Fail questions

Criteria	**Pass (Compliant) / Fail (Non-Compliant)**
Has the bidder submitted one full proposal (Technical and Commercial) including all price detail, and has the bidder submitted one Full Technical proposal which excludes all commercial price information?	Pass / Fail
Has the bidder submitted the proposal as a Firm price?	Pass / Fail
Are Labour rates and price as per the rates uploaded to RCloud?	Pass / Fail

	Has the bidder submitted one completed copy of RCloud Form Part C – Task Response Form including completed SRGS at Annex A and DEFFORM 711 at Annex B?	Pass / Fail

A fail on any of the above questions will result in your proposal being excluded from further evaluation and consideration