

TREASURES RESEARCH CENTRE FOR RESIDUE AND TOXIC INDUSTRIAL WASTE MANAGEMENT

1ST OPEN GRANT CALL

REQUEST FOR PROPOSALS (RFP) ON INNOVATIVE SOLUTIONS FOR LANDFILL TRANSFORMATION AND TOXIC INDUSTRIAL WASTE MANAGEMENT

Research Area	Innovative Solutions for Landfill Transformation and Toxic Industrial Waste Management
Publication Date	Wed, 17 June 2026, 10am
Closing Date and Time	Mon, 31 August 2026, 5pm
Proposal Submission	Applications shall be made via email to treasures@nea.gov.sg Note: Proposals submitted after the closing date and time will not be considered.
Instructions and Format of Submission	Please refer to the following website: https://www.ntu.edu.sg/treasures/callforproposals

REQUEST FOR PROPOSALS (RFP) ON INNOVATIVE SOLUTIONS FOR LANDFILL TRANSFORMATION AND TOXIC INDUSTRIAL WASTE MANAGEMENT

BACKGROUND

1. Singapore faces a critical waste management challenge with Semakau Landfill (SL) projected to reach full capacity by 2035. To address this, the National Environment Agency (NEA), in collaboration with Nanyang Technological University (NTU), has established a research centre, **TREASURES** (Towards Resource Efficiency And Sustainability for URban EnvironmentS). The centre serves as an open, multi-stakeholder platform supporting science, technology and engineering innovation into residue and toxic industrial waste management to achieve Singapore's net zero landfill goal and advance the vision to transform Semakau Landfill from a disposal site into a future-ready resource recovery hub that prioritises resource recovery and value creation over permanent disposal.

2. In Singapore, incinerable waste (IW) that cannot be recycled are disposed of at waste-to-energy facilities. This produces two key categories of incineration ash: Incineration Bottom Ash (IBA), the main residue remaining after incineration, and the finer Incineration Fly Ash (IFA) captured by flue gas treatment systems. In addition, Non-Incinerable Waste (NIW) — comprising Treated Toxic Industrial Waste (TTIW) processed by licensed toxic industrial waste collectors, alongside sludge and other non-incinerable materials — is disposed of at Semakau Landfill. These wastes present both challenges and opportunities for recovery and valorisation. TREASURES seeks innovative solutions to address these waste streams and residues through research and innovation.

3. TREASURES covers four interdisciplinary research nodes:

- i. Node 1: Waste Flow & Analytics
- ii. Node 2: Landfill Transformation
- iii. Node 3: Toxic Industrial Waste Solutions
- iv. Node 4: Risk Assessment & Standards Development

SCOPE OF RFP

4. This RFP is an open grant call for R&D proposals to address key scientific and technological challenges and develop innovative solutions for Research Node 2 (Landfill Transformation) and Research Node 3 (Toxic Industrial Waste Solutions). Applicants may submit one or more proposal(s) addressing either or both of the focus areas. The examples and research directions provided in this RFP are intended to illustrate the types of challenges that TREASURES seeks to address and are not

intended to be exhaustive. Applicants are encouraged to propose novel science and technology solutions that align with the objectives of the relevant focus area and demonstrate clear potential for impact.

5. Projects should demonstrate clear scientific or technological innovation and are expected to advance beyond routine optimisation or deployment of commercially available solutions. Proposals should generate new knowledge, technologies or capabilities with a credible pathway towards translation and practical implementation in Singapore.

Focus Area 1: Landfill Transformation

6. This focus area aims to develop innovative science and technology solutions that enable material and resource circularity through innovative applications of residue streams, as well as reimagining landfill design, structure, operations, and methods towards a future of reduced reliance on disposal at Semakau Landfill. The research should focus on solutions to repurpose and/or valorisation of waste residues, especially on IFA, NIW, and mixed materials (MM) (i.e. mixture of NIW and incineration ash accumulated at SL) for diversion from landfill. Research on IBA is a lower priority for this node. While proposals addressing any or all relevant residue streams are welcomed, applicants should clearly justify the significance, novelty and potential impact for the selected waste stream(s). Proposed projects should develop cost-effective solutions that enable safe and beneficial applications, including but not limited to structural and non-structural construction materials, coastal protection materials, land reclamation materials, and other value-added products.
7. One central challenge across all residue streams is the management of persistent organic pollutants and heavy metallic elements. The potential for transport and deposition of the pollutants via atmospheric and aqueous pathways from waste-derived materials, and the amounts, characteristics, and time-dependent evolutions of pollutants in the materials as well as their mobility are not well understood yet. Where relevant to the proposed application, projects should investigate the occurrence, characteristics and long-term fate of contaminants, and propose or develop treatment or mitigation strategies that ensure environmental protection, public health and safety, and support broader utilisation of such waste-derived materials.
8. The primary objectives of this focus area are as follows (while projects need not address all waste/residue streams or application types, they are expected to contribute to one or more of the listed objectives):

- i. Development of cost-effective treatment, recovery or processing technologies that enable the reuse of waste-derived materials from IFA, NIW, and MM (IBA is of lower priority) that demonstrate clear application pathways.
- ii. Development and validation of technologies that enable waste-derived materials to meet relevant environmental and performance requirements for structural, non-structural construction, or other value-added applications.
- iii. Characterisation of contaminants and development of mitigation or treatment approaches that facilitate safe and sustainable utilisation of waste-derived materials.
- iv. Development of pilot scale, field scale or accelerated testing methodologies that evaluate the long-term environmental performance and mechanical integrity of treated waste-derived materials.
- v. Development of scalable technologies or engineering solutions that improve the recovery, processing and/or utilisation of MM from Semakau Landfill.

Focus Area 2: Toxic Industrial Waste (TIW) Solutions

9. This focus area aims to develop innovative, cost effective and resource efficient science and technologies that reduce, recover, and valorise toxic industrial waste (TIW) streams and residues. Current approaches focus primarily on safe disposal, often generating significant carbon emissions and requiring substantial fixation materials. Research should therefore target innovative treatment, recovery or process technologies that minimise TIW generation, enable resource recovery, convert low-value residues into useful products for viable markets, and provide low carbon treatment pathways, thereby transforming waste management costs into opportunities for value creation.
10. One central challenge across TIW streams is the complexity and variability of residues arising from advanced manufacturing processes. Conventional methods such as cement/lime stabilisation or incineration increase waste volumes and/or carbon emissions, while recovery of valuable metals, minerals, and solvents remains inefficient due to rapidly evolving industrial processes and the heterogeneous nature of TIW – containing multiple hazardous components and persistent organic pollutants. Projects should address these challenges by developing alternative conversion technologies, advanced stabilisation methods, and efficient recovery systems, in tandem with rigorous safety standards and research collaboration with industry to accelerate adoption and deployment at scale.

11. The primary objectives of this focus area are as follows (while projects need not address all TIW streams or application types, they are expected to contribute to one or more of the listed objectives):
 - i. Development of innovative solutions that minimise TIW generation in major industries and maximise resource recovery within industrial processes.
 - ii. Development of low carbon alternatives to incineration, such as torrefaction, low temperature pyrolysis, slagging gasification, bioprocesses, and hydrothermal treatment systems (non-exhaustive), to reduce emissions while producing reusable byproducts.
 - iii. Development of advanced treatment or stabilisation technologies beyond conventional cement/lime methods that reduce waste volumes while ensuring environmental safety and complying with regulatory requirements.
 - iv. Development of technologies for recovering valuable metals, critical minerals or reusable chemicals from toxic industrial sludge and treatment residues.
 - v. Development of solutions to convert low value residues into useful materials for viable markets.

12. Priority TIW streams refer to those that are landfilled either directly or after treatment, as well as those that generate treated residues (e.g. solids/sludges and liquid wastes containing dissolved salts or inorganic constituents) subsequently disposed of at landfill. These include, but are not limited to:
 - i. Carbon soot spent metallic catalysts, and oil contaminated filter cakes from the petrochemical industry.
 - ii. Residues with precious metals and valuable materials from TIW generators or collectors.
 - iii. Hydrogen fluoride, calcium fluoride sludge, and acid/alkaline waste streams from the semiconductor industry.
 - iv. Other toxic industrial waste streams where applicants can demonstrate a compelling scientific rationale and significant potential for waste reduction, resource recovery or value creation.

FUNDING SUPPORT AND ELIGIBILITY

13. TREASURES offers four funding modalities based on project maturity and scope:

Modality	Scope & Purpose	Funding Quantum	Project Duration
Seed	Proof-of-Concept, feasibility studies, and quick sense-making.	Up to S\$90,000	up to 12 months
Catalyst	Accelerate innovation in strategic areas; novel ideas with potential for scale-up.	Up to S\$500,000	up to 2 years
Partnership	Address specific industry challenges; focus on translation and implementation (Technology Readiness Levels 5–8 – refer to Appendix A).	No Cap (Scale dependant)	No requirement, typically up to 4 years
Core	Long-term strategic challenges addressing fundamental knowledge gaps.	No Cap	No requirement, typically up to 4 years

*Note: For **Partnership projects**, active industry involvement is mandatory – industry partners must demonstrate meaningful collaboration through either a Research Collaboration Agreement and/or in-kind contributions to the project. For **Seed, Catalyst and Core projects**, industry participation is strongly encouraged to strengthen translational potential and maximise project impact. Companies with*

local presence are also encouraged to participate, preferably in collaboration with local Institutes of Higher Learning (IHLs) and Research Institutes (RIs).

14. This tiered funding framework balances meeting needs for emerging opportunities and early-stage innovation with major investments and development.
15. This RFP is open to all IHLs, RIs, and companies, and will support projects that advance novel, practical, scalable solutions for residue and toxic industrial waste management, with research activities conducted in Singapore to build local capabilities and strengthen collaboration across academia, industry, and government agencies. Collaborative proposals involving multiple institutions and/or industry partners are encouraged where they strengthen the scientific excellence, translational potential or implementation pathway of the project.
16. The funding support for successful proposers is indicated below:

S/N	Type	Maximum Direct Costs (DC) support
1	Public Sector Entities	100%
2	Singapore-based small and medium enterprises (SMEs), start-ups, and not-for-profits	70%
3	Singapore-based large local enterprises (LLEs)	50%
4	non-Singapore entities based in Singapore (including non-Singapore not-for-profits)	30%

17. Funding of private entities for research projects (of total project budget >\$500,000) and test-bedding/demonstration/scale-up projects (of total project budget >\$2M) is conditional on collaboration with a public sector performer. Funding for non-Singapore entities is conditional on the appointment of a Singapore Technology Licensing Officer (STLO). More details can be found in **Annex A (Guidelines on Funding Private Sector Entities)**.
18. Indirect costs will not be supported for all private sector entities. Indirect costs shall be funded at up to 30% of qualifying direct research costs for public sector

entities. The definition of indirect costs is given in **paragraph 21 of Annex B (Guidelines for the Management of Research Grants)**.

19. Further details on funding administration, disbursement, required records and audits, reporting requirements for approved and accepted projects amongst other terms and conditions can be found in **Annex B (Guidelines for the Management of Research Grants)** and **Annex C (Research Grant Terms and Conditions)**.

PROPOSAL REQUIREMENTS AND SUBMISSION

20. Proposals shall be submitted through email to treasures@nea.gov.sg before the closing date and time, by filling in **Annex D.1 (Simplified TREASURES Proposal Template) for seed and catalyst funding applicants, OR Annex D.2 (Full TREASURES Proposal Template) for core and partnership funding applicants**. Applicants are to refer to: <https://www.ntu.edu.sg/treasures/callforproposals> for detailed submission instructions and templates for submission of the proposal.
21. Together with **Annex D.1 or Annex D2**, filled-in copies of **Annex E (CV template)** should be submitted for each principal investigator, co-principal investigator, applicant, co-applicant, or project team member.
22. Applicants from private sector entities are required to fill in **Annex F (Additional Declaration Form for Private Sector Applicant(s))**, as part of the proposal application.

EVALUATION CRITERIA

23. Proposals will be evaluated against the following criteria:

S/N	Evaluation Criterion	Weightage (%)
1	Effectiveness in achieving desired outcomes a) Relevance of proposed scope b) Technical feasibility of the proposed methodologies c) Innovativeness of the proposed methodologies	25
2	Competencies of the research team a) Track record of Principal Investigator(s) and collaborators	15

	b) Relevant R&D capabilities and expertise of the Principal Investigator and team members	
3	Project management, budget reasonableness, and cost-effectiveness of proposed solution a) Clarity of proposed milestones, deliverables, and implementation schedule b) Reasonableness of proposed budget c) Cost-effectiveness of proposed solution	30
4	Translation pathway and commercialisation a) Clear pathway for scaling and adoption b) Potential for industry collaboration and partnerships c) Commercial viability and alignment with national resource circularity and sustainability goals	30
Total Score		100

24. The full proposal will be submitted for review to TREASURES' review panel of stakeholders and relevant technical experts, to enable comprehensive assessment and informed decision-making, unless applicants specifically indicate that there may be commercial, research, or other sensitivities involved.

25. All reviewers will declare potential conflicts of interest before evaluating proposals. Reviewers who have declared a conflict of interest shall receive only an executive summary to ensure broad alignment with TREASURES' objectives and they will be recused from the evaluation process.

CONTACT

26. For **general enquiries** regarding the grant call and proposal submission, please contact treasures@nea.gov.sg.

27. For **technical enquiries** and **potential collaboration opportunities** related to the research focus areas, please contact the respective Focus Area Research Leads:

Focus Area	Research Leads and Email Contacts
Landfill Transformation	Professor HE Jianzhong; jianzhong.he@nus.edu.sg Associate Professor GENG Guoqing; ceegg@nus.edu.sg
Toxic Industrial Waste Solutions	Professor ZHOU Yan; ZhouYan@ntu.edu.sg Associate Professor Grzegorz LISAK; g.lisak@ntu.edu.sg

28. Applicants should refer to <https://www.ntu.edu.sg/treasures/callforproposals> as the primary source of information.
29. All applicants will be notified in writing of the outcome of their proposals.

Appendix A

Definition of Technology Readiness Levels (TRLs)

TRLs	Description
TRL 1	Basic principles observed and reported
TRL 2	Technology concept and/or application formulated
TRL 3	Analytical and experimental critical function and/or characteristic proof of concept
TRL 4	Component and/or breadboard validation in laboratory environment
TRL 5	Component and/or breadboard validation in relevant environment
TRL 6	System/subsystem model or prototype demonstration in a relevant environment
TRL 7	System prototype demonstration in an operational environment
TRL 8	Actual system completed and qualified through test and demonstration
TRL 9	Actual system proven through successful mission operations