The Massachusetts Toxics Use Reduction Institute's

Academic Year 2021/2022 Request for Proposals

Academic Research Grants

Introduction

The Toxics Use Reduction Institute (TURI) is pleased to invite proposals from University of Massachusetts (UMass) faculty for support under TURI's Academic Research program. This program provides research funding to UMass faculty and their graduate students on a competitive basis, encouraging university and industry partnerships. UMass faculty from any of the five UMass campuses (Amherst, Boston, Dartmouth, Lowell and Worcester) are eligible for this research funding.

Each year the number of academic research grants awarded is contingent upon the amount of funding TURI receives from the Massachusetts legislature, and the quality of the proposals received. Typically, this has resulted in TURI funding between 2 to 4 research projects annually. Since 1992, over 100 research projects from the various UMass campuses have been supported by TURI.

The goal of this funding is to promote research for the identification, evaluation, and development of safer, technically feasible and commercially viable alternatives to identified toxic chemicals currently in use by Massachusetts companies. For more information about toxic chemicals used in Massachusetts, visit the following TURI website: (http://turadata.turi.org/).

TURI offers its expertise in chemical hazard assessment to help guide chemical and material choices for research projects. Every year we offer training designed to 1) help research teams better understand the inherent hazards associated with the chemicals they are considering to work with, and 2) describe the resources that are available to assess the environmental, health, and safety impacts of chemicals. This training, entitled "Beyond the SDS", is offered at our Boott Mills location in Lowell in the spring and fall of each year for current and prospective research teams, as well as the general UMass community. It is likely that this training may be held virtually during the Fall 2021 semester. A recorded webinar of this training is available at www.turi.org/beyondSDS.

Research Focus Areas

TURI seeks proposals for research focus areas that have relevance to Massachusetts companies that use toxic chemicals. This includes research of new processes, materials and/or chemicals that can significantly reduce or eliminate the use of toxic chemicals for specific applications. TURI does not fund research for end-of-pipe technologies, such as pollution control, treatment or remediation. Research proposals are encouraged for safer alternatives to any toxic chemicals used in Massachusetts. Examples of research topics of interest to TURI include:

1. Industry-specific research projects previously identified by TURI. These companies would serve as industry partners for any faculty proposals submitted to address the following identified research projects. More detailed descriptions are provided in "Appendix A: Research Project Descriptions".

- Ideal Tape (Lowell, MA): Research safer solvents to replace the use of toluene in their manufacturing of adhesives.

- Johnson Matthey (Devens, MA): Research safer solvents to replace the use of methylene chloride in their manufacturing of active pharmaceutical ingredients.

- Raytheon Technologies: (Andover, MA): Research safer solvents to replace the use of methylene chloride in their conformal coating stripping operations.

- Transene Company (Danvers, MA): Research safer chemicals to replace the use of PFAS as a surfactant.

2. Research proposals are also encouraged for safer alternatives to any toxic chemicals used in Massachusetts. This includes the toxic chemicals listed below, as well as any other toxic chemicals used in Massachusetts.

Toxic Chemical	Relevant Applications
Per- and polyfluoroalkyl substances (PFAS)	Food packaging, water and stain resistant fabrics (e.g. carpets), non-stick products, waxes, fire-fighting foams, fume suppressants, etc.
Engineered nanomaterials	Carbon nanotubes/fibers (highest priority), fullerenes, quantum dots, and metal nanoparticles used in a variety of applications such as energy storage, conductive plastics, carpets, antimicrobial, etc.
Quaternary ammonium compounds	Disinfectants, surfactants, fabric softeners, etc.
Cadmium and cadmium compounds	Electroplating, wiring devices, etc.
Trichloroethylene (TCE)	Metal degreasing, laminated textiles, etc.
Formaldehyde	Embalming, resins, electronics, etc.
Hexavalent chromium (Cr+6)	Plating, anti-corrosion coatings, etc.
Methylene chloride	Metal degreasing, paint stripping, adhesives, etc.
n-Propyl Bromide (nPB)	Metal degreasing, dry cleaning, adhesives, etc.
Hydrogen fluoride (HF)	Titanium or silicon etching, metal pickling, etc.
Cyanide compounds	Electroplating, etc.
Dimethylformamide (DMF)	Textile coatings, electronics components, etc.
Toluene Diisocyanates (TDI)	Polyurethane foam, surface coatings, etc.
Toluene	Nail polish, adhesives, paint thinner, etc.
Methyl ethyl ketone (MEK)	Coatings, films, paint remover, etc.
Tetrahydrofuran	Column chromatography, PVC cement, etc.
Perchloroethylene (perc)	Dry cleaning, degreasing, etc.
Sodium hydroxide, sulfuric acid, hydrochloric acid	Wastewater treatment

Research Project Budget

The maximum funding amount for each research project is $25,000 for a one year project, or $35,000 for a two year project. This program emphasizes the importance of graduate student engagement, and the bulk of the funding provided is intended to compensate graduate students actively involved in the research. Funding for the second year is contingent upon funding availability and adequate performance during the first year. Strong preference will be given to proposals where the proposed TURI funded research will be the same topic as the graduate student's masters thesis or doctoral dissertation.

Budgets must be developed for proposed research projects, and must consider the following:

- Graduate student stipend and tuition/fees should be included. For one year projects, TURI prefers to fund full time (18 hrs/week) research assistants (RA), who will be eligible to receive a full time RA stipend and full tuition waiver[1]. For two year project proposals, the preference is to use a single graduate student with a half time RA contract for a two year period.
- Graduate student time during non-academic year periods is optional and may be included (e.g., during winter and spring breaks and the period from the end of the academic year to the end of TURI's fiscal year, June 30th). TURI offers hourly rates for graduate students that range from $12 to $16, depending on the academic level and experience of the graduate student. The total budget allocated for non-academic periods should **not exceed $4,000**.
- Costs for graduate students that elect health care coverage (11.15% of student stipend)
- Undergraduate students can provide additional assistance to the research on an hourly contract basis. These costs should **not exceed $3,000 per year**.
- Testing services, materials, equipment, and/or supplies, should **not exceed a total of $3,000.** All purchase requests must be submitted to TURI by May 1, 2022.
- For research projects that require the identification of safer solvents or solvent blends, an additional **$1,200** may be included in the budget for a license of the Hansen Solubility Parameter in Practice (HSPiP) software.
- Travel expenses and non-student compensation (e.g., consultant, faculty, and post-doctoral) are not typically allowed.
- Because this research funding is an internal source for any UMass Lowell recipient, there has been no requirement to include the UMass Lowell RA Tuition Contribution of $8,000 throughout the history of this grant program. Therefore, this amount does not need to be incorporated into your budget estimate.

Responsibilities of Researcher

Researchers selected to receive this funding award are responsible for the following:

[1] Student stipends are paid according to UMass "TA/RA/GA Payscale" for the current academic year available at: https://www.uml.edu/HR/Payroll-Services/ta-ra-ga-payscale.aspx

- Attendance at a kick-off meeting, to be held: 1) in person at or near the research facilities of the funding recipient or the industry partner or 2) remotely via video conference call, preferably during early September 2021;
- Attendance of the "Beyond the SDS" training class for faculty, graduate students, and undergraduate students on the proposed research team. TURI prefers that research teams receive this training no later than the end of the Fall 2021 semester;
- For research that involves the use of nanomaterials, additional laboratory safety training will be required, along with a commitment to adhere to the *General Safe Practices for Working with Engineered Nanomaterials in Research Laboratories* which can be accessed at: http://www.cdc.gov/niosh/docs/2012-147/pdfs/2012-147.pdf;
- Participation in weekly project status in-person meetings or conference calls with TURI staff. These status meetings may include the industry partner when appropriate;
- PI will review and approve all student time submittals for RA contract, graduate student work during non-academic periods, and undergraduate hourly contract.
- Presentation of one interim project update, to be conducted in Lowell or via webinar for TURI staff and other invited guests (target timeframe: March - April 2022). This is expected to consist of a 30-minute presentation (typically conducted by the students) followed by approximately 15 minutes of questions and answers; and
- A draft journal article, due June 30, 2022, that includes a description of the research objectives, research plan, discussion of results, description of the chemical hazard review associated with the chemicals/materials studied, and suggestions for future research. TURI and the PI will work together to determine the appropriate target journal for the article. Preference will be given to journals that provide open access for free or for a nominal fee. In the event that intellectual property is developed as part of the research, the journal article must provide as much detail about the research methods and results as possible without directly impacting intellectual property rights. If the paper is not accepted by the journal, then it will be made available to the public via TURI's website.

Specific Requirements for Research with Industry Partners

For the initial year of funding under this program, the research will be supported solely by University of Massachusetts and TURI funds. In order to maintain confidentiality for both researchers and their industry partners, a non-disclosure agreement (NDA) will be executed by the University of Massachusetts and the industry partner to cover information exchanged during the research process, and a material transfer agreement (MTA) will be executed by University of Massachusetts and the industry partner to cover any materials exchanged during the research process. Management of intellectual property developed as a result of the research shall be through the University of Massachusetts Lowell Office of Technology Commercialization (OTC) (https://www.uml.edu/research/otc/), or its equivalent at other University of Massachusetts campuses. If the UMass Lowell OTC relinquishes the intellectual property, then the industry partner will then have the option to control the intellectual property.

Industry partners are encouraged to support/fund continued research in subsequent years. Any such sponsorship would be under a separate agreement. The intent is to have ongoing good faith cooperation between the University of Massachusetts and the industry partner during the research process.

Proposal Instructions

Proposals should not exceed four pages in length (not including Curriculum Vitae and industry letters of support) and should include the following information:

- Project title, toxic chemical to be replaced; target application of the toxic chemical to be replaced (e.g. degreasing, electroplating, coating, etc.);
- Principal Investigator(s), including UMass affiliation and department, and Curriculum Vitae;
- Graduate student(s) to be supported in conducting this research, and their Curriculum Vitae. The proposal should indicate the role of the graduate students within the proposed research, and emphasize the relevant learning aspects of the research;
- Industry partners or other types of partners with letters of support (not required for previously identified projects with companies listed in Appendix A) including their anticipated role and contribution. Industry partner support is typically in-kind, and relates directly to the research project. Examples of industry partner support include providing expert feedback on the research plan and results, providing material samples, identifying pertinent performance requirements, and providing access to production and/or testing equipment;
- Project description, including:
    - The research objectives to be accomplished within the funding period (one or two years). Include an indication of where the research is along the development path (from basic research to commercialization), and anticipated next steps after the initial period of funding. Also, what are the potential impacts to Massachusetts companies and general public if the research objectives are met.
    - Research plan that describes the research activities that will be accomplished in order to achieve the research objectives, including a detailed description of any chemicals or materials that will be used.
    - Information comparing the relevant characteristics of the chemicals being considered in the research. The alternative chemical proposed is expected to be safer than the target chemical it would replace. The successful proposal should include relevant environmental, health, and safety concerns for all chemicals that will be used in the research, and reference the source of those data. A table similar to the following example could be used within the proposal to summarize chemical information. Please note that TURI staff are available for assistance in completing a table similar to the following example.

Chemical	CAS #	Key Environmental, Health, and Safety Concerns (e.g., carcinogen, flammability, aquatic toxicity, corrosive, neurotoxin, etc)	Approximate Cost per Unit
Toxic chemical being replaced			
Chemical(s) to be used in research			

- If studying the use of a chemical or material for which there is little or no environmental, health, and safety data (such as for nanomaterials), thoughtful justification should be presented for why this alternative is to be considered safer than the target chemical or process it would replace. This shall include a discussion of the limitations and uncertainties associated with data. Past proposals have included plans to address chemical data gaps by including some toxicity screening testing or including the identification and evaluation of appropriate chemical analogs; and
- Relevance of research to improve the safety of Massachusetts workers and general public;

- Description of any directly related research for which the PI has, is, or anticipates receiving funding, including the level and duration of funding; and
- Budget breakdown: the total amount typically falls within the **$20,000 to $25,000** range (refer to the *Research Project Budget* section for details about budget allowances).

Proposal Review Process and Schedule

Please submit proposals via email **no later than June 25, 2021**. You should submit your proposal in either Word doc or Adobe pdf format, to Gregory_Morose@uml.edu.

You are encouraged to contact Greg Morose, Research Manager, at 978-934-2954 or Gregory_Morose@uml.edu to discuss your research project ideas. Proposals will be reviewed by a panel consisting of representatives with research, regulatory, engineering, and industry experience.

Researchers may be requested to provide clarification and/or to modify their proposals based on the feedback of the review panel. **Researchers will be contacted no later than July 30, 2021** with TURI's final funding decision.

Funding will cover the period from September 1, 2021 through June 30, 2022 for a one year project, or September 1, 2021 through June 30, 2023 for a two year project.

About the Massachusetts Toxics Use Reduction Institute

TURI's mission is to promote reduction in the use of toxic chemicals and the generation of toxic by-products in industry and commerce in Massachusetts. TURI is funded through the Massachusetts Toxics Use Reduction Act (TURA) Program and is located within the College of Health Sciences at the University of Massachusetts Lowell.

Appendix A: Research Project Descriptions

Safer Adhesives: Substitution of Toluene – Ideal Tape

Ideal Tape has been a major manufacturer of tape products for a wide array of markets for more than 50 years. Ideal Tape manufactures plain foil and jacketing tapes for the HVAC and insulation markets, and coats a variety of backings to create tapes for the aerospace, industrial, and shoe market segments. Ideal Tape's manufacturing facility is located in Lowell, Massachusetts. During 2018, Ideal Tape utilized 669,000 pounds of toluene to solvate polymers in their manufacturing operation. Toluene is listed by California Prop 65 for developmental and reproductive toxicity.

Ideal Tape is seeking assistance from UMass faculty to conduct research on safer alternative chemicals to toluene for use in their manufacturing lines. This research would include the identification of potential safer solvents or solvent blends, and the in-depth evaluation of these materials. The alternative materials need to be safer from an environmental, health, and safety standpoint, as well as provide equivalent or better technical performance than toluene. In addition, the raw material costs for the alternatives must be cost comparable to toluene. The results of this research will be of value to other companies in various industries that use toluene to solvate polymers for diverse applications.

For further information about the alternative solvent requirements for this project, please contact:

Jeffrey Fehlmann, Senior Manager EHS fehlmann@abitape.com

Safer Pharmaceutical Manufacturing: Substitution of Methylene Chloride – Johnson Matthey

Johnson Matthey is a contract research and contract manufacturer of active pharmaceutical ingredients and intermediates in Massachusetts. Johnson Matthey reported the use of 359,223 pounds of methylene chloride (DCM) in 2018. Johnson Matthey mainly uses DCM for purifying and producing active pharmaceutical ingredients (API) and intermediates. Johnson Matthey is interested in seeking assistance to conduct research on alternative chemicals to DCM for use in their reaction and purification processes. This research would include the identification of potential safer solvents or solvent blends, and the in-depth evaluation of these materials. The alternative materials need to be safer from an environmental, health, and safety standpoint, as well as provide equivalent performance to DCM. This would build on previously TURI funded research in this area.

For further information about the alternative solvent requirements for this project, please contact:

Krishna Kondaveti Leelakrishna.Kondaveti@jmusa.com

Safer Coating Strippers: Substitution of Methylene Chloride – Raytheon Technologies

Raytheon Company is a major manufacturer of defense and civilian technology products in the areas of command, control, communications and intelligence systems. Raytheon uses methylene chloride to remove chemical agent resistant coatings (CARC) and conformal coatings. Raytheon is interested in seeking assistance from UMass faculty to conduct research on alternative chemicals to methylene chloride for use in their coating stripping operations. This research would include the identification of potential safer solvents or solvent blends, and the in-depth evaluation of these materials. The alternative materials need to be safer from an environmental, health, and safety standpoint, as well as provide equivalent or better stripping performance than methylene chloride. The results of this research will be of value to other electronics companies also using methylene chloride in similar coating stripping operations. This would build on previously TURI funded research in this area.

For further information about the alternative solvent requirements for this project, please contact:

Shelley Fitzgerald Shelley.A.Fitzgerald@raytheon.com

Safer Surfactants: Substitution of PFAS – Transene Company

Transene Company, located in Danvers, Massachusetts, researches and develops new materials for the electronics and aerospace industries in the following areas: dielectrics, capacitors, photoresist materials, adhesives, photomask processing chemicals, conformal coatings, chemical etchants, electrolytic and electroless plating chemistries, encapsulants, and high purity cleaning compounds.

Surfactants are important components of many semiconductor and electronic process chemicals. Their wetting action allows solutions to contact surfaces uniformly, can aid in solution penetration of complex geometries, and enhances the ability of etch by-products such as gases to be liberated from substrates. Fluorosurfactants (PFAS) do a wonderful job and provide good compatibility with the aggressive chemicals used in these processes. However, due to their environmental and health impacts, there is a strong need to replace PFAS with alternatives. Transene Company is interested in seeking assistance from UMass faculty to conduct research on identifying and/or developing alternative chemicals to replace fluorosurfactants for their specific applications. Some of the requirements that would need to be met by the alternative chemistry include:

- Compatibility: There are a fairly wide range of chemistries requiring surfactants, and each presents its own compatibility challenges. Most surfactants either precipitate out of solution or just float on the surface.
- Sufficient surface tension reduction: Most starting chemistries exhibit surface tension in the 70-80 dyne range. The surfactant should bring this down to 25-35 dyne. Ideally, the concentration should be 0.1% or less so that it does not contaminate the electronics.
- Sodium: Ideally, no sodium ions. Sodium is poisonous to the semiconductors.

For further information about the alternative surfactant requirements for this project, please contact:

Christopher Christuk sales@transene.com