TURI provides valuable seed funding for research and development of new processes, materials and/or chemicals that can reduce or eliminate the use of toxic chemicals for specific applications of interest to Massachusetts companies.

TURI’s academic research program provides research funding to UMass faculty and graduate students on a competitive basis, encouraging faculty and industry partnerships. To date, 96 academic research projects and over 110 graduate and doctoral students from four UMass system campuses have been supported by TURI, resulting in the adoption of new, less toxic chemistries and processes in research and industry throughout the Commonwealth. Summaries of previous funded research can be found at: [www.turi.org/AcademicResearch](http://www.turi.org/AcademicResearch).

The goal of this funding is to promote the research 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 TURA Data website ([http://turadata.turi.org/](http://turadata.turi.org/)).

As part of this program TURI offers its expertise in alternatives assessment to 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 working with, and 2) describe the resources that are available to assess the environmental, health, and safety impacts of chemicals. This training, entitled Beyond the (M)SDS, is offered at our Wannalancit 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. A recorded webinar is available at [www.turi.org/beyondMSDS](http://www.turi.org/beyondMSDS).

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**Applying for the TURI grant has been a valuable catalyst...Now we have an opportunity to identify safer chemical alternatives, and then implement them in coordination with Massachusetts-based industrial partners so that the use of toxic chemicals can be avoided at the outset.**

*Asst. Prof. Chris Hansen, Mechanical Engineering*
Research Focus Areas

TURI seeks proposals on research focus areas that have particular relevance to Massachusetts companies that use toxic chemicals. This includes research and development of new processes, materials and/or chemicals that can significantly reduce or eliminate the use of toxic chemicals for specific applications.

Examples of research topics of interest to TURI include:

- **Safer alternatives to chemicals that have been designated as higher hazard substances (HHS) under TURA.** The current list of HHS includes:
  - Cadmium and its compounds
  - Trichloroethylene (TCE)
  - Perchloroethylene (perc, PCE)
  - Formaldehyde
  - Hexavalent chromium (Cr+6)
  - Methylene chloride (dichloromethane, DCM, MeCl2)
  - 1-Bromopropane (n-Propyl Bromide, nPB)
  - Hydrogen fluoride (HF)
  - Cyanide compounds
  - Dimethylformamide (DMF)

- **Industry-specific research projects of high interest to Massachusetts manufacturers identified by TURI.** These companies would serve as industry partners for any faculty proposals submitted to address one of the identified research projects.
  - Camco Manufacturing (Leominster, MA): Research alternative chemicals to methanol for use in windshield washer fluid formulations.
  - Waters Corporation (Milford, MA): Research safer solvents to replace tetrahydrofuran as the mobile phase solvent in gel permeation chromatography instruments.
  - Mexichem Specialty Compounds (Leominster, MA): Research alternative wire and cable jacketing compounds for riser applications that reduce or eliminate the need for antimony trioxide synergists without increasing the amount of halogenated flame retardants used.

A full description of each industry partner project for FY17 research is provided in “Appendix A: Research Project Descriptions”.

- Research proposals for work that relates to our mission of reducing toxics use in Massachusetts but is not specifically listed above. Refer to the About the Massachusetts Toxics Use Reduction Institute section for information on our mission.

Please note: TURI does not fund research for end-of-pipe technologies, such as pollution control, treatment or remediation.

Eligible Recipients

UMass faculty from any of the five UMass campuses (Amherst, Boston, Dartmouth, Lowell and Worcester) are eligible for this research funding.
This research is not intended for industry or consultant research unless in collaboration with and under the direct supervision of UMass faculty and supporting the funding of UMass students within the research.

Research Project Funding

Each year the number of academic research grants awarded is based upon the amount of funding TURI receives from the Massachusetts legislature, the strategic goals of the program and the quality of the proposals received. Typically, this has resulted in TURI funding between 2 and 4 research projects annually. This program emphasizes the importance of graduate student engagement, and the bulk of the funding provided is intended to compensate students actively involved in the research over the course of the academic year. Research proposals that do not include direct support for students will not be considered.

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

- **Student stipend and tuition/fees.** TURI prefers to fund full time (18 hr/week) research assistants, who will be eligible to receive a full time RA stipend and full tuition waiver\(^1\). Clear justification must be presented if the research project proposes to use half time RAs.

- **Student time during non-academic year periods** (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 30\(^{th}\)). TURI offers hourly rates for student researchers that range from $12 to $15, depending on the academic level and experience of the student researcher. The hourly rate will be negotiated as part of the overall budget, but the total budget allocated for non-academic periods may **not exceed $4,000** over the course of the fiscal year.

- **Non-student salaries** (e.g., consultant salaries) shall not exceed 10% of the overall project budget, with hourly rates negotiated with TURI.

- Testing services, equipment, and/or supplies, up to but **not to exceed $2,000** without prior approval from TURI (Note: toxic chemicals will **not** be approved for this research without specific justification for why a safer alternative cannot be used).

- For research projects that require the identification of safer solvents or solvent blends, an additional **$1,200 can be included** in the budget for a license of the Hansen Solubility Parameter in Practice software.

- Travel expenses are not typically allowed.

- It is our understanding that because this research funding is an internal source for any UMass Lowell recipient, there is no requirement to include the UMass Lowell RA Tuition Contribution of $5,000. Therefore this amount does **not** need to be incorporated into your budget estimate.

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\(^1\) Student stipends are paid according to UMass “TA/RA/GA Payscale” for the current academic year. Go to [http://www.uml.edu/docs/TARA-Process-Pay-Schedule-2011-2012_tcm18-88099.pdf](http://www.uml.edu/docs/TARA-Process-Pay-Schedule-2011-2012_tcm18-88099.pdf) for the appropriate UMass Lowell form.
Responsibilities of Researcher

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

- Attendance at a kick-off meeting, to be held at or near the research facilities of the funding recipient or the industry partner, preferably in early September 2016;
- Attendance at the “Beyond the (M)SDS” training for faculty and students on the proposed research team. TURI prefers that research teams receive this training no later than the end of the fall semester;
- For research that involves the use of nanomaterials, additional laboratory safety training, provided by TURI or an approved alternate, 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 monthly project status in-person meetings or conference calls with TURI staff and/or the industry partner;
- Presentation of one interim project update, to be conducted in Lowell or via webinar for TURI staff and other invited guests (target January 2017). This is expected to consist of a 20 minute presentation (typically conducted by the research student) followed by at least 15 minutes of questions and answers;
- One final written report, due July 15, 2017, that includes a description of the research methodology, discussion of results, description of the chemical hazard review associated with the chemicals/materials studied, and suggestions for future research. In the event that intellectual property is developed as part of the research, the report must provide as much detail about the research methods and results as possible without directly impacting intellectual property rights. The written report will be made available to the public via TURI’s website (go to http://www.turi.org/Our_Work/Research/Academic_Research for examples of past reports). A conference paper, article, thesis, or other document may be used in lieu of the final written report if it substantially covers the research conducted and can be made publicly available; and
- At least one presentation at a professional conference. If no appropriate external information dissemination opportunity occurs during the course of this research, other potential outreach mechanisms may be negotiated with TURI.

Development of intellectual property as a result of the research shall be managed through the UMass Lowell Office of Technology Commercialization (OTC) program (http://www.uml.edu/research/otc/), or its equivalent at other UMass campuses, and shall be negotiated with the industry partner as appropriate.

Proposal Instructions

Proposals shall include the following information:

- Project title;
- Principal Investigator(s), including UMass affiliation and department, and Curriculum Vitae (CV);
• Student(s) to be supported in conducting this research, and their CV. The proposal should indicate the role of the graduate students within the proposed research, and emphasize the relevant learning aspects of the research;

• Industry or other partners with letters of support including their role and contribution. Industry partner support is typically in-kind, and relates directly to the research project. Examples include providing expert feedback on the research plan and status, providing material samples, identifying pertinent performance requirements, providing access to production and/or testing equipment, etc. Please note that projects responding to the industry specific project ideas provided in this RFP do not require an industry letter of support;

• Project description, including:
  
  o Research Objectives and Research Development Plan, including an indication of where the research is along the development path (from basic research to commercialization),
  
  o Connection of the research to TURI’s mission (see About the Massachusetts Toxics Use Reduction Institute at the end of this document),
  
  o Methodology, describing the research activities that will be accomplished in order to achieve the specific objectives of the research, including detailed description of any chemicals or materials that will be used in the research. Research questions expected to be answered in the final report should be identified. The proposed research must be achievable within the time and budget constraints of the project;
  
  o Information comparing the relevant characteristics of the chemicals being considered in the research. The alternative chemical or process proposed is expected to be safer than the target chemical or process it would replace. The successful proposal should include relevant hazard data 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 hazard data information. Sources of data should be included in this evaluation step. Please note that TURI staff is available for assistance in completing a table similar to the following example.

<table>
<thead>
<tr>
<th>Chemical</th>
<th>CAS #</th>
<th>Environmental Fate (e.g., persistent, bioaccumulative)</th>
<th>Occupational Exposure Pathways (e.g., dermal contact)</th>
<th>Acute Health Effects (e.g., skin sensitizer, asthagen)</th>
<th>Chronic Health Effects (e.g., carcinogen, endocrine disruptor)</th>
<th>Cost (approx or range) per unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical being replaced</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Process chemical</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reaction chemical</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solvent</td>
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</tbody>
</table>

  
  o If studying the use of a chemical or material for which there is little or no environmental or human health hazard data (such as for nanomaterials), thoughtful justification for why this alternative is appropriate to this funding source must be presented. This shall include an assessment of the potential hazards associated with the chemicals proposed to be used (see above) as well as a discussion of the

2 At a minimum, alternative chemicals considered in your research must not include any known or probable human carcinogens, persistent, bioaccumulative and toxic (PBT) chemicals, or very persistent and very bioaccumulative (vPvB) chemicals.
Proposals are due no later than June 17, 2016.

You may submit your proposal by email, either in Word doc or an Adobe pdf format, to pam@turi.org.

You are encouraged to contact Pam Eliason, Industry Research Program Manager, at 978-934-3142 or pam@turi.org, to discuss your research project ideas and to receive assistance in completing the proposal by the June 17, 2016 deadline.

Grant awards will be announced on or before July 15, 2016.

uncertainties associated with data. Past projects have included some toxicity screening testing as part of the overall research approach to help fill data gaps. Other approaches to fill data gaps include identification and evaluation of appropriate analogs for the chemicals proposed for use in the research.

- Relevance of research to Massachusetts industry or communities;
- Description of any 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 $15,000 to $25,000 range (refer to the Research Project Funding section for details about budget allowances).

Proposal Review Process and Schedule

Proposals will be reviewed by TURI staff and a review panel consisting of research and industry experts. The review panel will determine the quality of the proposal in addressing the instructions laid out above. For projects that address a specific industry partnership project provided in Appendix A, the industry partner in question will be invited to participate in the review panel.

Researchers are often requested to provide clarification and/or to modify their proposals based on the feedback of the review panel.

After receiving any modifications or clarifications requested by the review panel, TURI will determine which projects to fund. The decision will be based on the recommendations of the review panel as well as on the overall funding available and TURI’s overall strategic goals for the fiscal year. The final determination of which projects to fund lies with the TURI Director. Researchers will be contacted no later than July 15, 2016 with our decision.

Please submit proposals with the subject line “Academic Research Proposal FY17” no later than June 17, 2016.

You are encouraged to contact Pam Eliason, Industry Research Program Manager, at 978-934-3142 or pam@turi.org, to discuss your research project ideas and to receive assistance in completing the proposal by the June 17, 2016 deadline.
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 provides training to industry professionals and the public, conducts research on alternatives, sponsors industry mentoring programs, and promotes green chemistry. TURI also houses the largest collection of toxics use reduction (TUR) and pollution prevention research materials in New England and a university-based laboratory that tests and evaluates the performance of safer alternatives to hazardous cleaning solvents. We support community efforts to reduce toxics through education and grant projects.

TURI is funded through the Massachusetts TURA Program and is located within the College of Health Sciences at the University of Massachusetts Lowell. It maintains a core staff of analysts, scientists, engineers and educators and draws upon the expertise of community and public interest groups, industry managers, workers, government officials, private consultants, and faculty from the University of Massachusetts Lowell and other universities.
Appendix A: Research Project Descriptions

Safer Windshield Washer Fluid Formulation: Substitution of Methanol - Camco Manufacturing

Methanol is a toxic chemical used as a major ingredient in most automotive windshield washer fluid products. In Massachusetts, there are several manufacturers of windshield washer fluid products. During 2013, Massachusetts manufacturers used more than 57 million pounds of methanol, with the majority being used for windshield washer fluid products. Typically, these products contain 30 – 35% methanol combined with water.

Camco Manufacturing is a company based in Greensboro, North Carolina that has over 3,000 products and five manufacturing facilities, including one in Leominster, Massachusetts. Their windshield washer fluid products include Rain Cutter and Xtreme Blue brands. Due to toxicity issues associated with methanol, Camco Manufacturing is interested in providing technical input for University of Massachusetts faculty to conduct research to identify and evaluate alternative chemicals for use in windshield washer fluid formulations.

Methanol is a very inexpensive chemical (approximately $2 to $3 per gallon), therefore alternative formulations must be cost competitive. In addition, the alternative formulation should be able to meet the EPA Volatile Organic Compound (VOC) requirement of no more than 35% VOC by weight, be less toxic than methanol, be able to work in an all season formula with freeze protection to -25 degrees F, clean streak-free, and be effective at removing road grime, film, tree sap, and bugs.

For further information about the windshield washer fluid product requirements for this project, please contact Robert Flowers at: robertf@camco.net.

Safer Gel Permeation Chromatography: Substitution of Tetrahydrofuran – Waters Corporation

Waters Corporation is an analytical instrument manufacturer that primarily designs, manufactures, sells and services high performance liquid chromatography (HPLC), ultra performance liquid chromatography (UPLC®), supercritical fluid extraction (SFE), and mass spectrometry (MS) laboratory instruments and support products, including analytical software, chromatography columns, and chemistry standards. These systems are ultimately used to provide answers regarding material composition analysis in many areas, including environmental analysis, pharmaceutical research, clinical testing, food safety and chemical materials. The insights gained through the use of our instruments support scientific research and help improve quality control for many industrial applications.

One area of research that is performed using HPLC/UPLC technologies is gel permeation chromatography (GPC). GPC technology is widely used for the identification and analysis of polymers by size. Waters has developed instrumentation to advance polymer science by using smaller particles for GPC, assisting research organizations to analyze samples more quickly and gain more information per analysis.

With new generations of instruments, Waters has worked to reduce the amount of solvent required to perform a given analysis, and in so doing has greatly reduced the environmental impacts of analytical labs. However, there may be improvements that can be made with respect to the solvents themselves. The issue is that the primary solvent used by our customers for some of these analyses (tetrahydrofuran, or THF) is toxic and must be handled...
and disposed of as hazardous material. With the Waters ACQUITY® Advanced Polymer Chromatography® (APC™) Columns, based on sub-3μm hybrid materials, there should be greater flexibility in the choice of solvents for this analysis, thus adding additional flexibility and speed to laboratories’ analyses of polymers.

Waters seeks assistance from UMass faculty in determining whether three relatively common GPC-based polymer analyses can be performed using a less toxic solvent or solvent blend than THF. Specifically, we are seeking an alternative solvent that can solvate the following three common materials used in our analytical techniques:

1. Epoxy resin, a widely used material for the development of various polymers;
2. Polyurethane; and
3. Polystyrenes, which are routinely used to calibrate systems for analysis.

Specific requirements for potential safer solvent replacements for THF include:

- Maintains the necessary pressure profile across the GPC column, which is packed with C18-coated silica microbeads;
- Solvates epoxy resin, polyurethane, and polystyrene materials
- Is miscible in water; and
- Raw material cost is comparable to THF.

For further information about the alternative GPC solvent requirements for this project, please contact Jim McCabe at Jim_McCabe@waters.com.

Safer Flame Retardants for Wire and Cable Coatings: Substitution for Antimony Compounds – Mexichem Specialty Compounds

Mexichem Specialty Compounds (formerly AlphaGary Corporation) proposes to collaborate on an academic research to investigate a functional alternative to reduce the use of antimony compounds and other synergistic flame retardants used in riser jacketing materials common to wire and cable products.

Plastic compounders as well as downstream wire and cable producers, located within the Commonwealth of Massachusetts, currently process significant quantities of antimony compounds. Antimony compounds are among the top 20 TURA chemicals reported in the category of “shipped in product” as multiple facilities throughout the Commonwealth process materials using antimony compounds as a synergistic flame retardant used with halogenated flame retardants for wire and cable applications.

The National Electric Code (NEC) defines requirements for wire and cable products installed in vertical building spaces that span multiple floors (risers). Flame retardant performance characteristics are outlined in UL 1666, a fire test for determining values of flame propagation height for electrical and optical-fiber cables that are for installation vertically in shafts or in vertical runs that penetrate one or more floors.

Thermoplastic (both flexible PVC and olefins) materials are commonly used for jacketing wire and cable products in riser applications. Mexichem is interested in collaborating on research into alternative formulations and/or substitutes to reduce use of antimony compounds and potentially other synergistic halogenated flame retardants
used in riser wire and cable applications. Formulations containing greater than 6 phr (parts per hundred resin) of antimony compounds represent both the greatest challenge and opportunity.

Collaborating with academic researchers, we propose to share information, materials, and resources available at Mexichem Specialty Compounds’ Leominster, MA facility.

For further information about flame retardant and riser jacket compound requirements for this project, please contact:

Gary Nedelman  
gnedelman@mexichem.com
Mark Jozokos  
mjzokos@mexichem.com