**PROJECT TITLE: Assessing Human Exposure Risk to Harmful Algae Blooms**

**I. PROJECT STATEMENT**

There is too much at stake to ignore the threat of **Harmful Algae Blooms (**HABs) in MN lakes where they pose serious risk and ***problems*** to ecosystems and specifically to human health. We have the ***opportunity*** to develop an economic framework, tools, and ***solutions*** for Minnesota (MN) communities to assess the health costs associated with chronic exposure to HABs in lakes and ponds. Over 170 possible cases of illness are associated with Cyanotoxins, a toxin and a potential carcinogen produced by freshwater blue-green HABs, which can cause gastrointestinal diseases (diarrhea, abdominal pain, nausea, vomiting, fever or abdominal cramps) in HAB-related water recreational exposures. What is missing, is a framework and the necessary tools to assess the health risks and costs of human exposure to regularly occurring and persistent HABs in lakes and ponds. After completion of this project, the MN policy makers, health, and environmental managers will:

* have access to tools that can assess and minimize public health risk of HABs exposure at public beaches, water recreational activities, and drinking water supplies (25% of MN population), and
* be better suited to fight HABs’ impending and increasing presence and become resilient to the negative environmental, economic, and health threats of HABs poisoning.

*How will we achieve our goals?* Our team will monitor three healthy and three algae infested lakes in northern, central, and southern regions of the State. We will gather pre-identified health data and metrics (such as the occurrence of asthma or the common cold) for each lake region to develop the associated HABs-linked health cost values. Ultimately, past and current research will be incorporated to create tools for assessing HABs’ exposure risk and mitigation. Our unparalleled approach is one of the first work to document cost assessment of human health poisonings by HABs in MN communities.

**II. PROJECT ACTIVITIES AND OUTCOMES**

**Activity 1: Launching, staging, and getting the project off the ground**

*Objective*s: partners meet, finalize plans, establish monitoring protocols, and initiate community engagement. Finalize 6 HAB infested and healthy lakes in northern, central, and southern MN regions. Prepare drone (DJI Matrice 100) with spectral-Tetracam and water temperature sensor. Deploy the autonomous continuous water quality monitoring station (buoy). Hire a graduate student to operate drones, conduct literature reviews, and prepare the pre-tested computer model for producing exposure risk maps.

**ENRTF BUDGET:** $ 245,952

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| **Outcome** | **Completion Date** |
| 1. Initial partners in-person meeting, finalizing monitoring and sampling plans/protocols | *11/1/2020* |
| 2. Contact, visit, and engage with communities surrounding selected lakes | *11/1/2020* |
| 3. Equipment, materials procurement, configurations, and field preparation | *2/1/2021* |

**Activity 2:****All hands on deck with lake monitoring, laboratory analysis, and modeling**

*Objectives*: conduct field investigation to produce field verified chronic exposure risk maps.

Use buoy and drones to intensely monitor selected HAB infested lakes to produce and field verify HAB exposure risk maps that demonstrate the seasonal and accumulative potential human exposure to HABs. Sustain community engagements.

**ENRTF BUDGET:** $ 139,590

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| **Outcome** | **Completion Date** |
| *1.* Deploy buoy, conduct drone flights, carry out HAB toxin testing-1st-year field sampling | *5/1/2021* |
| *2.* Monitoring data analysis, calibrating and validating the site-specific 3D HAB prediction model, and producing and verification of the human health HAB-exposure risk maps. | *2/1/2022* |

***Activity 3: The product - developing an economic framework to assess associated health costs of HABs***

*Objectives*: to generate a framework to assess HAB costs that will inform policy-makers and management.

We will develop health cost estimates for the state of Minnesota by conducting a review of the HAB and water body valuation literature, and a statistical economic analysis on health data relating to concerns such as Alzheimer’s, asthma, the common cold, and pet poisonings on three lakes which commonly experience HABs in the summer, and three lakes which do not experience HABs (as a control). We will purchase sales data for products related to treatment (such as cold medicine and inhalers), in order to estimate health spending. We will also use available data for such as county hospital intake records to estimate Alzheimer’s rates and animal poison control data for pet poisonings. With data generated in Activity 1 and Activity 2, we will create a HAB health prediction model. The prediction model will be combined with the economic health cost estimates to generate a framework to assess HAB costs at specific lakes, which will inform policy and management. We will also 1) create a lake algae and toxin monitoring website, 2) create exposure maps, 3) provide drinking water intake designs, and 4) make all data and protocols available online.

**ENRTF BUDGET:** $ 144,090

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| **Outcome** | **Completion Date** |
| *1. Literature Review and Economic Data Collection and Assessment* | *12/30/2021* |
| *2. Health Data Collection and Analysis and Prediction Model Development* | *7/30/2022* |
| *3. Economic Framework Development* | *7/30/2022* |
| *4. Outreach: Website, map, and designs generated and made available* | *12/30/2022* |
| *5. Data analysis, compiling reports, and write publications* | *12/30/2022* |

**III. PROJECT PARTNERS:**

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| --- | --- | --- | --- |
| **Name** | **Title** | **Affiliation** | **Role** |
| **A. Partners receiving ENRTF funding** | | | |
| Shahram Missaghi, PhD | Extension Professor | UoM Extension | Principal Investigator |
| Lucia Levers, PhD | Research Associate | UoM WRC | Co-Principal Investigator |
| Miki Hondzo, PhD | Professor | UoM SAFL | Co-Principal Investigator |

**IV. LONG-TERM- IMPLEMENTATION AND FUNDING:**

The occurrences and intensities of harmful algae blooms are on the rise. Beyond ecological damages they also pose a serious human health risk, which has economic consequences. This project will create tools that for the first time, allow communities around the infested lakes to assess the health cost associated with HABs and to become stronger and more resilient to HABs occurrence. The project sponsor currently leads the Minnesota HABs Group and will continue to nurture collaboration among all stakeholders, promote original discoveries, develop research supported educational materials, and to train water resources’ professionals and communities.

**V. TIMELINE REQUIREMENTS:**

The project is for 3 years: starting on July 1, 2020, and ending on June 30, 2023. Periodic project status update will be submitted January 1 and July 1 of each year with a final report submitted by June 30, 2023.