Intelligence Database and Tools for Chemical Hazards - A program to develop tools to assist soldiers in an environmental with Toxic Industrial Chemicals

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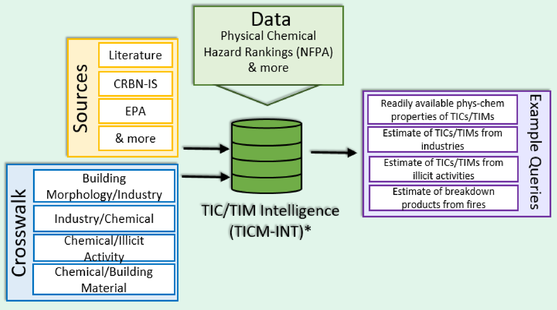
Problem Statement

Toxic industrial chemicals and material (TIC/Ms) can be defined as chemicals with industrial value that can be used to create hazardous situations during emergency responses, or worse, used in improvised chemical attacks. For these reasons, TIC/Ms represent a significant threat to civilians, emergency responders, and warfighters. Some TIC/Ms are highly toxic and can be more environmentally problematic than typical chemical weapons. Furthermore, the broad spectrum of TIC/Ms often renders simple decontamination solutions ineffective. In recent years, the U.S. Army has encountered TIC/Ms used in improvised chemical attacks. Advanced planning and mitigation resources for TIC/Ms would be valuable to minimize potential exposure and health risks.

Objective

The purpose of our project is to provide planning tools to anticipate and address the potential for TIC/Ms encounters in order to minimize impacts to health and mission success. We are approaching this goal by first developing a dynamic database, the toxic industrial chemicals and material intelligence (TICM-INT) that includes physical-chemical data to allow calculations of contaminant migration and transformation. The database also includes data that allow the user to predict presence of TIC/Ms associated with industries, dynamic environmental chemistry of TIC/Ms, and hazard data linked to maximum exposure limits. The integration of this data is being used to develop probabilistic risk models for mission planning purposes. Although the TICM-INT is focused on disaster responses and military applications, it may also have great value in homeland security and anti-terrorism applications.

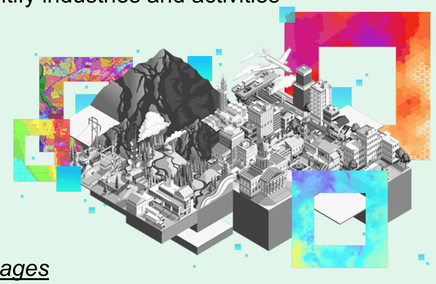


The Roadmap: Subtasks 1 – 2

Technology Gap: Due to the diversity of TIC/TIMs, the Army pulls from several sources for Mission planning

Question: What TIC/TIMs are readily available to adversaries and sympathizers that could affect the Mission success, and Soldiers' health?

Solution: Develop tools that identify and quantify TIC/TIMs via intel databases and overlays that identify industries and activities



Stages

1. Develop of TIC/TIM Intelligence database
2. Development of ESRI tools linking database with:
   - 2a. Industries & activities
   - 2b. Estimate quantities of TIC/TIMs
   - 2c. Unconventional sources and building materials

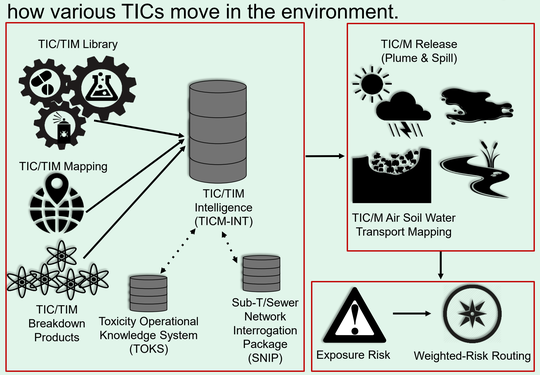
Stage 1:

Rank	Global Ranking	Rank	Global Ranking
1	Chlorine	16	Phosphoryl Trichloride
2	Ammonia	17	Chlorine dioxide
3	Hydrogen chloride	18	Bromine
4	Sulfuric acid	19	Nitrogen dioxide
5	Hydrogen fluoride	20	Phosphorus trichloride
6	Formaldehyde	21	Fluorotrichloromethane
7	Mercury	22	Hydrogen sulfide
8	Nitric acid	23	Molybdophosphoric acid
9	Sulfur dioxide	24	Toluene-2,4-diisocyanate
10	Phosgene	25	Fluorine
11	Hydrogen bromide	26	Malathion
12	Nitric oxide	27	Parathion
13	OMPA	28	Acetylene tetrabromide
14	Boron trifluoride	29	o-Anisidine
15	Methyl bromide	30	Phosphine

- Identification – CAS, synonyms, other languages
- Physical Data – state, color, odor, storage
- Properties impacting fate and transport – solubility, vapor density, Kow/Koc, transformation/degradation
- Hazard/Toxicity Data – NFPA, AEGLs, MEGs, PPE

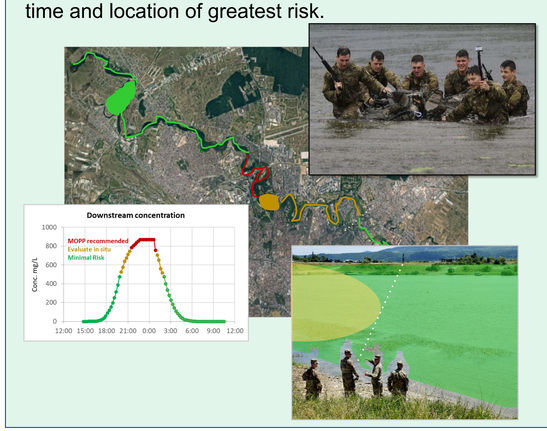
The Roadmap: Subtasks 3 – 8

TICM-INT data will then be used for course forecasting to minimize the potential risks to soldiers. This will first be accomplished through soil and hydrological modeling of how various TICs move in the environment.



Subtasks 3 – 5

Data from TICM-INT will then be fed into dynamic release fate and transport models using both surface water flows and soil heterogeneity. These models, which will estimate TIC concentrations, will have map based tools to identify time and location of greatest risk.



Subtask 6

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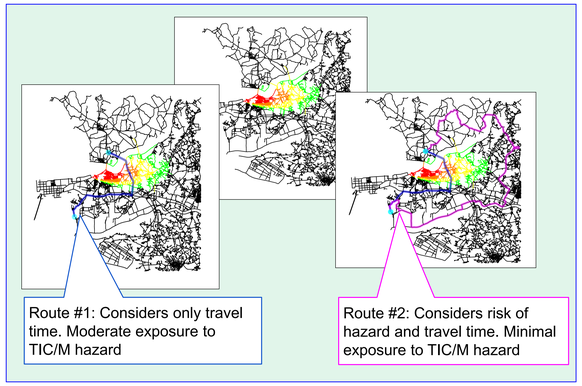
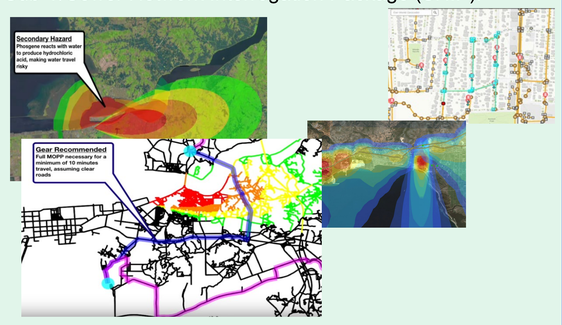


Subtasks 7 – 8

The last project tasks include tool integration, validation, and ESRI overlays. This will be accomplished with three modules: Intelligence Threats of Chemical Hazards (ITCH), Determining Routes in Variable Environments (DRiVE), and Sub-T/Sewer Network Interrogation Package (SNIP).



Conclusion

The threat of TICs for soldiers fighting in urban environments may pose a serious risk. Being able to determine the location, fate/transport, and toxicity of these TICs will prove greatly beneficial for mission planning and ensuring the health and safety of soldiers.

For more information

Please contact Dr. Christa Woodley at Christa.M.Woodley@usace.army.mil for more information on this project.