Actionable Science for Communities

The Risk-Informed Materials Management (RIMM) Tool System for Determining Safe-Levels of Contaminated Materials Managed on the Land

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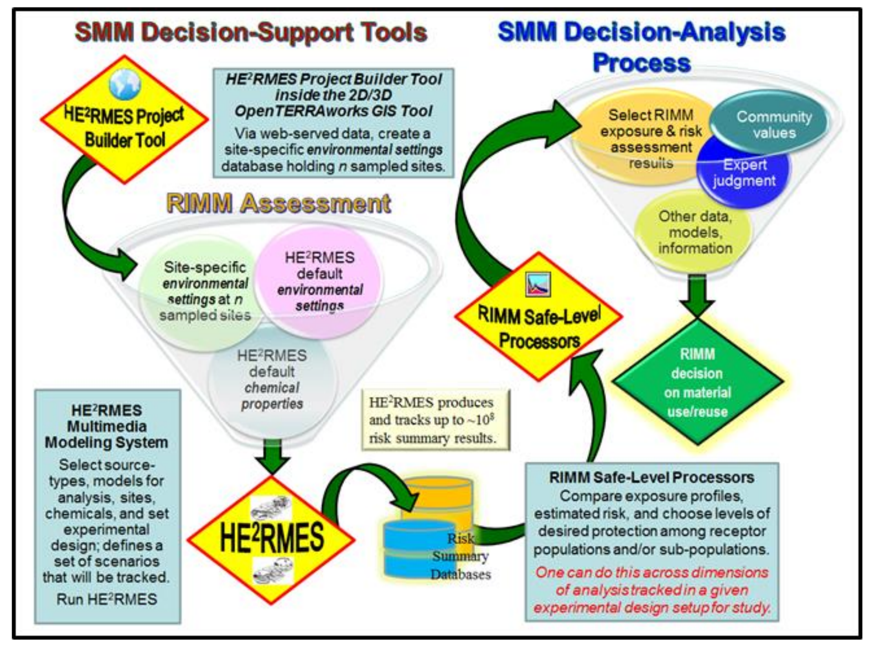
EPA United States Environmental Protection Agency

Purpose/Utility of Research

- Provides an open-source **RIMM Tool System** that allows users to conduct exposure and risk assessments evaluating placement of toxicant-laden materials into a wide range of environmental settings.
- Facilitates ***Anywhere, USA*** auto-parameterization of its science models, allowing study of impacts across one or more sites (e.g., 1 site to 10,000 sites).
- Helps assessors and decision-makers set safe material loading rates to the environment for a given decision context and set of community values
- Directly supports sustainable materials management (SMM) decision analysis and decision-making at site-to-community-to-regional-to-national scales.

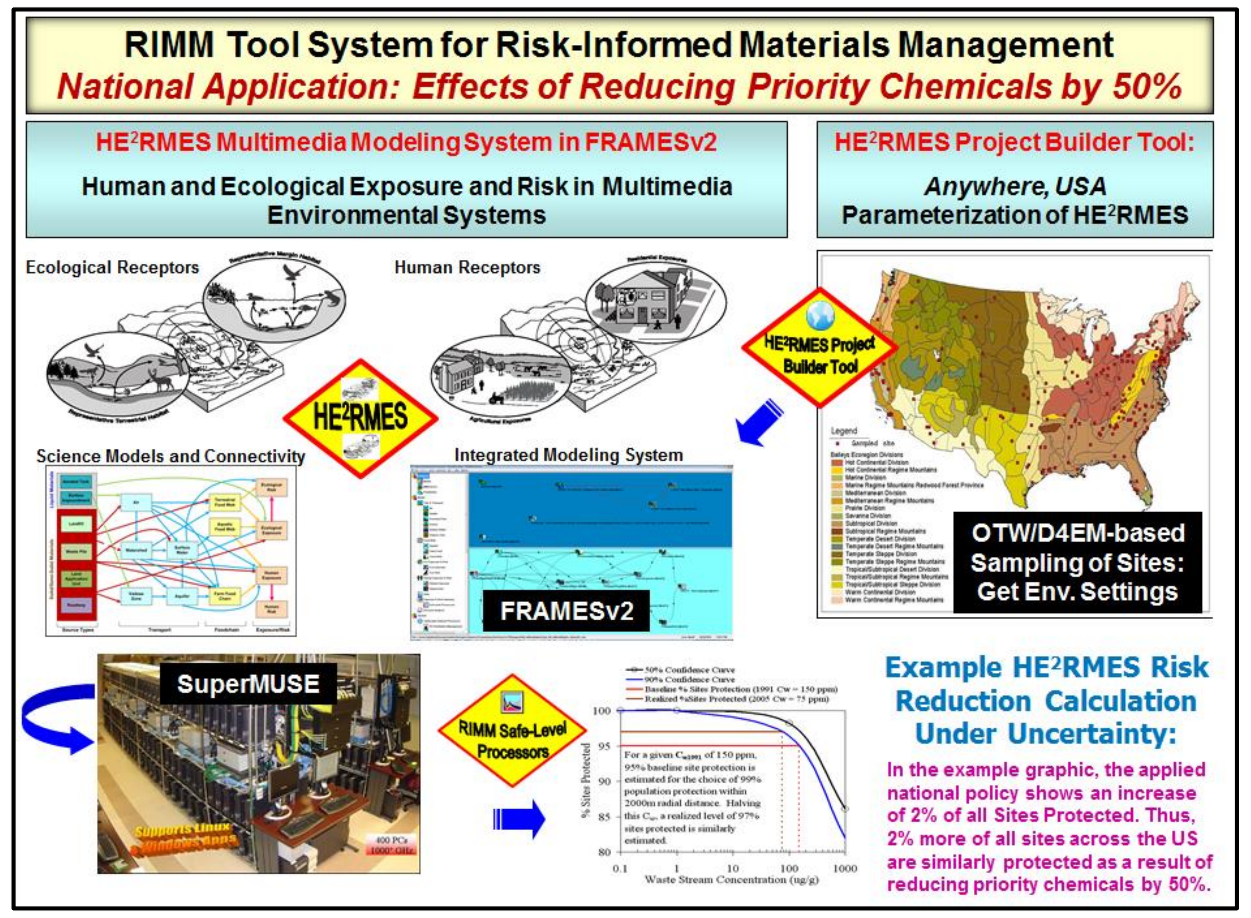
Highlights

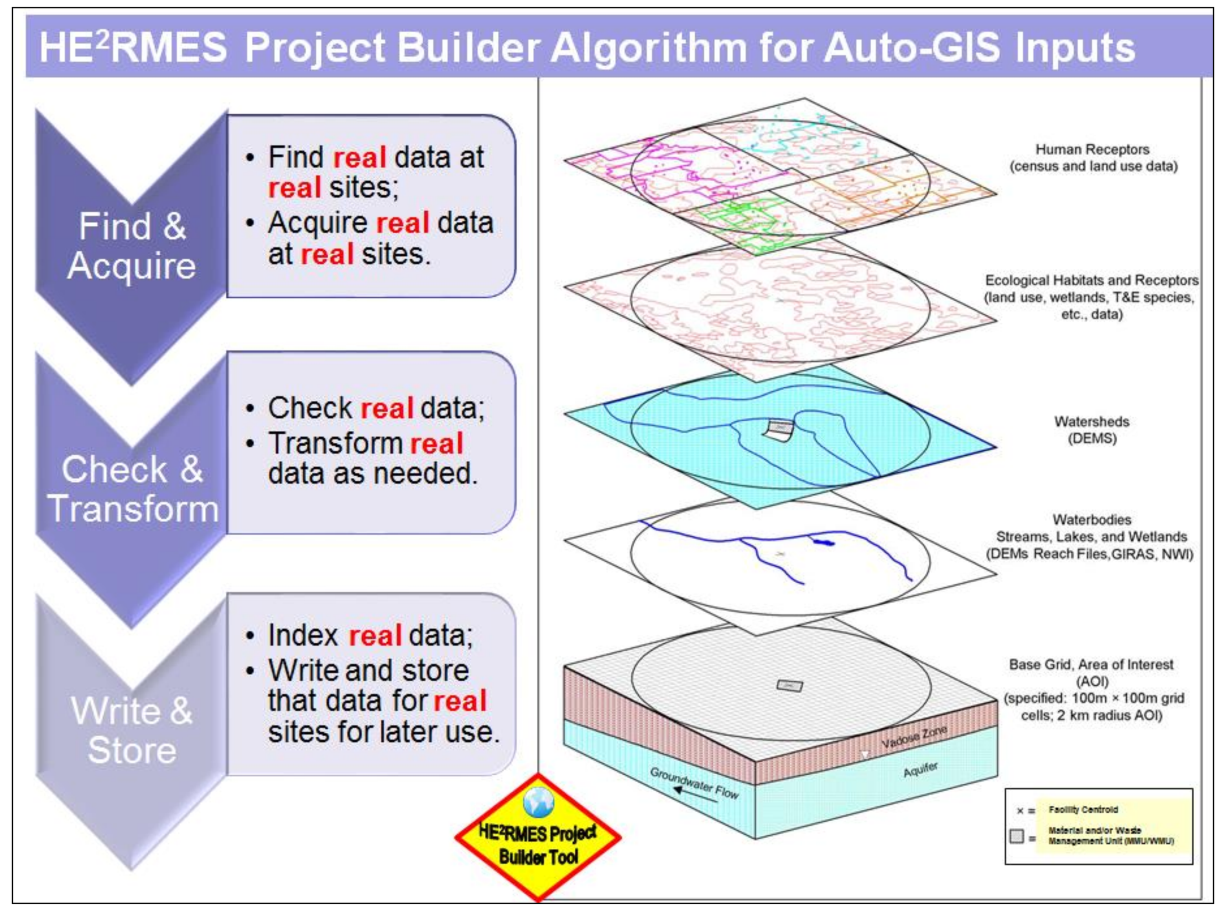


As various communities seek to become more sustainable, they are faced with *problems of choice* in evaluating and analyzing the potential impacts and uses of contaminated materials as they relate to waste management systems, transportation options, land use planning, and infrastructure needs. The RIMM Tool System supports a broad range of decision-support and analysis functions for assessing exposure and risk.

RIMM: helping view 'waste' materials as reusable inputs to make safe products that benefit society.

EPA has responsibility under RCRA for regulating the management of hazardous waste. As part of its transition towards sustainability, EPA recognizes that some kinds of *'waste' materials can in fact be reused as input materials for making safe products that benefit society*. The RIMM Tool System provides an integrated data-gathering and analysis technology to enable scientifically rigorous analysis of risks, benefits, and opportunities for the safe, beneficial reuse of a variety of materials that may have been considered 'waste' in the past. This will enable decision makers at all levels – from communities to states to the Nation – make better, science-informed decisions about waste management. Better decisions will reduce disposal costs, increase protection of public health and the environment, and reduce the use of raw materials.

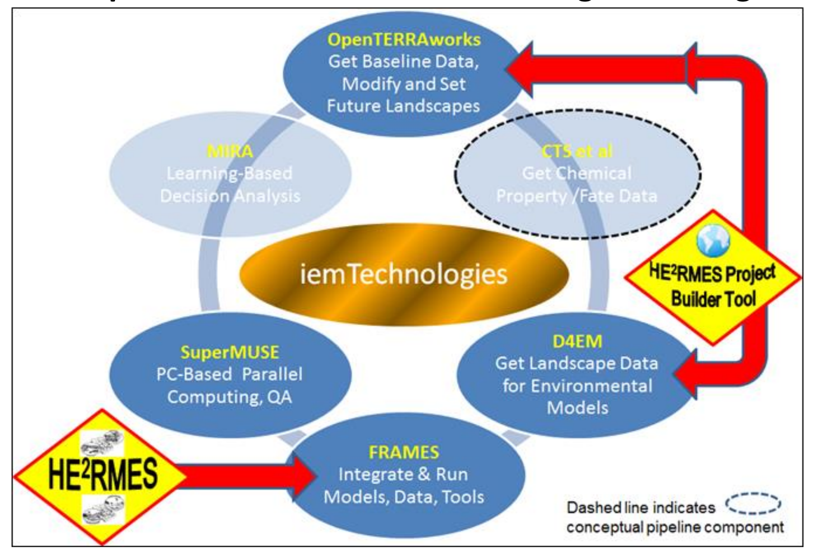




RIMM Builds upon ORD's Interoperable iemTechnologies Modeling Platform:

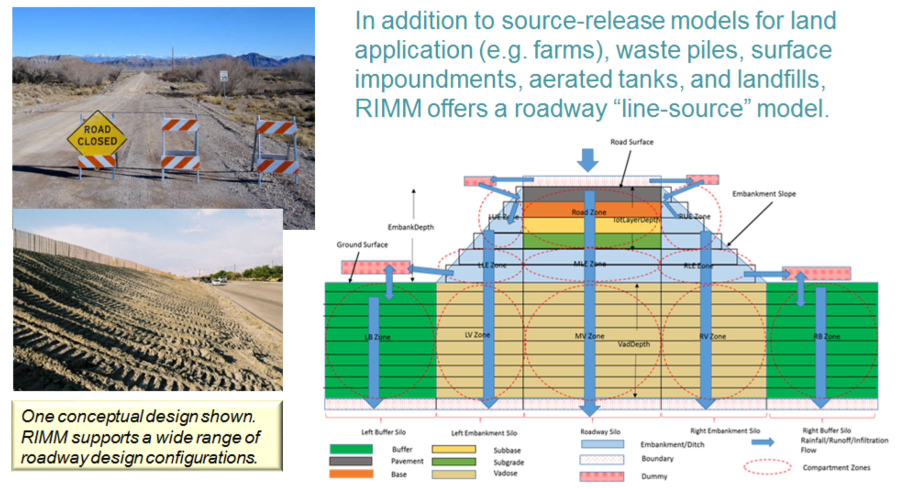
- Establishes the HE²RMES modeling domain in FRAMES v2.0 (Whelan et al, 2014);
- Establishes a fully implemented D4EM-4-HE²RMES solution (the HE²RMES Project Builder Tool), servicing all of HE²RMES's science models for "Anywhere USA" application of the RIMM methodology; and
- Improves upon and expands on the suite of natural science models in HE²RMES. Incorporates updated hydrogeological models (EPA CMTP v2.1, 2.2), new GEM-based source-terms (Little, 2012), adds OLEM/ORCR's Rags-and-Wipes landfill model; and creates a new line-source Roadway source-term model.

RIMM Leverages ORD's iemTechnologies: A Platform of Interoperable Environmental Modeling Technologies



Beneficial Use of Industrial Materials in Roadways and Structural Fill Emplacements

In addition to source-release models for land application (e.g. farms), waste piles, surface impoundments, aerated tanks, and landfills, RIMM offers a roadway "line-source" model.



RIMM Problem: Hazardous Material Reuse in Roadway Construction

Example Range of RIMM Applicability to Support Multiple Program Exposure and Risk Assessment Needs

Case	Who	Problem Statement
1	OSWER-ORCR, OSRTI, OW	Beneficial Use of Flue Gas Desulfurization (FGD) Gypsum in Agricultural Application
2	OSWER-ORCR, US-DOT	Beneficial Use of Industrial Materials in Roadways and Structural Fill Emplacements
3	OSWER-ORCR, Superfund	National-Scale Evaluation and Updating of Soil Screening Levels to Support Existing and Future Contaminated-Site Assessment Programs
4	ORD OAR-OAQPS U.S. EPA Regions	Disposal of Debris Following a Natural Disaster
5	OAR-OAQPS, NATA	Modeling of Air Emissions to Predict Multi-pollutant and Cumulative Risk Impacts
6	Numerous Regulators and Regions	Assessing Cumulative Impacts of Landscape Modification and Mine Drainage
7	ORD, States w/ Superfund authority, other locales.	Risk-based Cleanup Options for Dioxin and other Persistent Organic Pollutants (POPs)
8	EPA's Office of Water USDA-ARS	Hydrologic and Water Quality System (HAWQS) and/or BASINS BP Analysis – Expand Capabilities Leveraging iemWatersheds and/or HE²RMES Modeling Systems
9	OSWER-ORCR, OSRTI, OW US-ACE, US-BLM, US-FS	Implementation of 108(b) Rule Requiring Financial Assurance
10	OW	Class 1 Biosolids Exposure and Risk Assessment
11	OSWER-Superfund, Brownfields, States, Tribes	Screening HH/Eco Cumulative Exposure and Risk Assessment of Contaminated Sites

Application & Translation

RIMM Supports Applications Across Multiple Scales

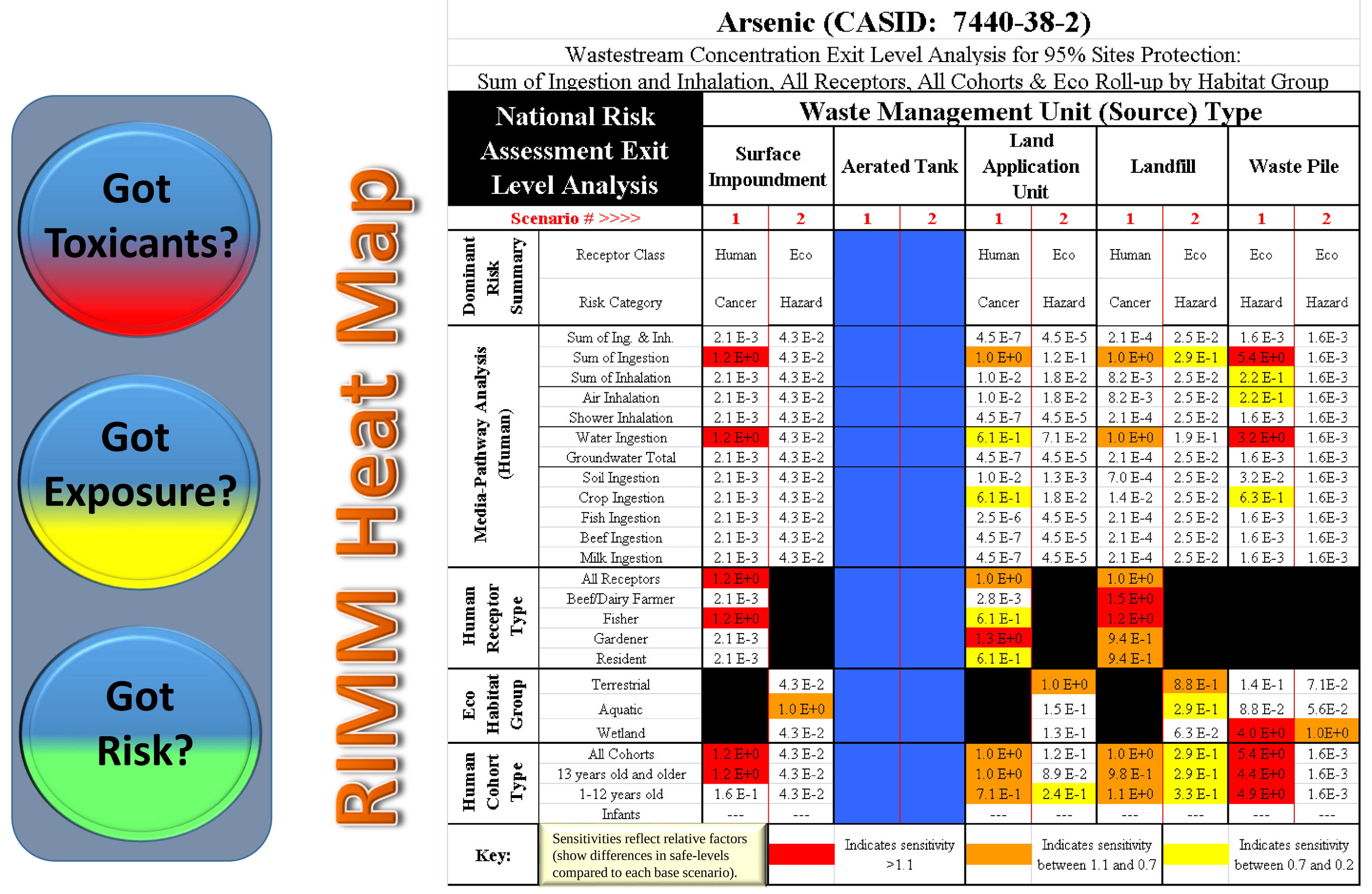
FGD Gypsum National-Scale Problem: Farm Application

For a given annual unit-area loading rate for application to U.S. farmlands, what is a safe concentration ($C_{M\text{-}Farm}$) of arsenic in FGD Gypsum resulting in:

- **Human Protection** -- Greater than A% of the people living within B distance of each farm with a risk/hazard of C or less, and
- **Ecological Protection** -- Greater than D% of the habitats within E distance of each farm with an ecological hazard of F or less,
- **National-Scale Protection** -- For G% of farms nationwide,
- **Under Uncertainty --** With confidence H% bounding empirical uncertainties (as *accuracy of model inputs and models*), and confidence I% bounding experimental error (as *computational precision*).

Red ≡ indicates a decision variable. **RIMM integrates science, data, and expert opinion with community-based VALUES determined via a decision-analysis process and decision context.**

$C_{M\text{-}Farm}$ ≡ represents the safe application level for material reuse on farms.



Intended End Users

OLEM/ORCR Partners in Integrated Modeling:

Program Management, Communications and Analysis Office.

The RIMM Tool System is intended for broad application and uses; the system is capable of serving many Program Office needs and assisting multi-scale community-based decision-making for SMM.

Lessons Learned

Achieving science, web-served data, and tool integration and interoperability across the source-to-outcome continuum using spatially-explicit, mechanistic modeling approaches is possible. Success required monumental effort and faced many unexpected challenges.