GreenBiz 2016 Panel: Evaluating Material & Energy Options in a Circular Economy

Tools for finding the path to sustainability for management of municipal solid waste and use of industrial by-products

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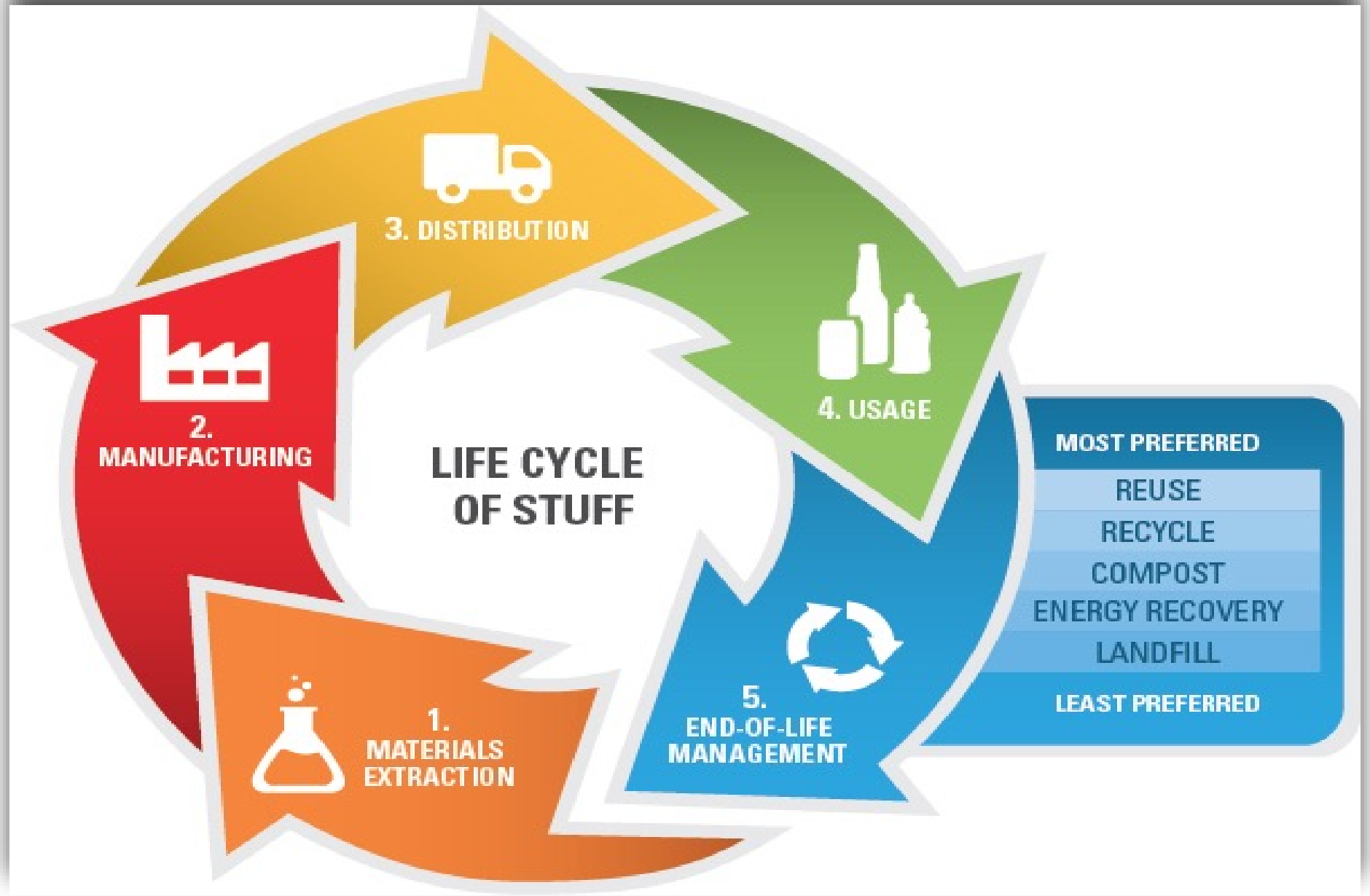
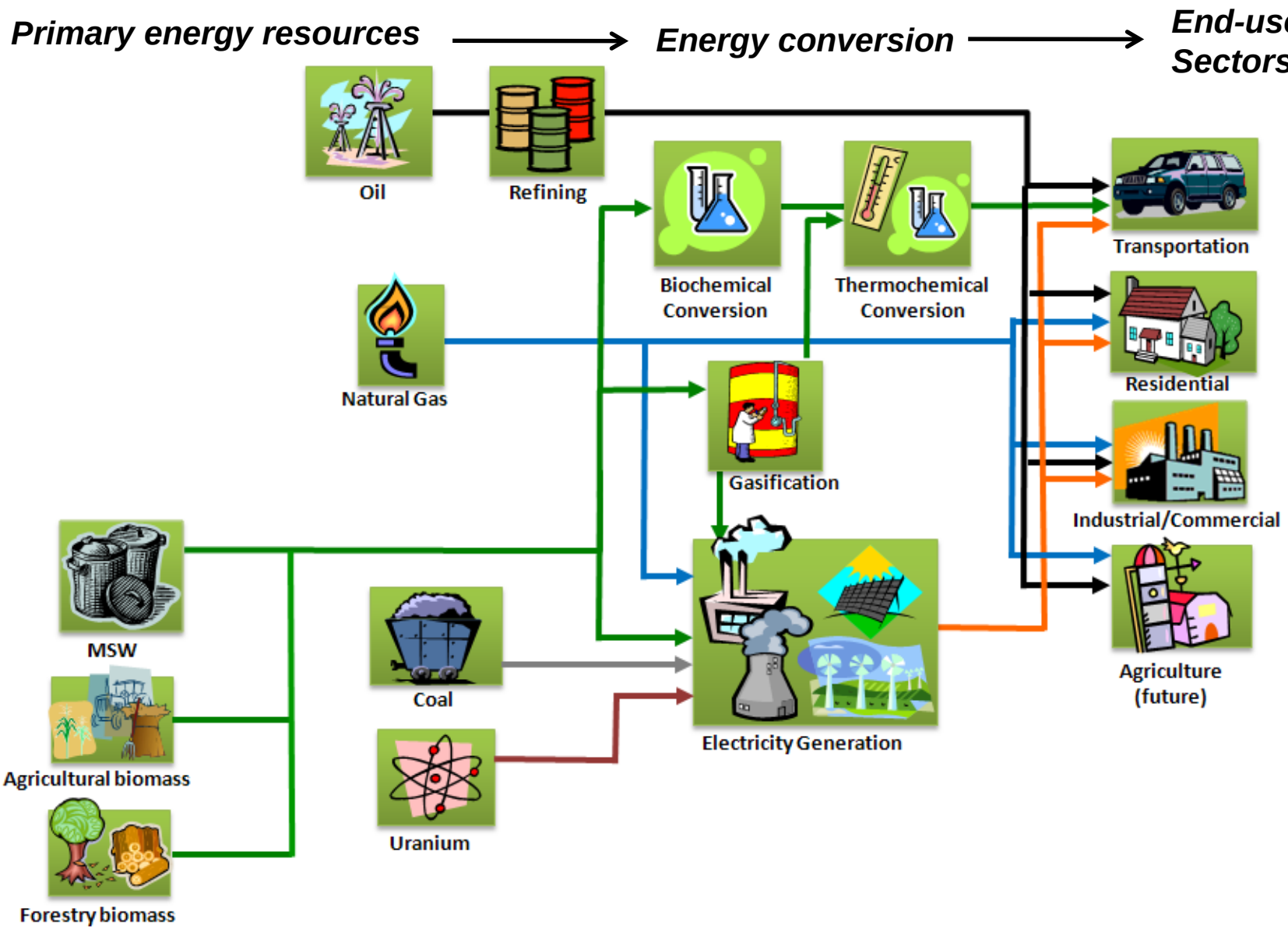
Objective

- Identify tools that are science based and quantify a range of metrics to identify “best” strategies based on different priorities that are often location or material specific
- Communicate results supporting more informed decisions
- Use tools to track performance over time

The Life-Cycle of “Stuff”



Importance of reflecting energy grid changes



Tool for identifying more sustainable strategies for managing materials and discards in municipal solid waste

In 2012, ORD released a decision support tool to simulate existing MSW management practices and conduct scenario analyses of new strategies based on cost and environmental objectives.

The tool is freely available including multiple design options for MSW collection, transport, transfer, materials recovery, composting, waste-to-energy, and landfill disposal. Has been used in over 200 studies by industry, academia, World Bank, NGOs, and state and local government.

A next generation tool for MSW management of materials and discards is under development

Anticipate work to be completed by 2018. New tool will include

- Updates to life-cycle based process models and addition of new process models (i.e., anaerobic digestion and gasification) using results from recently completed research funded by National Science Foundation
- Mixed-integer optimization to allow for analysis of evolution MSW system over a period of time
- Estimate of metrics for cost, LCA environmental and energy tradeoffs, and societal aspects (such as land usage and population density). Cost is based on full cost accounting and environmental metrics include greenhouse gas emissions, energy and land usage, waterborne pollutants, air criteria pollutants, and other life-cycle environmental tradeoffs

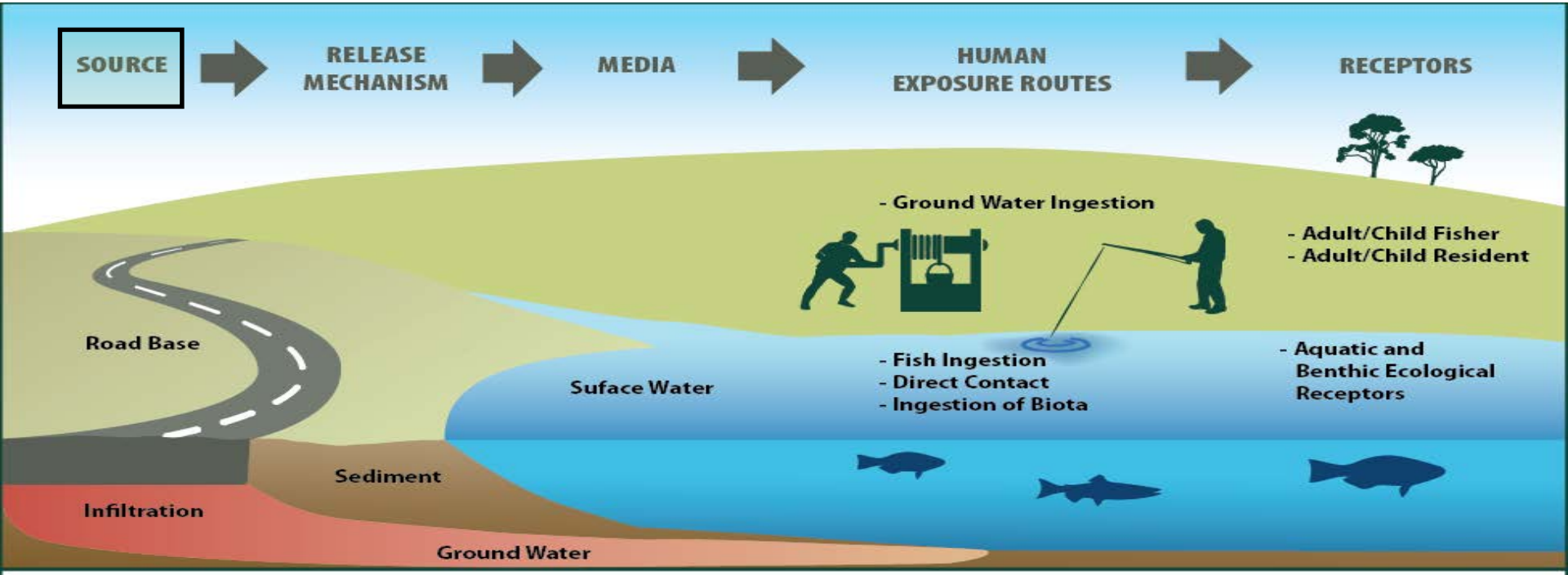
Other improvements include:

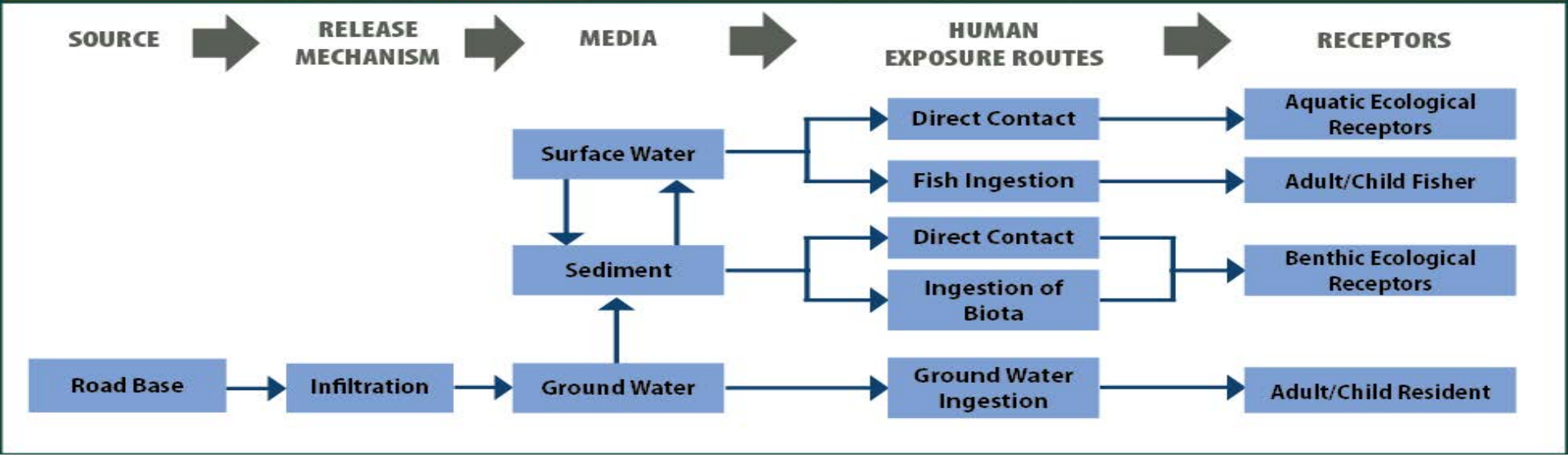
- Incorporating feedback from current user group on improvements to user interface and ability to answer community-specific questions
- Advanced visualization and interpretation tools for use in communicating with public, city officials, and other decision makers

EPA's Beneficial Use Framework

- Virtually all industrial sectors generate by-products that are typically discarded but may be used to replace natural resources and conserve energy
- EPA has defined beneficial use as the incorporation of an industrial material into a commercial product that
  1) provides functional benefit;
  2) meets relevant design specifications and performance standards for the proposed use;
  3) replaces virgin, raw materials in a product already on the market and
  4) doesn't pose any unintended risk to human health and the environment

From EPA's Beneficial Use Framework



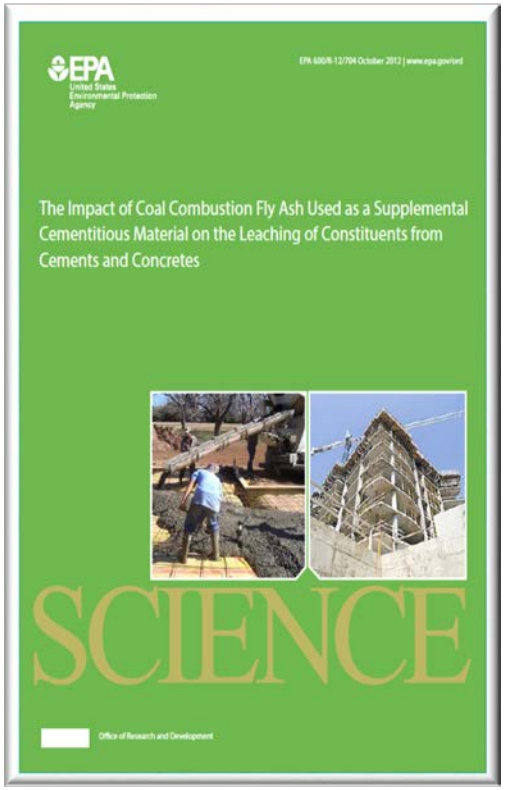


More accurate source term to evaluate any unintended consequences from use of industrial by-products

- Leaching Environmental Assessment Framework (LEAF) is a collection of
  (1) four leaching methods;
  (2) data management tools,
  (3) geo-chemical speciation and mass transfer modeling;
  (4) quality assurance and control; and
  (5) integrated leaching assessment approaches.
- LEAF provides data to more accurately predict the source term for environmental release of mercury and other constituents of potential concern to either groundwater or surface water bodies.
- The integration of leaching results provides a site-specific or material-specific “source term” for use in fate and transport models.

EPA's Decision to Allow Use of Coal Fly Ash

- EPA applied the beneficial use framework and concluded that coal fly ash can be used as replacement for portland cement in concrete and flue gas desulfurization gypsum as a substitute for mined gypsum in wall board
- EPA encourages the beneficial use of coal ash in an "appropriate and protective manner", because of the potential positive environmental, economic, and product benefits such as:
  - reduced use of virgin resources,
  - lower greenhouse gas emissions,
  - reduced cost of coal ash disposal, and
  - improved strength and durability of materials.
- While the beneficial use of coal ash has potential benefits, the environmental impacts associated with their use should be considered. LEAF is intended for developing more reliable source terms for use in evaluating management decisions for either beneficial use of industrial by-product or for waste treatment and disposal.



Benefits from using these tools

- Purpose of using these tools
  - Have standardized process for evaluation that is internally consistent and can reflect the net LCA environmental tradeoffs, costs, and other societal aspects
  - Assess the potential roles of specific technologies or strategies to meet policy goals
  - Identify important system interactions and potential unintended consequences
  - Consider uncertainties in fuel prices, technologies, and policy
- Reflecting differences in how the energy system evolves over time which will have profound impacts on our environment, including climate, air and water

Notes

- For more information, contact: Susan Thorneloe
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  For further information on these tools refer to the tools section at this EPA web address:

  http://www.epa.gov/land-research/models-tools-and-databases-land-and-waste-management-research

  Or access to tools and further information can be found on the project websites

  https://mswdst.rti.org/

  http://www.vanderbilt.edu/leaching/

** This presentation has gone through the EPA clearance process but does not necessarily reflect the opinions and policies of the EPA.*