

# **A Tool for Sustainable Integrated MSW Management**

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# Outline

- Research objective
- System description
- Decision support tool
- Case study applications

# Research Objective

- To develop state-of-the-art tools and information to support the evaluation of strategies for integrated MSW management with respect to:
  - Life cycle energy consumption
  - Life cycle environmental burdens
  - Full cost of solid waste management

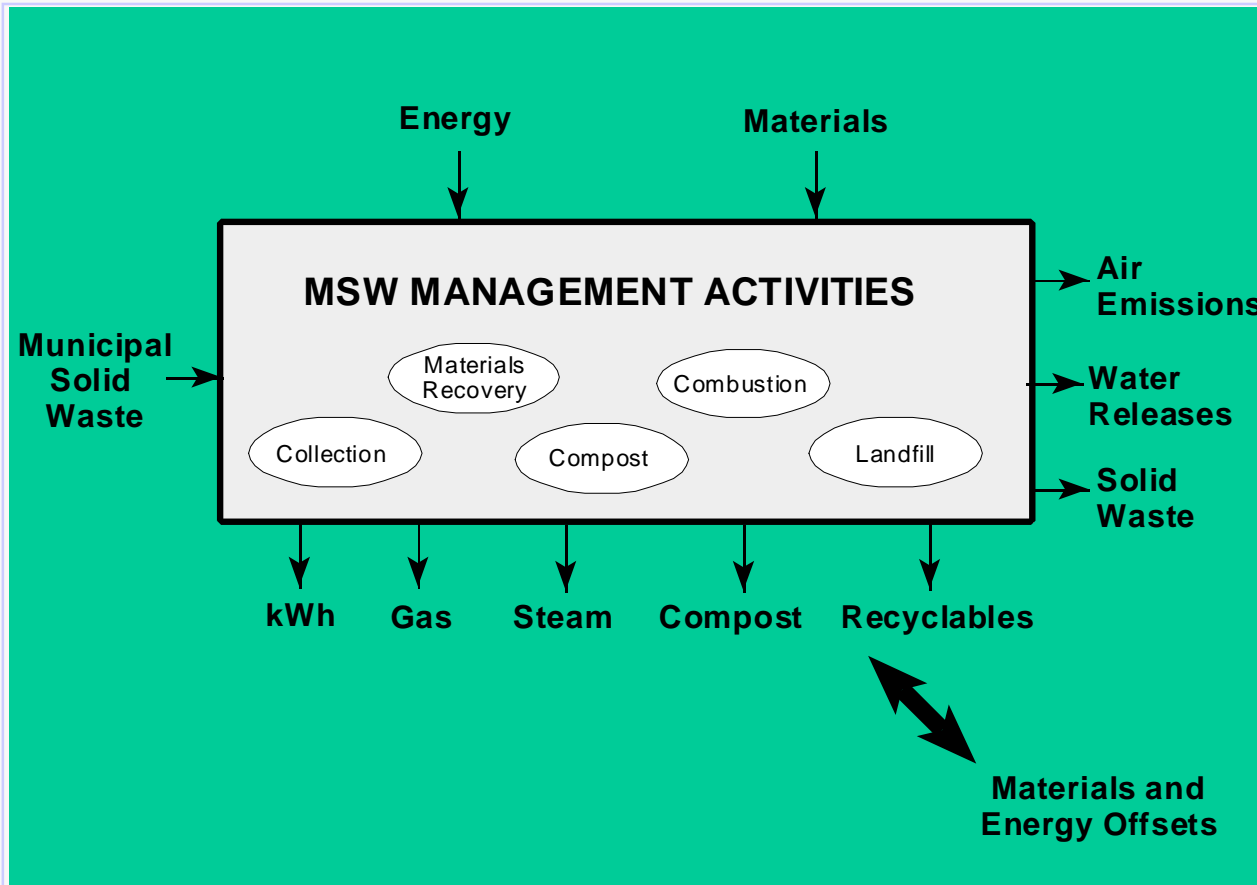
# Acknowledgments

- Research funded by the U.S. EPA and U.S. DOE.
- Research team consists of:
  - Research Triangle Institute (Prime)
  - North Carolina State University
  - University of Wisconsin at Madison
  - Franklin Associates
  - Roy F. Weston

# System and Functional Unit

- *System Function* - to manage a given quantity and composition of MSW for a defined region.
- *Functional Unit* - the management of a defined quantity and composition of MSW.

# Integrated Waste Management



# MSW Components

- Includes 48 individual aluminum, glass, paper, plastic, steel, and yard/food waste materials.
- Includes combustion ash
- No C&D waste
- No hazardous waste
- No industrial process waste

# Waste Generation Sectors

- Residential (2)
- Multifamily (2)
- Commercial (10)

\*14 Total Sectors



# Unit Processes

## MSW Management:

- Collection (21)
- Transfer Station (8)
- MRF (5)
- Combustion (1)
- Compost (3)
- RDF/PRF (2)
- Landfill (3)

## Other:

- Electrical Energy
- Transportation
- Remanufacturing
- Source Reduction

\*43 Total Waste  
Management Options

# Parameters Tracked

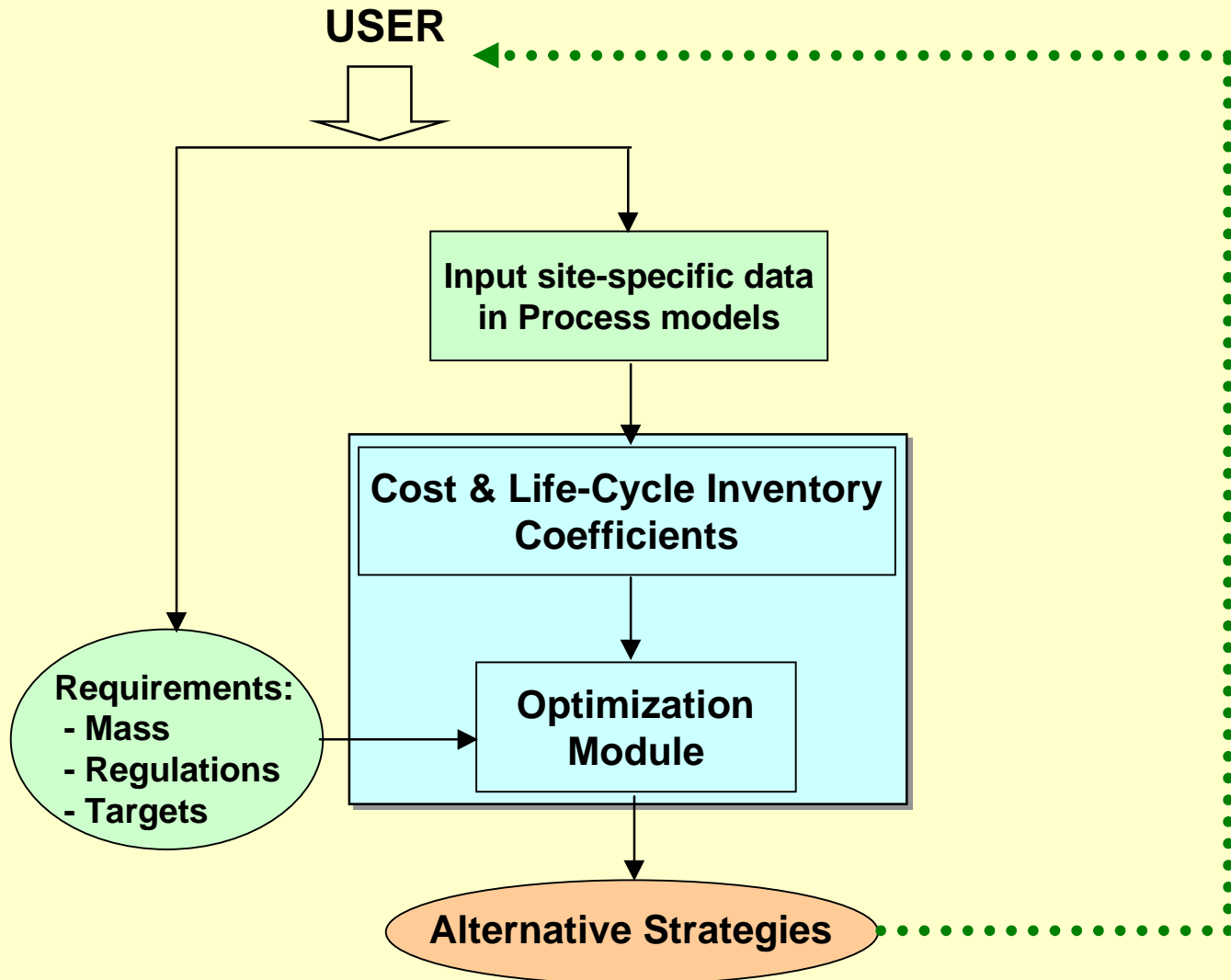
- Cost
- Energy Consumption
- Air Emissions
- Waterborne Releases
- Solid Waste

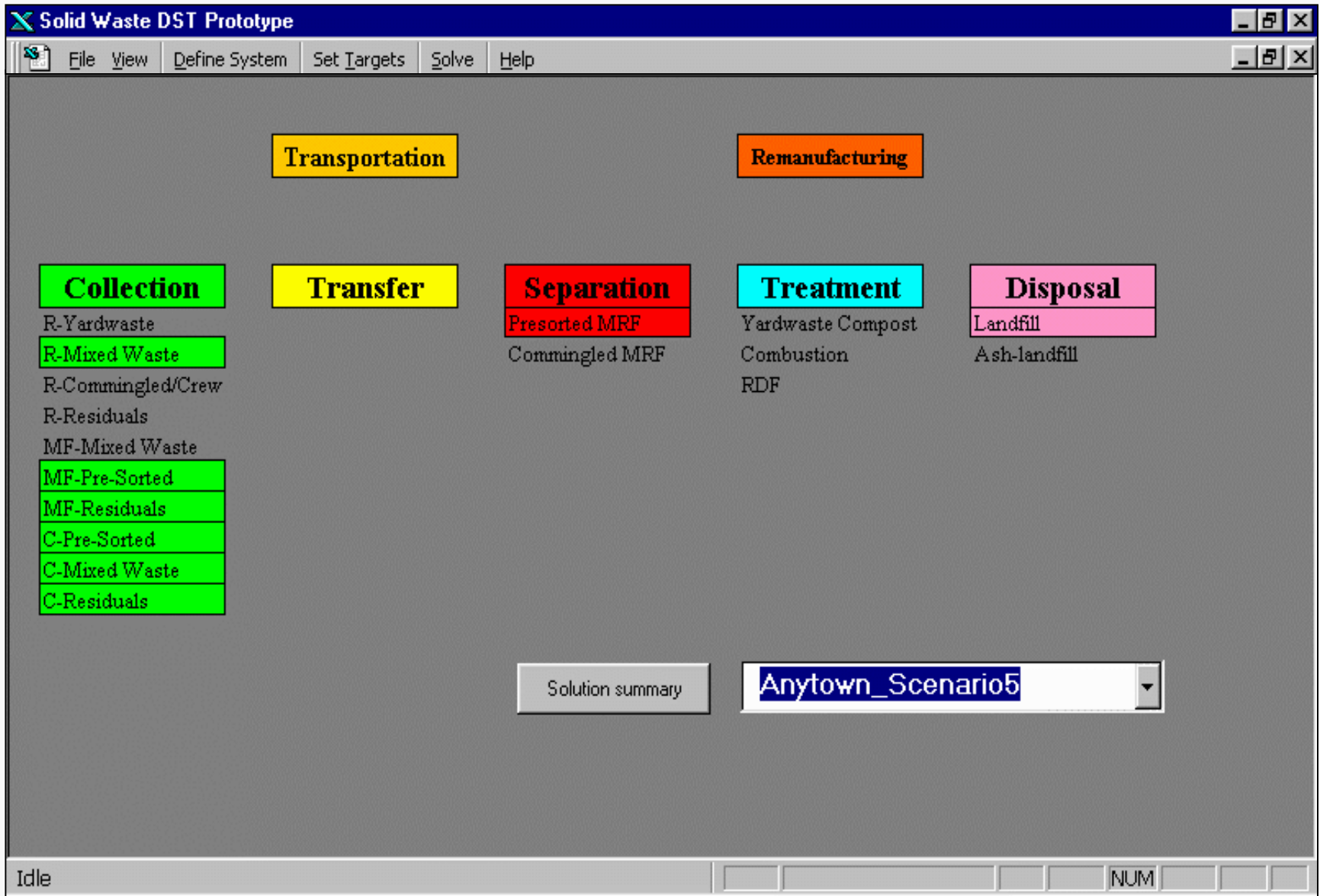
\*32 Tracked Parameters

# Not Included in System

- Backyard composting
- Home processing of recyclables
- Container/bag manufacture
- Facility construction
- Capital equipment manufacture
- Minor ancillary materials (e.g., tires)

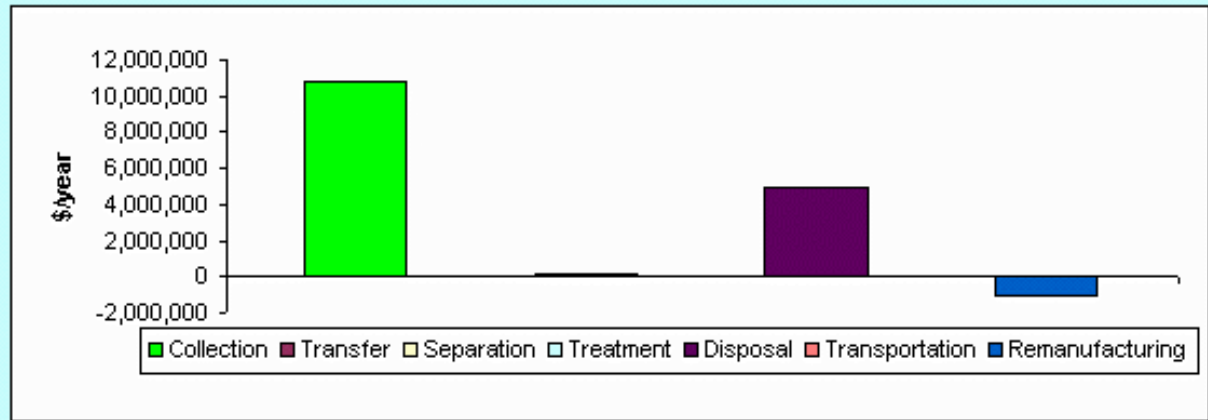
# Decision Support Tool Framework



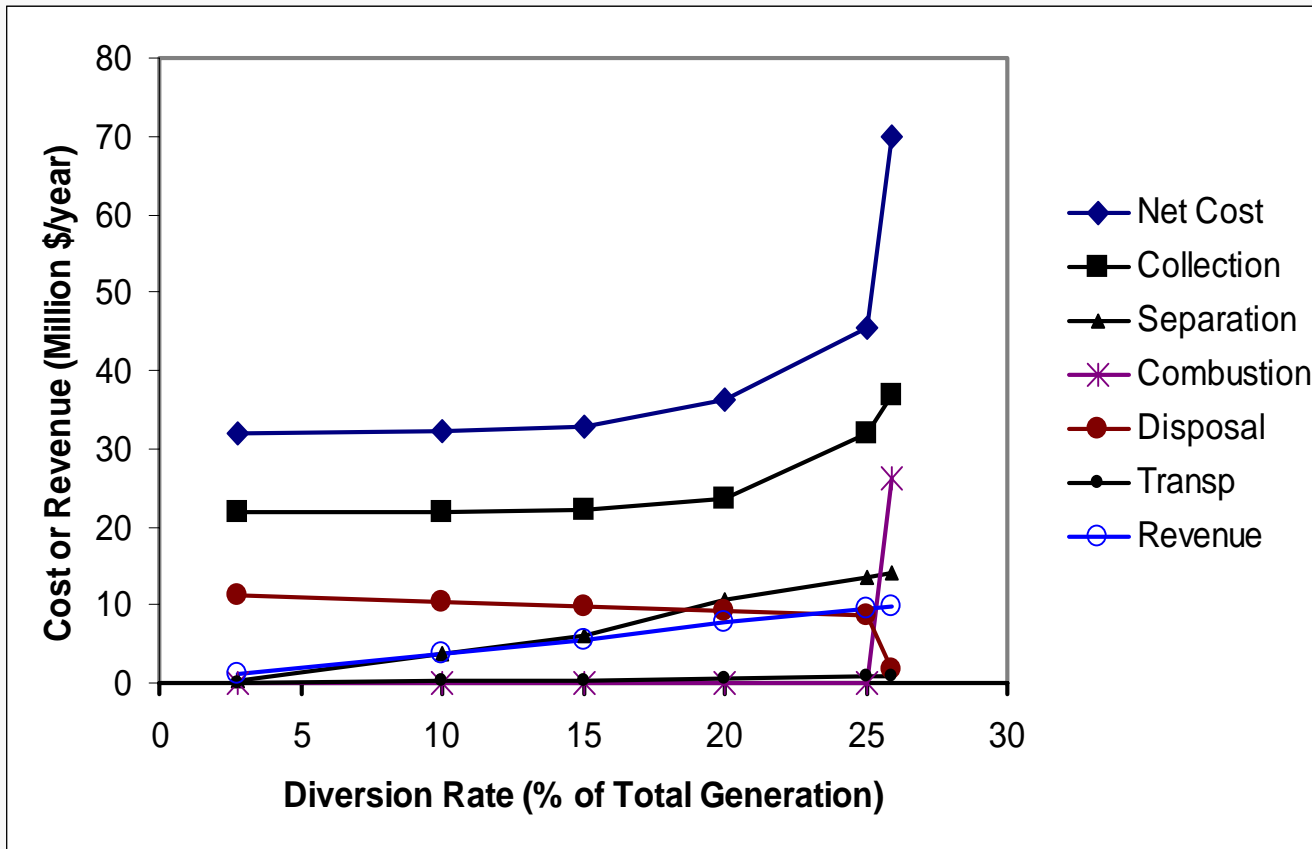


## Anytown Scenario5

<b>Cost</b>		<b>14,862,253 \$/year</b>	<input type="button" value="Return"/>
Energy Consumption		-105,482 MBTU/year	
Particulate Matter 10	n/a	lbs PM10/year	
Total Particulate Matter		-69,080 lbs Total PM/year	
Nitrogen Oxides		-42,835 lbs NOx/year	
Sulfure Oxides		-232,315 lbs SOx/year	<input type="button" value="Solution workbook --&gt;"/>
Carbon Monoxide		-479,685 lbs CO/year	
Carbon Dioxide Biomass		45,637,359 lbs CO2 Bio/year	
Carbon Dioxide Fossil		4,212,754 lbs CO2 Fossil/year	
Green House Equivalents		26,201 lbs GHE/year	



# Cost and Diversion Rates



# Current Case Studies

- Lucas County, Ohio
- Great River Regional Waste Authority, Iowa
- Anderson County, South Carolina
- Integrated Waste Services Association
- State of Wisconsin
- Navy Region Northwest
- Southern Research Institute
- EPA Region 5



# State Of Wisconsin

- Evaluating environmental benefits of State-wide recycling programs:
  - How do changes in State mandated recycling goals affect environmental burdens?
  - How do landfill tipping fee surcharges affect environmental burdens?
- Results will assist State in deciding upon MSW management strategies to help meet environmental improvement goals.

# Waste Flow in Wisconsin

Waste Generation by Category (data used to generate results)		2000 (projected) (tons)	1995 (tons)	Percent Increase in 2000 from 1995 levels
<b>Waste Generated</b>				
	Residential	1,882,678	1,858,176	1%
	Multi-family	219,869	213,097	3%
	Commercial	1,599,000	1,443,000	11%
	<i>Materials recycled in Wisconsin and that are not captured in model</i>	220,670	201,075	10%
	total	<u>3,922,216</u>	3,715,348	6%
<b>Materials Recycled</b>				
	Residential	353,292	348,694	1%
	Multi-family	36,925	35,788	3%
	Commercial	617,011	556,815	11%
	<i>Materials recycled in Wisconsin and that are not captured in model</i>	220,670	201,075	10%
	total	<u>1,227,898</u>	1,142,371	7%
<b>Yardwaste Diverted from Landfill</b>				
	Backyard Composting	290,000	290,000	0%
	Yardwaste Composting at Facility	200,000	199,000	1%
	total	<u>490,000</u>	489,000	0%
<b>Waste Landfilled</b>				
	Residential	1,329,386	1,310,482	1%
	Multi-family	182,943	177,309	3%
	Commercial	981,989	886,185	11%
	total	<u>2,494,318</u>	2,373,976	5%

# Decreases in Environmental Burdens

Parameter	Units	2000 LCI	1995 LCI	Percent Decrease in 2000
<b>Energy Consumption</b>	MBTU/year	-18,401,487	-16,336,584	13%
<b>Air Emissions</b>				
Total Particulate Matter	lbs/year	-7,099,020	-6,661,000	7%
Nitrogen Oxides	lbs/year	-5,701,841	-4,113,438	39%
Sulfur Oxides	lbs/year	-28,309,439	-26,180,065	8%
Carbon Monoxide	lbs/year	-58,941,490	-53,383,855	10%
Carbon Dioxide Biomass	lbs/year	-4,808,539,768	-4,245,230,977	13%
Hydrocarbons (non CH4)	lbs/year	-2,176,317	-2,074,993	5%
Lead	lbs/year	-172,303	-156,015	10%
Ammonia	lbs/year	-3,156	-2,833	11%
<b>Total Solid Waste</b>	lbs/year	-260,148,440	-258,263,368	1%
<b>Water Releases</b>				
COD	lbs/year	-13,992,549	-12,456,840	12%
Sulfuric Acid	lbs/year	-317,452	-271,836	17%
Ammonia	lbs/year	-58,926	-51,950	13%

# Increases in Environmental Burdens

Parameter	Units	2000 LCI	1995 LCI	Percent Increase in 2000
<b>Air Emissions</b>				
Carbon Dioxide Fossil	lbs/year	730,444,272	633,036,225	15%
Carbon Equivalents	tons /year	153,449	137,516	12%
Methane (CH <sub>4</sub> )	lbs/year	18,802,272	17,876,727	5%
Hydrochloric Acid	lbs/year	-31,471	-38,060	17%
<b>Water Releases</b>				
Dissolved Solids	lbs/year	4,631,647	4,448,438	4%
Suspended Solids	lbs/year	-112,863	-338,610	67%
BOD	lbs/year	5,738,022	5,287,224	9%
Oil	lbs/year	730,062	660,790	10%
Iron	lbs/year	765,001	695,309	10%
Phosphate	lbs/year	17,512	16,154	8%
Zinc	lbs/year	10,669	9,653	11%

# For More Information

- Visit the project web site
  - <http://www.rti.org/units/ese/p2/lca.cfm>
  - Contains
    - Quarterly updates
    - Publicly available information such as a project brochure, DST power-point presentation, & summary documentation
    - Copies of review documents for stakeholders (with Password)
- Further questions?
  - Contact Keith Weitz at [kaw@rti.org](mailto:kaw@rti.org) or 919-541-6973