



Massachusetts  
Department  
*of*  
ENVIRONMENTAL  
PROTECTION

# **RESOURCE CONSERVATION PLANNING GUIDANCE**

**UNDER THE TOXICS USE REDUCTION ACT  
(TURA)**

**WORKING DRAFT**

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*Developed in collaboration with:*  
Office of Technical Assistance and Technology  
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## Table of Contents

	<b>Page</b>
<b>I. Introduction</b>	<b>1</b>
A. What is Resource Conservation Planning?	1
B. What Types of Assets can be Considered in a Resource Conservation Plan?	3
C. What Does Resource Conservation Planning Involve and What Does it Commit my Facility to do?	4
D. General Guidelines for Resource Conservation Planning	5
<b>II. Resource Conservation Planning Requirements For All Assets</b>	<b>6</b>
A. Employee Notification	6
B. Facility-Wide Information	7
C. Detailed Evaluation for Selected Operations	10
D. Certification Requirements	12
E. Plan Summary and Progress Report	13
<b>III. Guidance for Specific Assets</b>	<b>14</b>
A. Energy	15
B. Water	22
C. Materials That Contribute to Solid Waste	30
D. Toxic Substances Exempt From TURA Reporting and Non-listed Chemical Substances	36
1. Toxic Substances Exempt From TURA Reporting	36
2. Chemicals Used In Articles and Products	39

Note: This guidance document will be used for the 2008 TURA planning cycle. After the 2008 planning cycle, MassDEP will review and revise this guidance as needed to support future planning cycles. Please submit any suggestions and feedback on the usefulness of this Resource Conservation guidance to Julia Wolfe at MassDEP at [Julia.wolfe@state.ma.us](mailto:Julia.wolfe@state.ma.us).

## I. INTRODUCTION

The Toxics Use Reduction Act (TURA, MGL c. 21I) and its regulations at 310 CMR 50.00, establish toxics use reduction as a central component of the Commonwealth's efforts to protect public health and the environment and to promote the competitive advantage of Massachusetts businesses through efficient materials use and management. Originally enacted in 1989, TURA requires certain facilities that manufacture, process, or otherwise use listed toxic substances in their operations above specific thresholds to file annual reports detailing their management of toxics, and to undergo a planning process to identify opportunities for toxics use reduction. The outcome of the planning process is a toxics use reduction plan (TUR plan).

While facilities have made significant progress through TUR planning – including a 41% reduction in toxic chemical use and a 65% reduction in toxic byproducts<sup>1</sup> – program stakeholders agreed that additional opportunities for environmental benefits exist and that the program should be updated and improved in light of the experience gained from TURA over its 15-year history. On July 28, 2006, “An Act Amending the Toxics Use Reduction Act” (Chapter 188 of the Acts of 2006) was signed into law, representing the first major overhaul of the statute since it was enacted.

The new legislation allows TURA facilities that have completed a TUR plan and two plan updates to choose alternative planning options: they can choose to develop either a Resource Conservation Plan every other planning cycle, or to implement an Environmental Management System (EMS) that integrates toxics use reduction in lieu of further TUR plan updates. These options provide new flexibility for TURA filers to focus on resource conservation opportunities in water, energy, solid waste, or non-TURA regulated chemicals and to voluntarily implement facility improvements that result in environmental and economic benefits.

This guidance document focuses on **Resource Conservation Planning**. Its purpose is to help TURA facilities understand the resource conservation planning process and the required elements of a resource conservation plan (see 310 CMR 50.90), and to direct you to additional resources. For information on implementing an Environmental Management System and guidance on developing a TUR plan, please visit the Massachusetts Department of Environmental Protection's (MassDEP's) website at [www.mass.gov/dep/toxics/toxicsus.htm](http://www.mass.gov/dep/toxics/toxicsus.htm).

### (A) What is Resource Conservation Planning?

“Resource conservation” is defined by statute (MGL c. 21I Section 2: Definitions) as “an action that decreases the use or consumption of a natural asset such as water, energy, or raw materials, or increases the efficiency of the use of the asset, without increasing the risk to the public, including workers and consumers, or the environment and without increasing the amount of the waste generated”. The specific natural assets considered are described below in the next section (section B).

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<sup>1</sup> Measured using 2004 data normalized for changes in production reported by a core group of industries that have been subject to reporting since 1990.

*Resource Conservation Planning is an opportunity for TURA filers to identify other source reduction opportunities that would produce environmental and health benefits, while improving their competitive business position.*

*This document should be used in conjunction with the regulations, which specify the requirements of Resource Conservation Planning.*

Resource conservation planning is a voluntary pollution prevention planning option for TURA filers who may not have additional technically or economically feasible TUR opportunities. Any TURA filer who has already completed a TUR plan and two plan updates is eligible to choose the resource conservation planning option. TURA filers **do not** have to demonstrate lack of remaining TUR opportunities in order to choose to complete a resource conservation plan. However, in the following planning cycle after the first resource conservation plan is completed, the TURA filer must return to TUR planning (as prescribed in M.G.L 21I Section 11). In subsequent planning years, the TURA filer can choose to alternate between TUR planning and resource conservation planning with the same asset or a different one – in other words, they can return to resource conservation planning every four years.

The resource conservation planning option is an opportunity for companies to identify resource conservation opportunities in areas not covered by a TUR plan that would produce environmental and health benefits, while improving their competitive business position. This planning option provides companies the **flexibility** to use the TUR planning tool to identify source reduction opportunities within a chosen resource or natural “asset”, in order to reduce the use of the asset, including the amount of waste generated. In some cases reductions in one asset may reduce the use of another asset (e.g., reductions in water use reduce energy use). However, resource conservation planning should not increase the use of one asset in order to decrease the use of another asset – unless the overall environmental impacts are reduced.

### **Reducing Greenhouse Gas Emissions that Contribute to Climate Change Through Resource Conservation Planning**

Industrial and commercial energy use accounts for nearly 30% of total U.S. greenhouse gas emissions. These emissions primarily result from electricity use, product transportation, burning fossil fuels to power boilers and produce steam, and using gasoline to power vehicle fleets. MassDEP believes that reducing the use of energy, water, and materials can achieve greenhouse gas (GHG) reductions and associated climate benefits. Beyond energy use, for example, reducing water use can result in less energy (and associated GHG emissions) needed for facility processes. Reducing materials use also will reduce GHG emissions when viewed from a life-cycle perspective.

While Resource Conservation planning focuses on facility-based operations, it is flexible so that a company may include in its plan issues such as refrigerant releases, business travel, and other broader GHG emission reduction initiatives, provided the plan addresses facility operations in at least one of the listed assets. Ideally, a climate-focused resource conservation plan would address energy, water, and materials; however, a facility can choose to focus its resource conservation plan on just one asset.

**(B) What Types of Natural Assets Can Be Considered in a Resource Conservation Plan?**

TURA filers may choose *one or more* of the following categories of natural assets for resource conservation planning. For each of these assets, reductions may be measured in terms of overall reductions or reductions per unit of production:

1. **Energy:** Reducing the amount of energy consumed and/or reducing the amount of fossil fuels used to produce energy. This includes:
  - a. Energy conservation and efficiency (e.g., technologies and standard operating procedures that reduce the amount of energy consumed per unit of industrial production, which also may reduce greenhouse gasses emitted);
  - b. Energy supply management (including types of energy used such as renewable energy); and
  - c. Energy related to products and services (including vehicles).
  
2. **Water:** This includes:
  - a. Reducing the amount of water used (e.g., demand management, conservation techniques such as water reuse);
  - b. Reducing the amount of water wasted by reducing losses (e.g., fixing leaky faucets and pipes)
  
3. **Materials that contribute to solid waste:** This includes:
  - a. Reducing materials use through source reduction and reuse;
  - b. If no source reduction options exist, increasing recycling and/or composting of materials.
  
4. **Toxic substances used below threshold amounts:** Reducing TURA chemicals (pursuant to 301 CMR 41.00) used below reporting thresholds (defined in 310 CMR 50.10);
  
5. **Chemical substances exempt from TURA reporting:** Reducing non-listed hazardous, toxic or other substances used in the facility. This includes:
  - a. Chemicals with emerging hazard information too new to be listed (e.g., penta BDE flame retardants)
  - b. Other substances with low hazard, but where there is substantial opportunity for pollution prevention.
  - c. TURA chemicals used in processes or operations not required to report and plan under TURA
    - janitorial products
    - research and development
    - pilot equipment
    - toxics in articles<sup>2</sup> (e.g., reducing mercury in bulbs, switches and relays, and lead

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<sup>2</sup> “Article” is defined in 310 CMR 50.10 as: a manufactured item, other than an item which is manufactured at the facility: (a) which is formed to a specific shape or design during manufacture; (b) which has end use functions dependent in whole or in part upon its shape or design during end use; and (c) which does not release a toxic substance under normal conditions of

in alloys of parts included in products, but not manufactured or processed at the facility).

**(C) What Does Resource Conservation Planning Involve, and What Does It Commit My Facility To Do?**

A TURA filer that chooses resource conservation planning is committing to:

1. ***Complete a Resource Conservation Plan:*** The plan is the resulting documentation of the planning process and is similar to a TUR plan. A resource conservation plan must include:
  - a. Targeted asset(s)
  - b. A facility-wide review of the chosen asset that gathers enough information to enable identification of resource conservation opportunities.
  - c. Identification of resource conservation opportunities in specific operations
  - d. A detailed assessment of the selected operations, including documentation such as a process flow diagram, baseline use of the asset, identification of resource conservation options, technical and economic evaluations of options, and an implementation schedule.
  - e. Resource conservation options the facility plans to implement, including an implementation schedule, and other identified options not selected for implementation.
  - f. Expected change in the use of the asset during the planning period.

MassDEP requires plans to be completed by July 1 in even-numbered calendar years (e.g., July 1, 2008). A TURA filer that has completed a TUR plan and two plan updates may develop a resource conservation plan as early as July 2008.

2. ***Notify and solicit input from employees on the requirements of the Plan:*** Companies are required to notify and begin soliciting input from their employees on the plan at least six months prior to plan completion (i.e., by January 1 of the applicable planning year). Facility personnel in engineering, environmental compliance, marketing, finance, purchasing, sales, production, management, quality control, legal, health and safety, materials control, and research and development represent a wide range of expertise and may have resource conservation ideas or information to contribute.
3. ***Submit to MassDEP a certified Resource Conservation Plan Summary:*** A resource conservation plan summary describes the entire plan in broad strokes (similar to a TUR plan summary).
4. ***Submit to MassDEP a Resource Conservation Progress Report with the next TUR Plan Summary:*** The TURA filer must complete a resource conservation progress report (see Section II D) with the next TUR plan summary that provides qualitative and quantitative results on the progress of the resource conservation plan.

5. **Keep Records:** Plans and supporting documentation must be kept at the facility for at least five years after the plan completion date and must be made readily available for review if requested by a MassDEP inspector. Please note:
- a. The plan must specify the location of all referenced documentation and supporting data.
  - b. Calculations, assumptions, supporting data, and other documents used for the calculations must be included or referenced in the plan.
  - c. Analyses and calculations may be presented in the plan in a variety of ways: in their original form, whether handwritten, a formal consultant's report, a computer printout, etc. There is no need to reformat or retype the work done. As long as the information is legible, it can be included as is. Also, duplicate information may be cross-referenced in the plan.

#### **(D) General Guidelines for Resource Conservation Planning**

Facilities should adhere to three standards in preparing a resource conservation plan:

- good faith effort,
- good engineering practices, and
- sound accounting practices.

Decisions that are made during resource conservation planning and implementation are like other business decisions companies make. The analysis must be sufficiently thorough to allow informed business decisions. In some situations minimal analysis is appropriate or required. Other choices require careful study, monitoring, and testing.

MassDEP highly recommends that facilities begin the planning process early in the year (e.g., hold their first planning team meeting no later than January or February). Experience shows that facilities that start early have the time needed to gather enough information to develop a meaningful and useful plan that will benefit the facility.

Facilities are not required to implement any resource conservation options they identify but experience shows that when companies have completed the planning process they often discover options they want to implement because doing so is in their best interest. If a facility decides to pursue a resource conservation option, the plan must contain an implementation schedule. While facilities are not required to abide by the implementation schedule, if a facility decides to alter or abandon the schedule the regulations require that an explanation for the decision must be included in the resource conservation progress report that is submitted with the next TUR plan summary.

Although the company is only required to submit one resource conservation progress report with the next TUR plan summary (i.e., two years after the resource conservation plan is completed), companies are encouraged to follow the TUR continual improvement process for their resource conservation plan. The TUR continual improvement process is built around four steps: plan, implement, evaluate, and review.

## II. RESOURCE CONSERVATION PLANNING REQUIREMENTS FOR ALL ASSETS

Resource conservation planning allows companies to take the planning methods and skills they have used successfully to achieve toxics use reduction and apply them in a similar way to specific natural assets. This includes creating a multi-disciplinary team, tracking the flow of materials and resources, brainstorming resource conservation opportunities, assessing options, developing implementation strategies, and measuring progress. This guidance focuses specifically on how these proven strategies can be applied to resource conservation planning. Since resource conservation planning is essentially the same as TUR planning, users of this guidance also should refer to MassDEP's TUR planning guidance.

*Resource Conservation Planning is a voluntary and flexible option for TURA filers.*

In addition to the resource conservation planning process laid out in 310 CMR 50.90 and in this guidance, there are many other planning tools that a facility can use in resource conservation planning. These include tools that are specific to particular assets, such as energy efficiency. They also include different approaches, such as Design for the Environment principles that can be applied to operations or products under development. This guidance does not describe every approach, but provides references for common strategies.

The resource conservation planning regulations are flexible, leaving companies free to use a process and format that works best for them provided that all the elements and the general process required in the regulations are met. Companies routinely compile much of the information needed to do an adequate plan in the normal course of their business and are encouraged to use available data. Facilities that have recently completed an audit of one of the assets (e.g., an energy audit) may build on the audit to create their resource conservation plan.

*Although the planning process is flexible, certain regulatory requirements need to be met for a plan to be certified by a TUR planner.*

The following section provides detailed explanation of the resource conservation planning process and requirements.

### (A) Employee Notification [310 CMR 50.92(6)]

Similar to TUR planning, facilities must notify all employees about the resource conservation plan and solicit ideas on resource conservation options (e.g., ways to reduce energy or water use, etc.). Facility personnel in engineering, environmental compliance, marketing, finance, purchasing, sales, production, management, quality control, legal, health and safety, materials control, and research and development represent a wide range of expertise and may have resource conservation ideas to contribute. The plan need only describe the steps it took to notify employees. It is not necessary that the employee notice be in writing. If the company notified the employees through a written notice, then the plan should include the written notice and a description of how and when it was distributed.

To comply with the planning requirement, the company is required to do the following at least six months before the plan due date (i.e., by January 1<sup>st</sup> of each planning year):

1. Notify all of its employees of the requirements of the plan;

2. Identify the asset and processes being considered for inclusion in the plan; and
3. Solicit comments and suggestions from employees on resource conservation options.

**(B) Facility-Wide Information**

In TUR planning, you must develop a plan for all listed chemicals used above threshold amounts in all production units. In resource conservation planning, you are not required to develop a detailed plan for all uses of an asset in your entire facility. Instead, the resource conservation plan requires a facility-wide evaluation of all asset use and potential resource conservation opportunities, but allows you to choose a subset of operations for detailed evaluation of resource conservation options. The facility-wide plan requirements [310 CMR 50.93(1) – (2)] include:

1. Establishing a resource conservation management policy
2. Developing a plan scope for the chosen asset that includes:
  - a. Description of the natural asset chosen (e.g., water)
  - b. Summary of the facility’s use of the selected asset including a description of all facility operations using the selected asset
  - c. Description and ranking of the resource conservation opportunities
  - d. Description of which operations were selected for detailed evaluation
  - e. Summary of the process for identifying resource conservation options
  - f. Description of the resources conservation options considered and those selected for implementation.
3. Summarizing the expected change in the chosen asset use based on the options selected to be implemented.

Each of these requirements is described in greater detail below.

Management Policy [310.CMR.50.93(1)]

The management policy should be similar to and/or build on the policy developed for TUR planning except it should focus on resource conservation. As with TUR planning, strong management commitment is central to successful development and implementation of resource conservation programs. Because these programs may encompass many facets of facility operations, such as process engineering, environmental management, financial analysis and research and development, it is essential that support and coordination for resource conservation occur at the management level.

The following are two examples of management policies that address resource conservation as well as toxics use reduction:

<b>Sample Management Policy #1</b>
We, the management of Facility X, are committed to achieving the highest standards of environmental performance and recognize our corporate responsibility to the environment. Our company acknowledges that its operations have a direct and indirect environmental impact and aims to minimize that impact and operate in an environmentally responsible manner. We aim

to produce the highest-quality products possible while identifying cost effective measures for toxics use reduction and resource conservation. In this effort, our highest priority will be the proactive pursuit of identifying processes and technologies that conserve resources, by either reducing or eliminating the use of toxics and other resources. These objectives will be incorporated into the design of new production processes, the redesign of existing processes, and the construction of new facilities. We encourage all employees to forward their suggestions for helping to conserve resources.

## **Sample Management Policy #2**

### ***Policy Statement***

Facility Y believes that a proactive approach toward conserving and enhancing natural resources is consistent with our Core Values and fundamental to achieving our Mission. We recognize that efficient resource use and protection of the environment are vital for the continued success of our operations and provide a valuable benefit to our customers and communities. As a Company, we strive to act as responsible stewards of the environment and are committed to continuous improvement. We recognize that resource conservation and environmental protection is the collective responsibility of government, business, individuals and communities. We are committed to implementing efficient and effective practices within our organization and to working in partnership with our stakeholders to pursue this goal.

### ***Corporate Commitments***

In pursuit of this policy our company commits to the following:

- Ensure environmental risks are properly identified, prioritized and managed in an appropriate and timely way.
- Establish sound environmental management policies and promote best practice.
- Manage operations in ways that are environmentally sustainable and economically feasible, by making efficient and environmentally responsible use of energy and water and exploiting opportunities to maximize efficiency.
- Minimize environmental impact and reduce or, where practicable, prevent pollution through toxics use reduction.
- Minimize waste production by reduced consumption and develop effective waste management and recycling procedures.
- Collaborate with key suppliers to promote environmentally responsible procurement of goods and services.
- Monitor actively results and audit policies and practices to ensure the company meets policy goals.
- Develop an HR policy to raise and maintain awareness among staff and promote individual good practice and encourage team participation.
- Recognize the legitimate interest that all our stakeholders, including customers, shareholders and employees, have in our environmental performance and communicate openly within the company and to the outside community.

This policy applies to all employees, departments and functions throughout the Company. The full participation of everyone is expected and necessary in order to meet the commitments set forth in this policy. This policy, and our performance under the policy, will be reviewed periodically.

### Scope of Plan [310 CMR 50.93(2)]

The scope of plan serves as an introduction and summary of the plan. It must include:

- a description of the natural asset selected,
- a summary of the facility's use of the selected asset including a description of all facility operations using the selected asset,
- a statement identifying and ranking of overall opportunities to achieve resource conservation,
- a description of which operations were selected for detailed evaluation,
- a summary of the process for identifying technologies, procedures, or training programs that will reduce the use of the asset, and
- a description of the resource conservation options considered and those selected for implementation.

A company may choose to include additional information in the scope of plan about the planning process and the company's environmental activities. The scope of plan cannot be completed until resource conservation options have been identified and evaluated. Though it serves as an introduction to the plan, typically companies will finish the scope of plan once the rest of the plan has been completed. Sample plan scopes are provided for each asset in Section III.

### Characterize Asset Use [310 CMR 50.93(2)(b)]

The facility must develop a summary characterizing the overall use of the chosen asset throughout the facility, including all of the operations in which the asset is used (across the entire facility, not just in production units that use TURA reportable chemicals). The purpose is to broadly identify and understand how, when and where the asset is used in the facility to help pinpoint where there are conservation opportunities. Collecting this information is intended to help in ranking opportunities to achieve resource conservation and identifying specific operations to focus on. Once the best resource conservation opportunities are identified, the second phase of the planning process involves selecting specific operations for more detailed evaluation of resource conservation options.

An effective resource conservation planning process requires a broad understanding of the use of the selected asset. There are different methods for collecting information depending on the asset, and the amount of data collection will vary from organization to organization. However, the goal is to have enough information to identify, rank and select resource conservation opportunities. Section III of this guidance provides more detailed information on characterizing specific asset areas.

There are some general "survey" techniques that may be applied at this point:

1. **Determine appropriate level of detail** — The scope of data collection will vary from organization to organization and from operation to operation. Data can be very specific (e.g., from sub-meters or individual processes) or may be more general (e.g., utility bills or tear sheets).
2. **Account for sources of asset use** — find out where the asset comes from and where it

- goes (e.g., purchased from offsite, generated on-site, released, or sent for disposal).
3. **Document all uses** — For the sources identified, assemble bills, meter readings, tear sheets, and other use data. This data may reside in the accounting or purchasing department or elsewhere at the facility, or can be obtained from utilities, energy or solid waste service providers, or other suppliers.
  4. **Gather at least two years of monthly data or a more frequent interval if available.** Use the most recent data available.
  5. **Collect facility and operational data** — To be able to normalize and benchmark, it may be necessary to collect any related data for all facilities and operations, such as building size, operating hours, etc.

Identify and Rank Opportunities to Achieve Resource Conservation and Select Operations for Detailed Evaluation [310 CMR 50.93(2)(c and d)]

After characterizing asset use, the facility should review the information and identify opportunities to achieve resource conservation in specific operations. This step is meant to be a “screening evaluation” of opportunities to achieve resource conservation of the chosen asset. For example, a facility planning team decides to target energy as their asset and conducts an energy audit to characterize the energy use and determine which facility operations provide the best opportunities for resource conservation. They determine generally where the most energy is being used in the facility: HVAC, lighting, machinery, and transportation. The facility then selects HVAC and lighting for more detailed evaluation of resource conservation opportunities.

In addition to the relative potential to achieve resource conservation, there may be other factors that affect your facility’s ranking and selection of operations to focus on for detailed evaluation. These may include criteria such as:

- Grant or rebate availability
- Production improvements
- Marketing advantage
- Strategic business objectives
- Health and safety improvements
- Liability reduction
- Compliance costs

Section III of this guidance provides information and resources to help facilities learn about resources conversation opportunities for specific assets. Companies may want to engage their TUR Planner when identifying, ranking, and selecting resource conservation opportunities, or even hire a consultant to provide recommendations. This step could involve extensive research and analysis or may rely on the expert judgment of the planning team.

### **(C) Detailed Evaluation for Selected Operations**

Once specific operations are selected for detailed evaluation of resource conservation options, the facility should conduct a more detailed analysis of the asset use in the operations. For each operation, the company should characterize use of the asset (to establish a baseline) and calculate the costs of using the asset in the selected operations. Much of this information already may

*The objective of detailed planning is to identify options and enough information that will allow your company to make a sound business decision on whether to implement an option.*

have been collected in the general asset characterization described above. In the detailed evaluation, the company should develop enough information to identify specific options for the asset in the selected operations. Based on this information, the company should conduct a technical and economic evaluation of the options and then choose the best option (or options) for implementation. The company should then identify goals for reducing the asset use and an implementation schedule for the chosen options.

#### Detailed Information for Selected Operations (310 CMR 50.94):

The resource conservation plan should identify in sufficient detail where and how the asset is used in the selected operations. This should include a process flow diagram, which is a visual representation of the movement of the asset through each relevant operation, including where the asset is lost or wasted. For electrical energy, this could be a visual representation of the operations schedule including utilization and power consumption for specific equipment (e.g., pumps or compressors). The plan should describe the total amount of the asset used in the operation (absolute amount or per unit of product), what estimation method was used in determining the amount, what purpose the asset serves in the operation, and the cost of the asset use. The process flow diagram should help with this description. Remember that the calculations and assumptions used must be included or referenced in the plan. Each asset area has different standards and practices for resource/asset accounting. Please refer to Section III for detailed accounting information for different assets.

#### Procedures for Identifying Resource Conservation Options (310 CMR 50.95)

The plan should include a description of how the company identified technologies, procedures, or training programs for achieving resource conservation for the selected asset, and list those identified as potentially achieving resource conservation. This section should include:

- A list of personnel involved
- Description of information sources consulted
- Description of information gathering techniques
- List of technologies, procedures or training programs identified as potentially achieving resource conservation

#### Technical and Economic Evaluation of Resource Conservation Options (310 CMR 50.96 and 50.96(A))

The company should evaluate the technical and economic feasibility of identified technologies, procedures and training programs. Companies do not need to evaluate a particular option if it is clearly technically or economically infeasible or will not result in resource conservation or will have an adverse environmental impact. Likewise, an economic evaluation only needs to be done for technically feasible options.

If a company cannot complete a technical and economic evaluation by the time the plan is due, the plan must include a description of the options, a description and schedule of the steps to be taken to further evaluate each option, and an explanation of why the evaluation cannot be completed by the due date of the plan.

There are no explicit decision criteria for technical and economic evaluations, and the amount of analysis needed to determine that an option is appropriate or inappropriate will vary. Companies should complete and document enough of an analysis to make an appropriate technical conclusion, which will in turn lead to a good business decision about whether or not to implement an option.

In the technical evaluation, the company should evaluate the expected reductions resulting from implementation of the technology, procedure or training program in each operation, projected for two years from the date the plan is due; the relationship between the option and other applicable laws and regulations; and whether the option is resource conservation as defined under TURA.

In the economic evaluation, the company should evaluate the cost and associated savings for implementing each identified technology, procedure, and training program. The economic evaluation tells a company whether or not it makes economic sense to proceed with implementing an option and should be as detailed as any other capital budgeting exercise the company undertakes.

A company may evaluate costs and savings however it wishes, but should use the same depreciation rate, cost of capital, and economic performance criteria (e.g., payback period, internal rate of return, net present value) it would normally use for capital budgeting. The plan should include economic calculations performed, including assumptions used.

The plan should describe those technologies, procedures and training programs that the company decides not to implement and explain the reason the options were not chosen. For those options the company decides to implement, the plan should describe the options, the anticipated costs and savings, the expected reductions (projected for two years from the date the plan is due) and an implementation schedule. The anticipated reductions should be expressed as goals for reducing the use of the asset (e.g., reduce kWh by 50% by 2010)

#### **(D) Certification Statements [310 CMR 50.92(4) and (5)]**

Once the plan has been developed it must be certified by a senior management official and a certified Toxics Use Reduction Planner with the required continuing education in resource conservation planning. A senior management official is an official who has management responsibility for the persons or team completing the plan, and who has authority to act as an agent for the toxics user. The senior management official certifies the accuracy of the statements in the plan and the information used in it, based on the manager's inquiry of persons immediately responsible for developing the plan. The Toxics Use Reduction Planner certifies that, in his or her professional judgment, the planning process and the plan conform to MassDEP's regulations. The certification statement, which is essentially the same as for TUR plans, will be included with the Plan Summary and Progress Report forms.

#### **(E) Plan Summary and Progress Report (310 CMR 50.97)**

*Resource Conservation Plan Summary Form:*

The plan summary form is due on July 1st of the applicable year. A facility should not submit the resource conservation plan to MassDEP, but must submit the plan summary form to MassDEP. As with TURA reporting and TUR plan summaries, this form should be submitted via eDEP whenever possible. The purpose of the plan summary is to report on the resource conservation plan and to establish a baseline for measuring progress. The following reporting elements will be included in the plan summary form:

1. Assets that were selected for resource conservation planning. More than one asset could be chosen.
2. Specific operations selected for resource conservation planning.
3. Baseline measure of the facility-wide use of the asset (s). This would include a baseline year, total baseline use of the selected asset, identification of a unit of measure, and if applicable, the per unit of product baseline use.
4. List of the resource conservation options chosen for implementation.
5. Other resource conservation options considered but not chosen for implementation.
6. Goals for reducing the asset use as a percent reduction or a specific amount of reduction over a certain time period.
7. Expected measure of change in the amount of asset used (due to the options implemented) between the year on which the plan is based and two years after the plan is due. This would be a measure of the change in asset use due to the options implemented rather than expected change in facility-wide use.
8. Any additional information about the resource conservation plan that the facility would like to report to MassDEP.

Facilities will be required to report actual progress on the Resource Conservation Progress Report in two years (see below).

### ***Resource Conservation Progress Report***

After a resource conservation plan is completed, a facility must return to toxics use reduction planning two years later for the next planning cycle. When the facilities submit its toxics use reduction plan summary, the facility also would submit a resource conservation progress report (on a form MassDEP will develop) based on the resource conservation plan it implemented two years earlier. In other words, a facility must track the progress made in implementing its resource conservation plan and must report on that progress two years later.

### III. GUIDANCE FOR SPECIFIC ASSETS

The following sections provide guidance on the different assets that may be included in a resource conservation plan. The elements required in a plan are covered in Section II of this guidance. The sections below follow a similar format and describe how to conduct facility-wide and detailed planning for specific assets:

1. Energy
2. Water
3. Materials Found in Solid Waste
4. Toxics Substances Exempt From TURA Reporting and Non-Listed Chemical Substances (this section provides guidance for the assets: *Toxic Substance Used Below Reporting Thresholds* and *Chemical Substances Exempt from TURA Reporting*)

Each section includes a list of online tools, documents, and additional information that may assist you in your planning efforts. The TURA partner agencies will post additional information and reference material for specific assets on their web sites to keep information up-to-date:

#### **MassDEP's Toxics Use Reduction Program**

[www.mass.gov/dep/toxics/toxicsus.htm](http://www.mass.gov/dep/toxics/toxicsus.htm)

(Resources for materials found in solid waste.)

#### **Toxics Use Reduction Institute (TURI)**

[www.turi.org](http://www.turi.org)

(Resources for toxic substances used below threshold amounts and chemical substances exempt from TURA reporting)

#### **Office of Technical Assistance for Toxics Use Reduction (OTA)**

[www.mass.gov/envir/ota](http://www.mass.gov/envir/ota)

(Resources for energy and water use.)

## **(A) ENERGY**

Reducing energy use and increasing energy efficiency are proven strategies for cutting and controlling costs with good returns and reducing environmental impacts. Massachusetts state and local governments have initiated multiple policies and programs that promote the development of clean energy and encourage energy conservation and efficiency..

Energy conservation planning includes any beneficial reduction in energy use or losses such as:

- *Reducing Demand through Conservation and Efficiency:* better management of existing systems and upgrades in technology.
- *Energy Supply Management:* including purchasing “green power” (such as power from renewable energy sources), building on-site renewable energy sources, purchasing combined heat and power systems, purchasing properly sized boilers and chillers, and load management (using less energy during high peak energy use periods).
- *Energy Related to Products and Services:* including reducing vehicles used or miles driven.

### **Benefits of Reducing Energy Use or Using Cleaner Sources of Energy**

Conservation and energy efficiency programs save businesses money, help protect the environment and mitigate climate change, reduce dependence on fossil fuels, and reduce the strain on the region’s power supply system.

Cutting energy use by investing in more efficient equipment is one of the most cost-effective investments a business can make—the rate of return on this type of investment is often 30% or greater. Increasing energy efficiency provides other benefits besides energy cost savings; energy-efficient lighting, heating, and air conditioning often improve worker comfort and productivity. Industrial process improvements can cut material use, improve product quality, or increase output, thereby raising the return on investment.

Increasing energy efficiency also means less fuel is consumed either on-site or by power plants, thereby reducing pollutant emissions and water consumption. This results in the reduction of greenhouse gasses. Additionally, the selection of cleaner sources of energy, whether by installing on-site solar panels, wind turbines or a combined heat and power system on site, or by purchasing cleaner sources of energy from your energy provider is another way to reduce pollution. This helps lower energy demand growth, which can reduce the need for new power plants and transmission lines.

### **Energy Conservation Planning**

In Massachusetts, your business may be eligible for assistance through ratepayer funded energy efficiency and renewable energy programs. One of the first planning steps is to check with all of your energy service providers for technical and financial assistance programs to help identify and implement energy conservation. Additionally, facilities that

*Resource Conservation Planning requires that resource use be assessed throughout the facility, not just in TURA production units.*

implement innovative projects may have access to additional opportunities. Section 4 – *Resources for Energy* contains descriptions of organizations and agencies that may assist your business.

A facility should first review how energy is used throughout the entire facility. All energy sources need to be considered in this broad review (e.g., electricity, natural gas, oil, etc.). Many facilities currently track their energy use through bills and meters. Company staff or external audits obtained through energy service professionals may be useful for this review. There are many online resources and experts in Massachusetts that can assist you. Energy experts can provide a holistic view of energy use at your facility, and provide recommendations on cost effective options and information on incentive programs.

Facility-wide energy use should be qualitatively and quantitatively analyzed to determine the best opportunities for energy conservation. Facilities should then select specific operations for detailed evaluation of energy reduction options and decide which to implement.

### 1. Sample Plan Scope for Energy Conservation

The following is an example of an energy resource conservation plan scope using a fictional facility. Please refer to Section II B of this guidance for more information on developing a plan scope.

*Explore Corporate Energy Management, which is a set of actions that move accountability for energy outcomes to upper management. Visit: [www.Leere.energy.gov/industry/bestpractices/corporate.html](http://www.Leere.energy.gov/industry/bestpractices/corporate.html)*

<b>Sample Plan Scope for Energy Conservation</b>
<p><u>Natural Asset Selected as the Focus of the Resource Conservation Plan</u> In order to improve the company’s competitive position and provide better service to its customers, Facility X selected energy use as the natural asset for its resource conservation plan.</p> <p><u>Summary of the Facility’s Use of the Selected Natural Asset</u> The company identified two types of energy used in the facility: electricity and natural gas. Natural gas accounted for the majority of the facility’s energy use and cost, so the assessment focused on process heating systems that use natural gas and/or energy derived from natural gas-fired systems. The company has over 30 direct-fired heating systems that use natural gas. This equipment is divided into 6 major categories: small furnaces (10), boilers (2), ovens (6), large furnaces (2), and others that include a thermal oxidizer, several dryers, etc. The plant has more than 100 make-up air units that are heated by steam produced in natural gas-fired boilers. Natural gas cost is accounted at \$8.80 per million (MM) Btu. Energy (natural gas) use for the equipment is distributed as shown below:</p> <ol style="list-style-type: none"> <li>1. Small Furnaces 34%</li> <li>2. Boilers 21%</li> <li>3. Ovens 16%</li> <li>4. Large Furnaces 11%</li> <li>5. Thermal Conversion Process 6%</li> <li>6. Other 12%</li> </ol>
<p><b>-Continued-</b> <b>Sample Plan Scope for Energy Conservation for Facility X</b></p>

#### Identify and Rank Opportunities for Resource Conservation of the Selected Natural Asset:

The plant has an active energy team and already have implemented commonly known (“low hanging fruit”) energy saving opportunities. The facility identified the following additional potential energy conservation opportunities, ranked in the following order:

- waste heat reduction and recovery in heating systems,
- upgrade natural gas burner controls,
- operate equipment at design capacity to maintain high efficiency levels,
- longer-term investigation of potential process changes in heating systems.

#### Description of Operations Selected for more Detailed Evaluation

Out of the list of conservation opportunities the team selected four representative heating systems for more detailed evaluation: large furnace A, one small furnace, oven #32 and boiler #2.

#### Procedures for Identifying Conservation Techniques

The company partnered with its energy suppliers to conduct an energy audit of the facility and the manufacturing practices in order to identify facility operations that use energy. The assessment activities included (a) review of energy use by the plant, (b) plant tour, (c) review of heat transfer and heat recovery systems related to process heating equipment, (d) collection of specific information for input into the Department of Energy’s PHAST software and (e) further analysis of energy saving opportunities for the systems review. Three teams of personnel selected from the attendees carried out measurements. The teams were given hands-on training for data collection, use of the data for PHAST, and use of PHAST for energy saving analyses. Several additional issues related to operation, maintenance and use of new technologies were researched.

#### Description of the Resource Conservation Technologies, Procedures, or Training Programs Identified and those Selected for Implementation

The facility selected five options to implement:

- Tune the large furnace A burners to get proper air-fuel ratio – 2% or less O<sub>2</sub> in flue gases. Potential savings - \$80,500 per year.
- Install proper controls (temperature control or other type of closed loop control – feed rate control) for large furnace A. Benefits would be improved production and better quality control.
- Adjust boiler burners to maintain approximately 2% O<sub>2</sub> in exhaust gases regularly and average current level of O<sub>2</sub> in flue gasses. Expected savings \$8,380 per year depending on current operation, adjustments, etc., (conservative with possibilities of higher savings depending on steam production and average current value of O<sub>2</sub> in flue gases). This can be done by using manual adjustment or tuning the burners periodically (i.e., twice a year) and by operating the boilers at as close to full load as possible to maintain efficiency of the boilers. The estimate is based on \$8.80/MM Btu, 6000 hrs. /year, one boiler @15,000 lbs/hr. average steam production and reduction of flue gas O<sub>2</sub> from 3% to 2%.
- Purchase basic instrumentation such as an oxygen/combustible analyzer to allow frequent flue gas analysis from the heating system.
- Install an economizer on boiler #2 stack for preheating combustion air.

#### Other Options Not Selected

The facility identified other potential process changes, but those options were not selected because of the longer payback periods and will be considered in the future.

## **2. Characterize Facility-wide Energy Use**

The regulations require facilities to characterize overall energy use throughout the facility. Ideally, your facility should form a energy planning team to investigate, plan, and possibly implement the plan, where appropriate. The planning team should include facilities management staff, process and production staff along with environmental staff.

The facility may conduct an energy assessment (or audit; see sidebar) or use a recently completed assessment. Note that the facility-wide assessment of energy use must include all energy use (building, process and other equipment, vehicles) and types of energy (electricity, natural gas, oil, etc.), not just in TURA production units. Resource conservation planning does not require knowing the exact amount of energy use for every part of your facility, but you should develop a good enough estimate to allow you to understand the relative uses across facility operations and to prioritize energy conservation opportunities.

### **Typical Operations to Consider**

1. Air Compressors
2. Air Handlers
3. Boilers, Furnaces, Chillers, Cooling Towers (not connected to HVAC)
4. Computers
5. Fan systems
6. HVAC Systems
7. Lighting
8. Motors
9. Ovens
10. Process Heaters
11. Pumps
12. Vehicles (incl. fork lifts and offsite vehicles)
13. Other “load” areas not included above

The following steps provide tips on how to assess energy use at a facility:

- *Account for all energy sources:* Inventory all energy purchased and generated on-site (electricity, gas, steam, waste fuels) in physical units (kWh, mMBtu, Mcf, lbs of steam, etc.) and on a cost basis. See text box for suggested equipment and systems to include in a tracking system.
- *Document all energy uses:* For the sources identified above, assemble energy bills, meter readings, and other use data. Gather data for at least two years on a monthly basis or a more frequent interval, if available.

Use the most recent data available. Energy data may reside in the accounting department, be held centrally or at the facility, or can be acquired by contacting the appropriate utilities or energy service providers.

- *Collect facility and operational data:* In order to accurately normalize and benchmark data to account for other variables it may be necessary to collect non-energy related data for all facilities and operations, such as building size, operating hours, and process specific operations information. For additional information on collecting facility data, normalizing and benchmarking, and determining load management opportunities visit [www.energystar.org](http://www.energystar.org) and [www.eere.energy.gov](http://www.eere.energy.gov).

Consider setting up a tracking system to track performance. This system can range from a simple spreadsheet to detailed databases and IT systems. The assessment will provide baseline information, but tracking information over time is important since it will be used for analysis and goal setting and eventually for tracking progress.

***Assessments are generally overviews of energy use by reviewing bills and types of operations.***

***Audits are generally detailed assessments of different operations. See the reference section for websites with online tools.***

A tracking system should include establishment of a base year and identification of appropriate metrics, which effectively and appropriately express energy performance for your organization (e.g., energy per unit of production, ENERGY STAR benchmark score, Btu/square foot, Btu/ product, total energy cost/square foot). Remember, the facility is seen as a “system” and all energy uses should be considered at this stage. There are a number of online tracking systems, such as ENERGY STAR’s Portfolio Manager and Energy Performance Indicators (EPIs) to organize data and benchmark against the industry ([www.energystar.org](http://www.energystar.org)).

### **3. Identify Energy Resource Conservation Opportunities and Select Operations for Detailed Evaluation**

A facility-wide energy assessment will provide you with a broad view of your facility energy use and enable you to identify, rank and select operations for detailed evaluation. This process may include assistance from an outside energy expert and should include both a qualitative and quantitative review of the information gathered. Once the analysis is complete, your facility should select operations for detailed evaluation.

- *Qualitative review may include:* interviews with staff to seek informed opinions, specific anecdotes, or lessons learned on specific systems (e.g., HVAC, lighting, refrigeration). It might also include any in-house audits or surveys that have been conducted, and policy or procedure reviews to determine their impact on energy use. Or, it may include research into other types of resource conservation opportunities other companies in your industry have identified.
- *Quantitative review may include:* developing user profiles to identify energy consumption peaks and valleys and how they relate to operations or key events; comparing performance data to similar facilities in the industry; assessing financial impacts such as high cost energy use; and analyzing gaps in data to determine where more info is needed for further analysis.

### **4. Detailed Evaluation of Specific Operations**

Your facility should select specific operations for detailed evaluation and identify energy resource conservation options within those operations. A description of all options identified must be included in the plan. *References for Energy* below lists resources that may help to identify options within selected operations.

For each identified option, the facility should complete a technical and economic evaluation to determine the feasibility, savings and costs of implementing that option. Some of the research may have been completed in previous steps. The analysis should be thorough enough to enable your facility to make educated decisions on whether or not to implement each option. If using contractors, consult with them before they begin to determine if they will perform this analysis. If a facility chooses to implement any options, goals for energy reduction and an implementation schedule should be included in the plan.

Facilities are encouraged to create an “audit report” as part of the plan. Using the results of

the detailed evaluation, the audit report would summarize the actual steps that can be taken to reduce energy use, and include recommendations ranging from simple adjustments in operations to equipment replacement. Estimates of resource requirements for completing actions would typically be included in this report.

## **Resources for Energy Conservation**

In Massachusetts, there are many programs to help industry and businesses identify and implement energy saving projects. Energy experts from outside your facility can help you identify cost effective measures that bring immediate savings and reduce payback time. There are many online tools and manuals to help facility staff with planning. The most relevant references and assistance programs are summarized in this section. Please refer to the OTA web site at [www.mass.gov/envir/ota](http://www.mass.gov/envir/ota) for more extensive resource and assistance information.

***Ratepayer Funded Energy Efficiency Programs:*** Many electric and gas utilities receive funding to provide their customers with energy efficiency programs. These programs may provide technical support and funding for energy efficiency audits and equipment rebates. Specific strategies may include enhanced energy efficiency, load management, or fuel substitution. If your energy supplier is a municipal utility, there may be limited incentive programs available – check with your utility for details. To find your utility visit the Massachusetts Energy Efficiency Partnership’s Utility Finder at: [www.maeep.org/utilitydsm.cfm](http://www.maeep.org/utilitydsm.cfm).

***Ratepayer Funded Renewable Energy Programs:*** The Massachusetts Technology Collaborative runs the Clean Energy Program, which provides grants and technical assistance for clean energy generating projects. This includes grants for the development of solar, wind, and biomass energy systems and includes incentives for Green Building and Infrastructure programs [www.mtpc.org/renewableenergy/index.html](http://www.mtpc.org/renewableenergy/index.html).

***Energy Services Companies (ESCOs):*** An ESCO is a business that develops, installs, and finances projects designed to improve energy efficiency and reduce costs for facilities. ESCOs generally act as project developers for a wide range of tasks and assume the technical and performance risk associated with the project. See the National Association of Energy Service Companies (NAESCO) [www.naesco.org/default.htm](http://www.naesco.org/default.htm) or Northeast Energy Efficiency Council [www.neec.org](http://www.neec.org) for listings of ESCOs in this area.

***Massachusetts Demand Response and Forward Capacity Market Incentive Program:*** Demand Response programs compensate large electricity users for reducing consumption when market prices are high or demand is high and system reliability is at risk. Users may choose from among different options designed to fit their needs. The Forward Capacity Market is used to purchase sufficient capacity – including energy efficiency - for reliable system operation for a future year at competitive prices where all resources, both new and existing, can participate. ISO New England, the operator of the electric grid in New England, offers Demand Response and Forward Capacity Programs: [www.iso-ne.com/index.html](http://www.iso-ne.com/index.html).

***Massachusetts Technical Assistance Programs:*** The state offers a number of incentive and

technical assistance programs through state agencies, educational institutions and non-profit organizations:

- The Office of Technical Assistance and Technology within the Executive Office of Energy and Environmental Affairs provides on-site technical assistance, workshops, regulatory assistance, and technology development programs to all businesses including those that report under TURA: [www.mass.gov/envir/ota](http://www.mass.gov/envir/ota)
- The Center for Energy Efficiency and Renewable Energy (CEERE) is located at University of Massachusetts - Amherst and provides technological and economic solutions to environmental problems resulting from energy production, industrial, manufacturing, and commercial activities, and land use practices. CEERE houses the Renewable Energy Research Laboratory, the Building Energy Efficiency Program, the Energy and Environmental Services Program and the Industrial Assessment Center. The Industrial Assessment Center provides technical assistance and audits to small to medium-sized manufacturing facilities and runs the Combined Heat and Power Initiative: [www.ceere.org](http://www.ceere.org)
- The Northeast Energy Efficiency Partnership is a regional non-profit that promotes energy efficiency thru a number of initiatives. The Partnership houses the Energy Efficient Motors Initiative that promotes the National Electrical Manufacturers Association premium motors and motor efficiency programs, the High Efficiency Commercial Unitary HVAC Initiative, the High Efficiency Commercial Lighting Initiative, Commercial and Industrial Information Exchange, and provides Building Operator Certification Training: [www.neep.org](http://www.neep.org)

**Federal Assistance Programs:** The two primary federal agencies that promote energy efficient products and practices are the U.S. Environmental Protection Agency (US EPA) and the U.S. Department of Energy (US DOE). They jointly run the Energy Star Program [www.energystar.gov](http://www.energystar.gov) that provides excellent tools for measuring current energy performance, benchmarking, normalizing, setting goals, identifying options, and tracking savings. Their focus is primarily buildings, however they also have the Energy Star for Industry program tailored for industrial facilities. The Portfolio Manager tool that assists facilities in measuring, tracking, and identifying options for energy reduction and the New Building Design tools may be particularly useful

The US DOE also runs the Energy Efficiency and Renewable Energy Program (EERE) [www.eere.energy.gov](http://www.eere.energy.gov), which manages the national Industrial Technologies Program (ITP) [www1.eere.energy.gov/industry](http://www1.eere.energy.gov/industry). UMass Amherst houses the regional ITP through the CEERE program listed above. This program partners with U.S. industry to improve industrial energy efficiency and environmental performance. Grants and other financing opportunities along with research and development programs are provided that seeks to reduce industrial energy requirements while stimulating economic productivity and growth. The primary focus is process equipment. Of particular note is the BestPractices Program that has a number of online assessment tools for major processing equipment (general assessments and specific processing equipment such as motors, combined heat and power, air compressors, fans, etc.).

## **(B) WATER**

Effective water conservation can run the gamut from simple methods of reducing water consumption to sophisticated technologies to completely eliminate water use. The US Environmental Protection Agency (US EPA) estimates that through the installation of water-efficient equipment and integration of water-reducing practices into everyday operations, a 30% reduction in water consumption is typically possible at a facility.

In Massachusetts, the Water Conservation Standards (updated in 2006) published by the Executive Office of Energy and Environmental Affairs and the Water Resources Commission set statewide goals for water conservation and water use efficiency, and provide guidance on effective conservation measures to meet the statewide goals ([www.mass.gov/envir/mwrc/pdf/Conservation\\_Standards.pdf](http://www.mass.gov/envir/mwrc/pdf/Conservation_Standards.pdf)). With the rising costs of water, wastewater treatment, and the energy used to heat water, businesses can save money by reducing water use through resource conservation planning.

Water conservation planning includes any beneficial reduction in water use or losses:

- Reducing the amount of water used through demand management (e.g., using ultra low-flow toilets and automatic shut-off faucets) and conservation techniques (e.g., reusing water that would otherwise be discarded such as treating water from sinks for use on landscaped areas).
- Reducing the amount of water wasted by reducing losses (e.g., fixing leaky faucets and pipes).

### **Benefits of Reducing Water Use**

Increasing water use efficiency can provide a competitive advantage for businesses by reducing operating costs (lower water bills, electrical power costs and chemical costs for water treatment) and reducing wastewater treatment costs (including costs of treatment chemicals). Water conservation can improve the performance and longevity of septic systems, benefiting the users of such systems as well as the integrity of adjacent surface and ground waters. Water conservation also benefits public water suppliers by reducing the need for additional plant capacity for pumping and treating water and avoiding the costs of investing in new sources of water.

Businesses can save significantly by decreasing their water use. Payback periods for implementing water demand reduction measures are generally low, between 1-4 years, with an average payback period of less than 2.5 years.

*Finding ways to use less water can result in savings through lower electrical power costs and reduced chemical costs for water treatment.*

### **Water Conservation Planning**

A facility first should review how water is used throughout the entire facility. Many facilities currently track their water use through bills and meters. This information should be analyzed to identify the best opportunities for water conservation. Facilities should then select specific operations for detailed evaluation of water reduction options and decide

which to implement.

## 1. Sample Plan Scope for Water Conservation

The following is an example water conservation plan scope using a fictional facility. Please refer to Section II B of this guidance for more information developing a plan scope.

<b>Sample Scope of Plan for Water Conservation</b>
<p><u>Natural Asset Selected as the Focus of the Resource Conservation Plan</u> Facility X selected water as the natural asset for its resource conservation plan.</p> <p><u>Summary of the Facility's Use of the Selected Natural Asset</u> The facility uses 19.2 million gallons of water per year of town-supplied water. The facility uses an estimated 14.2 million gallons of water per year in their production processes and an estimated 5 million gallons of water per year for cooling tower makeup, sanitary purposes and general cleanup. Of the 5 million gallons, about 3.12 million gallons is rejected from its high purity water treatment process.</p> <p><u>Identify and Rank Opportunities for Resource Conservation of the Selected Natural Asset:</u> The facility identified the following potential resource conservation opportunities, ranked in the following order:</p> <ul style="list-style-type: none"><li>● High purity process makeup water – 12.48 million gallons/year (65%)</li><li>● Process reject stream – 3.12 million gallons disposed/year (25% of the makeup water)</li><li>● Plating rinse water – 1.92 million gallons/year (10%)</li><li>● Cooling Tower – 3.26 million gallons/year (17%)</li><li>● Other non-production losses – 1.3 million gallons/year (7%)</li><li>● Sanitary sewer – 1.15 million gallons disposed/year of total discharge (6%)</li></ul> <p><u>Description of Operations Selected for more Detailed Evaluation</u> The facility decided to focus on the following facility operations for more detailed evaluation:</p> <ul style="list-style-type: none"><li>● The water purification system in the high purity process makeup operation</li><li>● Cooling tower</li><li>● Non-production losses</li><li>● Plating rinse water</li></ul> <p><u>Procedures for Identifying Resource Conservation Techniques</u> In 2006 the facility used the Massachusetts Water Resource Authority (MWRA) to conduct a Water Efficiency Study and identified several Water Efficiency Measures (WEM) that, if implemented, would have a combined estimated savings of 5.5 million gallons/year with a payback on investment of about 2 years. The facility manager reviewed records from MWRA, reviewed national wastewater data from similar facilities, reviewed purchasing records, and met with facility staff to determine the amounts of water used and wastewater generated, the facility operations to focus on, and options for reducing the amount of water used.</p> <p><u>Description of the Resource Conservation Technologies, Procedures, or Training Programs Identified and those Selected for Implementation:</u> The facility selected three options to implement:</p> <ul style="list-style-type: none"><li>● Replace two of the filter membranes for the ultra filtration and reverse osmosis units in the high purity water treatment system. The total replacement cost for this measure is estimated at \$34,000. With estimated water</li></ul>

**-Continued-**  
**Sample Scope of Plan for Water Conservation**

and sewer savings at \$42,500, payback for this measure is 0.8 years. After upper management reviewed this option, they realized the cost effectiveness of the membrane replacements and long-term lifecycle benefits, and decided to replace not only the UF and RO units, but to upgrade the entire water treatment system by replacing all pretreatment and process equipment including sand filters, ion exchange units, carbon filters, mixed bed deionization units, particulate filters, ultraviolet treatment and polishing units. The total implementation cost for the project is estimated at \$135,000.

- Reduce non-production period losses through valve replacement and employee training. Replace valves and train employees on the significance of water conservation. There is no implementation cost attributed to training employees, except for staff time. The valve replacements will be accounted for as a normal operational expense and no monetary investment is required to implement this measure. These measures have an annual savings potential of 190,000 gallons per year.
- The older equipment that was removed from the water purification system (old RO unit, cation/anion system, and some old pumps) can be modified to allow rinse tanks to go through a closed loop system. The initial investment for this measure is \$5,000 and consists of piping and electrical hookups. The net water savings from this measure is estimated at a projected 1.2 million gallons a year.

Other Options Not Selected

Use the RO and UF reject streams from the purification system for cooling tower makeup. This measure has a lower annual savings of 657,000 gallons and would need additional investment for cooling tower hookup but will be evaluated in the future.

## 2. Characterize Facility-Wide Water Use

**Typical Operations to  
Consider in a Water Audit**

1. Heating and Cooling (evaporative cooler and/or cooling tower make-up, boiler blow-down, etc.)
2. Kitchen Plumbing (ice machines, food preparation, dishwashers, etc.)
3. Landscape Irrigation
4. Laundries
5. Process Water (process cooling, rinsing operations, chemical dilution, waste pre-treatment)
6. Domestic Plumbing (restroom consumption such as toilets, urinals, showers, and faucets)
7. Water Features (pools, spas, fountains, etc.)

Performing some type of assessment of water use and losses is the first step in designing an effective water conservation plan. If you keep track of water use information, regularly check for leaks and whether operations are running optimally, you should know where and how you use water in your facility. If you do not know this information, have a water audit conducted to survey all water-using or conveying fixtures, plumbing, equipment and practices. The water audit results will serve as the starting point for identifying water uses, losses, and conservation practices and for recommending improvements.

Ultimately, the water audit should give you a water balance:

$$\textit{Consumption} = \textit{water in} + \textit{evaporation} + \textit{leaks} + (\textit{waste}) \textit{water out} + \textit{water in product}$$

The water balance will provide you with an estimate of the total amount of water that your facility consumes on a daily and annual basis. Resource conservation planning does not require knowing the exact amount of water used for every part of your facility, but you should develop a good enough estimate to allow you to understand the relative uses across facility operations and to prioritize resource conservation opportunities.

An audit for a large facility that uses large quantities of water can be a significant undertaking. The following steps provide some general guidance on how to survey water use at your facility. In addition, there are many online resources (*see Resources for Water below*) and qualified consultants that can help you perform an audit. Check first with your local water and sewer utility for possible assistance.

- a. *Identify your source of water:* Where do you get your water? Is it from an offsite municipal supplier, an onsite community water supply, an onsite private water supply, a surface water body, or a combination?
- b. *Gather all existing documents and sources of information including:*
  - Water (indoor and outdoor) and sewer bills. Contact your local water utility to get a complete list of all meters serving the facility, and, if possible, the type of use that each meter serves (landscape, fire line, etc.). By recording both the billing account number and the meter number (usually stamped on the dial cover for the meter), you may be able to determine which meters serve a particular building or area of the facility. Quantify all sub-meters as well, which will provide you with a better record of the amount used by a particular piece of equipment or operation.
  - Maps, schematics, and floor plans of the distribution system, plumbing and equipment, and prior water and energy surveys.
  - Number of employees/occupants and their schedules. Does your facility have shifts covering 24 hours? These factors make a difference in the magnitude of your water use.
  - Any paperwork (e.g., owner's manuals) related to water-using equipment, appliances, fixtures, pumps, etc. that has information on capacities, storage and water use of all appliances, fixtures, pumps, hoses, rinse tanks, cooling towers, recycling ponds, and other water-using equipment and structures. You may have to call the manufacturer or installer to get this information.
- c. *Quantify your facility-wide water use from each water source:* For businesses with meters, it is very easy to quantify facility water use by recording the meter readings at the beginning and end of a 24-hour period and subtracting the initial reading from the final one. This is how much water you used on that day. Do this several times and average the daily readings. Also consider whether there may be significant seasonal fluctuations in water use.

If you are not metered, you will need to estimate water use based on the use and type

of equipment you have, employees/occupant numbers, and the information gathered above. You also may use a portable, non-invasive, ultrasonic water meter to measure flows at various points in the facility. This is a device that clamps onto the outside of pipes and uses ultrasound to measure water flow through the pipe. This equipment requires a pipe diameter of at least 1.5 inches and does not perform well on some PVC piping.

- d. *Conduct an onsite survey:* The information collected in steps a-c above tells you where and how your facility uses water and serves as the foundation of the water survey. Take a walk through and observe how water is used in the facility. The walk-through should be viewed as an opportunity to involve others in brainstorming ideas about how to achieve reductions in water used. Different people can conduct it with several parties at once, or at different times so long as various perspectives are shared. The scope of a water survey will depend upon the size of the building, the complexity of its systems, and the survey budget (if any). The more comprehensive the survey, the greater the value the resulting water management options and cost savings are. The survey could include:
- *Catalogue water-using devices and measure daily use of each.* Note the number of each, the manufacturer and the amount of water each uses. Don't forget to include fixtures and practices employed in outside water use. For example: Three low-flush American Standard toilets at 1.6 gallons per flush each.
  - *Identify and quantify consumption and water leaks for each device.* This can be as simple as comparing manufacturing specifications with meter readings, if you have a portable meter. If the device uses more water than the manufacturer recommends, then there's a possible leak. Use the Waterwiser leak calculator to quantify leaks: [www.awwa.org/advocacy/learn/conserves/dripcalc.cfm](http://www.awwa.org/advocacy/learn/conserves/dripcalc.cfm). For un-metered facilities estimate the 24-hour water use of each device. For instance, multiply the flow rate of a garden hose in gallons per minute times the number of minutes of use.
  - *Characterize operational practices.* If you observe employees controlling the use of water, observe whether or not they are careful to conserve water, and solicit ideas from them on how they might minimize water use.
  - *Identify and quantify water conservation devices and practices already in place.* Quantify the savings compared with conventional devices and methods.
- e. *Categorize water use:* After gathering water use information and completing the inventory of water uses around the facility, you may want to group the uses by category. As you group the various water uses at your facility, you should be able to estimate a water balance. There are a number of online water balance worksheets and spreadsheets to help facilities gather this type of information. See *Resources for Water* below for additional references.

### **3. Identify Water Conservation Opportunities and Select Operations for Detailed Evaluation**

After you have characterized your facility's water use, you should rank water conservation opportunities for detailed evaluation. By grouping the various water uses into categories, you will be able to verify which categories use the largest amounts of water. This information should help you identify the best opportunities for resource conservation and select specific operations for detailed evaluation. For example, if the cooling system accounts for half of your facility's total water consumption, this could be a good area on which to focus conservation efforts.

In identifying and ranking resource conservation opportunities, you should consider both qualitative and quantitative information. Gathering qualitative information may include interviews with staff to seek opinions, anecdotes, or lessons learned on specific facility systems (e.g., process water systems, heating and cooling systems). It also might include reviewing any surveys, policies or procedures to determine their impact on water use and researching what other companies in your industry have done to reduce water use. Your consideration of options should involve those who would have to implement them, so they can be designed for maximum acceptability. Quantitative information already may have been gathered in a water audit that was conducted, which should identify how water use relates to operations and key events. It also may include comparing your facility's performance data to similar facilities in the industry and assessing the financial impacts of your water use and discharge. It also should identify any data gaps to determine where more information is needed.

Your approach to evaluating water savings opportunities for each water use category should be thorough enough to identify promising opportunities for resource conservation. You may want to consider developing a forecast of future water use. This forecast considers historical water demand, future expansion, employee/occupant increases or decreases, planned water conservation practices, retrofits and upgrades, and weather conditions and trends.

#### **4. Detailed Evaluation of Specific Operations**

After a facility has ranked opportunities for resource conservation and selected specific operations, it should identify and evaluate specific water conservation options within each selected operation (e.g., options for cooling systems, options for landscaping). A description of all options identified must be included in the plan. *Resources for Water* below includes resources that may help to identify and evaluate options.

While equipment replacement may be an option, it should not necessarily be the first place to look. Often, simple procedural changes in maintenance or operation can produce substantial water savings. A constantly running toilet, for example, can waste 4,000 gallons of water per day. Checking and replacing valves and ball-corks regularly can save this otherwise wasted water.

For each identified conservation option, the facility should complete a technical and economic evaluation to determine the feasibility, savings and costs of implementing that option. Some of the research may have been done in previous steps. There is no set way to complete this analysis, but it should be thorough enough to enable your facility to make educated decisions on whether or not to implement each option. If using contractors, you should consult with them before they begin to decide if they will perform this analysis. If a facility chooses to implement

any options, goals for reduction and an implementation schedule should be included in the plan.

## **Resources for Water Conservation**

Water authorities, municipalities, and the state regulate water use and discharge. Businesses should first check with their water and/or sewer authority to find out if they have any specific programs available to assist them in their water conservation projects. Also, there are many consultants that specialize in water conservation and auditing that can assist you.

OTA's web site at [www.mass.gov/envir/ota](http://www.mass.gov/envir/ota) contains extensive resource and assistance information on water use reduction. OTA offers onsite technical assistance visits and has online a number of best management practices and case studies for selected industries.

**Water and Sewer Utilities:** Municipal water and sewer utilities are the gatekeepers to water use and discharge in their communities. Check with your local water and sewer utility to see if there are specific eligible business conservation programs. One of the largest water and sewer utilities is the Massachusetts Water Resources Authority (MWRA): [www.mwra.com/index.html](http://www.mwra.com/index.html). MWRA has an Industrial, Commercial and Institutional Water Management website with case studies ([www.mwra.com/04water/html/indust.htm](http://www.mwra.com/04water/html/indust.htm)) and has published the *Industrial, Commercial and Institutional Water Management Guide*.

**Massachusetts Watershed Associations and Planning Councils:** Massachusetts has a number of associations and councils that work to protect rivers, streams and adjacent lands. A number of these have worked with businesses on water conservation projects. A list of these associations and councils can be found at: [www.mass.gov/dfwele/river/watershed](http://www.mass.gov/dfwele/river/watershed)

**Massachusetts Water Standards and Regulations:** In 2006 the Water Resources Commission ([www.mass.gov/envir/mwrc/default.htm](http://www.mass.gov/envir/mwrc/default.htm)) updated the Commonwealth's *Water Conservation Standards*, which set statewide goals for water conservation and water use efficiency, and provide guidance on effective conservation measures to meet the statewide goals. This document recommends that the industrial, commercial and institutional sectors complete water facility audits and contains sample audit worksheets. It also lists best management practices for selected industries: [www.mass.gov/envir/mwrc/pdf/Conservation\\_Standards.pdf](http://www.mass.gov/envir/mwrc/pdf/Conservation_Standards.pdf).

MassDEP is responsible for ensuring clean water and making sure that wastewater is managed properly. If you are considering water reuse projects or would like tips on water conservation, visit the MassDEP's website at: [www.mass.gov/dep](http://www.mass.gov/dep).

**Federal Resources:** The US EPA runs the WaterSense Program, which is a voluntary partnership program to help promote and enhance the market for water-efficient products and services. There are a number of documents and tools to assist businesses in identifying water efficient products, finding consultants, and tip sheets: [www.epa.gov/watersense](http://www.epa.gov/watersense). The EnergyStar Program also includes water in their tracking since reducing water use usually affects energy use, including the Portfolio Manager that lets you track water use and bills from indoor and outdoor uses along with wastewater:

[www.energystar.gov/index.cfm?c=business.bus\\_water](http://www.energystar.gov/index.cfm?c=business.bus_water).

***Other Assistance and Tools:*** There are a number of water associations that provide water conservation services, online tools, and assistance such as the American Water Works Association [www.awwa.org/waterwiser](http://www.awwa.org/waterwiser) and the Alliance for Water Efficiency [www.cuwcc.org/national\\_cwe.lasso](http://www.cuwcc.org/national_cwe.lasso). A general web search of “water conservation resources” and “water efficiency” also will provide a wealth of tools, fact sheets, and other online resources. States with dry climates and/or historical water issues (e.g., Arizona, California, Florida) have developed good online resources for businesses.

## (C) MATERIALS THAT CONTRIBUTE TO SOLID WASTE

There are many ways that a facility can reduce the solid waste it generates and save money at the same time. Facilities can identify opportunities for resource conservation by evaluating their production processes, product life cycles, and purchasing practices, and material use to identify “upstream” opportunities that will reduce the amount of waste produced. Massachusetts has set an aggressive 70% waste reduction goal by 2010 in the *Beyond 2000 Solid Waste Master Plan* ([www.mass.gov/dep/recycle/priorities/dswmpu01.htm#swmp](http://www.mass.gov/dep/recycle/priorities/dswmpu01.htm#swmp)) which includes policies and programs to encourage businesses and communities to reduce their waste, either through source reduction, reuse, recycling or composting.

This section provides more specific guidance on materials and products that contribute to solid waste. If choosing this asset for a resource conservation plan, the primary focus should be to identify source reduction solutions (i.e., avoiding use or reusing materials to reduce waste created). If no source reduction options exist, then recycling and composting options should be considered.

### Benefits of Solid Waste Reduction

Reducing materials that end up in solid waste can reduce waste disposal and handling costs, as well as recycling or composting costs. Reducing waste may also help reduce expenditures on raw materials, office supplies, equipment and other materials that the facility purchases. For

*If source reduction and reuse options don't exist, then recycling and composting should be implemented and are preferable to disposal.*

#### **Examples of Resource Conservation for Materials Found in Solid Waste**

##### Reduce Material Use:

- Reducing office paper waste by implementing a formal policy to use double-sided printing and copying, and by making training manuals and personnel information available electronically.
- Improving product design to use fewer materials.
- Redesigning packaging to eliminate excess material while maintaining strength.
- Working with customers and suppliers to design and implement a packaging return program.
- Switching to reusable transport containers.
- Purchasing products in bulk.

##### Reuse/Donate or Exchange:

- Using incoming packaging materials for outgoing shipments
- Reusing office furniture and supplies, such as interoffice envelopes and file folders.
- Donating unwanted supplies or building materials to local schools or nonprofit organizations
- Reusing industrial scrap

*(NOTE: after detailed planning has been conducted, if source reduction and reuse options do not exist, then recycling and composting, which are preferable to disposal, should be considered. Recycling and composting can also be considered in addition to source reduction options, but your planning should focus on source reduction options.)*

many companies, waste reduction is rapidly becoming an important component of their long-term business planning since it slows the depletion of natural resources, conserves landfill space, and reduces waste management costs. Ensuring more efficient use of resources and reducing waste can make significant contributions to reducing greenhouse gas emissions.

## Planning for Solid Waste Reduction

### **Typical Facility Operations**

- Production lines
- Offices
- Stock rooms
- Printer, copier or fax machines/rooms
- Employee lounge, kitchen, lunchroom or cafeteria
- Dock and/or shipping/receiving areas

A facility should review their waste streams throughout the entire facility (not just for TURA production units) and analyze gathered information to identify the best opportunities for waste reduction.

Facilities should then select specific operations for detailed evaluation of waste reduction options and decide which to implement. Once operations are chosen, detailed planning would follow the waste upstream to identify potential resource

conservation options and projects to implement.

Either company staff or consultants may be used to develop the plan. See *Resources for Materials Typically Found in Solid Waste* below for many online resources and other resources that may assist you.

### 1. Sample Plan Scope for Solid Waste Reduction

The following is an example of a waste reduction plan scope using a fictional facility. Please refer to Section II B of this guidance for more information developing a plan scope.

#### **Sample Scope of Plan for Materials That Contribute To Solid Waste**

##### Natural Asset Selected as the Focus of the Resource Conservation Plan

The facility selected materials that contribute to solid waste as the natural asset for its resource conservation plan because it had already begun some initial planning in that area and anticipated significant opportunities for savings.

##### Summary of the Facility's Use of the Selected Natural Asset

The facility disposes of about 2,900 tons of trash per year and recycles about 160 tons per year. The recycling is primarily metal (80 tons) and cardboard (60 tons). The facility spends an estimated \$55,000 per year on trash hauling and disposal costs. The facility disposes significant amounts of paper (from office and administrative operations); organics (from the facility cafeteria); and cardboard (from multiple facility operations). The facility also disposes large amounts of rubber from its manufacturing process and wood packaging crates from shipping operations.

##### Identify and Rank Opportunities for Resource Conservation of the Selected Natural Asset:

The facility identified the following potential resource conservation opportunities, ranked in the following order:

**-Continued-**

**Sample Scope of Plan for Materials That Contribute to Solid Waste**

1. rubber from the manufacturing process – 500 tons disposed/year
2. wood crating from shipping operations – 480 tons disposed/year
3. paper from office and administrative operations – 350 tons additional recycling potential/year
4. organics from the facility cafeteria – 180 tons additional recycling potential/year
5. cardboard from multiple facility operations – 80 tons additional recycling potential/year
6. plastic from cafeteria and shipping operations – 50 tons additional recycling potential/year

Rubber and wood crating provide the greatest opportunities for source reduction and are therefore prioritized over paper, organics, and cardboard, for which there are increased recycling opportunities.

Description of Operations Selected for more Detailed Evaluation

The facility decided to focus on the following facility operations for more detailed evaluation:

- Rubber disposed of from the manufacturing line
- Wood disposed of from product packaging and shipping
- Paper from office and administrative functions
- Food waste from the facility cafeteria
- Cardboard from shipping operations

Procedures for Identifying Resource Conservation Techniques

The facility reviewed records from solid waste and recycling contracting, reviewed national waste composition data from similar facilities, reviewed purchasing records, and met with facility staff to determine the amounts of materials found in solid waste and amounts recycled, the facility operations to focus on, and options for reducing the amount of materials found in solid waste.

Description of the Resource Conservation Technologies, Procedures, or Training Programs Identified and those Selected for Implementation:

The facility selected three options to implement:

Pilot manufacturing process change to dry rubber shavings and reintroduce into the manufacturing process. This pilot will evaluate effects on product quality. This change can potentially reduce amounts of scrap rubber by 50 %, saving \$20,000 in disposal costs and \$200,000 in materials purchasing costs.

- Switch from wood crates to reusable packaging transport containers. Although the new packaging cost \$30,000 in up front costs, it will save \$35,000 per year in disposal costs.
- Revise solid waste and recycling contracts to expand recycling services for paper, cardboard, and other materials and share value of recycled materials with recycling contractor. The facility will train facility staff on new recycling procedures and how to properly collect and separate recyclables within the facility. The facility's goal is to increase paper and cardboard recycling by 275 tons, which will capture \$1,500 in revenue and save \$26,500 in disposal and hauling costs.

Other Options Not Selected

The facility chose not to implement an on-site food waste composting option. The capital costs of the technology identified were too expensive given the projected savings. The facility will continue to try to identify technologies with lower capital costs that could provide a shorter payback period.

## 2. Characterize Facility-Wide Waste Streams

A facility should conduct some type of waste assessment (also known as a waste audit), which would include looking in dumpsters or bins, reviewing billing and contract information, and determining how much, and the cost, of what types of materials are thrown away or recycled each day/week. Assessments provide the information necessary to identify operations for detailed planning. Your business can do the assessment or contact a consultant to assist you. The following are some suggested steps to conduct an assessment:

- a. *Gather all waste management billing from the last year or two.* Different departments may manage their own waste streams. It is not unusual to have more than one service provider manage different waste and recycling streams. Typical waste management options include disposal, recycling, composting, donations/reuse, and rendering. Read the bills to find out what you are paying for. Billing can vary dramatically – and often businesses are not clear what they are actually paying for. Many waste management contracts “bundle” the services into one fee, making it difficult to itemize the costs. You may want to contact your waste management service provider to clarify all charges on the bill (see sidebar).
- b. *Review your contracts.* Do you have contracts with your waste or recycling service providers? If so, what do they include and over what time period? Does it match what you are actually paying for?
- c. *Identify the location and general contents of all disposal or recycling containers, their sizes, and who services the container in order to determine what makes up your waste stream:* It is recommended you walk through the facility to identify the location of trash/recycling containers and determine their typical contents. The walk through should include a visit to every department and the final waste disposal area (where your trash dumpster or recycling containers are located or where your waste management service provider removes it from your business).
- d. *Identify container sizes and type* (contact your trash or recycling service provider if its not clear). Estimate the percentage and types of materials. Determine the use of the material, if possible, when looking in the disposal or recycling containers. Is it used for industrial or manufacturing purposes, shipping, in the office, or the cafeteria? A quick look in the containers and talking with employees can determine this. If you want to accurately “dissect” your waste stream, consider sorting your trash over a period of time. You may need to convert volume to weight. It may be helpful to keep all your information in a tracking sheet

**Typical Charges or Revenue on Waste Bills:**

- **rental, collection and hauling fees**
- **disposal/recycling facility charges (usually referred to as a “Tipping Fee”);**
- **if recycling, type of materials recycled and possible revenue from the recycled material.**

<b>Typical Information Found in a Tracking Spreadsheet</b>
<ul style="list-style-type: none"><li>• Location of container</li><li>• Final disposition (disposal, recycling, etc...)</li><li>• Size of container</li><li>• Frequency of pick-up</li><li>• Whether the load is full or not</li><li>• Cost of service</li><li>• Service provider</li></ul>

– see box for suggestions on tracking information. There are many online tools that can assist you. See *Resources for Materials Typically Found in Solid Waste* below for suggested online waste audit tools.

- e. *Compare your billing and contract information to actual service levels.* Does what you are paying for match your current service levels? If not, you may want to clarify this with your waste or recycling service provider and update.

### **3. Identify Waste Reduction Opportunities and Select Operations for Detailed Evaluation**

Reducing waste at the source results in less waste to manage downstream. Analyzing waste streams and working “upstream” will allow you to identify which operations are using which materials. Keep in mind that you should examine waste outside of the manufacturing process as well. Rank the operations that generate waste streams that provide the best reduction opportunities.

### **4. Detailed Evaluation of Specific Operations**

After a facility has ranked opportunities for resource conservation and selected specific operations, it should identify and evaluate specific waste reduction options within each selected operation (e.g., redesigning products to use less material). By following waste “up stream,” you can identify how much material your facility purchases. This should include developing a process flow diagram that shows the movement of the material through the operations. There are many ways to reduce waste, whether by changes in materials ordering, specifications, or production practices to produce less waste, reusing materials in-house, such as using scraps as inputs to the same process from which they came; or using the material in other processes or for other uses in the facility.

Options could include working with suppliers (i.e., supply chain management) to reduce materials purchased and packaging used, or working with material-specific national trade associations to identify resource conservation opportunities, or instituting performance-based contracts with service providers to have them assist you in identifying and reducing waste. You may be surprised to find that some of the easiest, most cost-effective, and most widely used waste reduction techniques are simple improvements in housekeeping (e.g., reduced materials ordering).

If no source reduction opportunity exists then recycling and composting options should be considered, but your plan should focus first on source reduction options.

For each identified conservation option, the facility should complete a technical and economic evaluation to determine the feasibility, savings and costs of implementing that option. Some of the research may have been done in previous steps. There is no set way to complete this analysis, but it should be thorough enough to enable your facility to make educated decisions on whether or not to implement each option. If using contractors, you should consult with them before they begin to decide if they will perform this analysis. If a facility chooses to implement any options, goals for reduction and an implementation schedule should be included in the plan.

*Waste stream analysis may also provide valuable information to clarify appropriate service levels for trash and recycling and other waste reduction opportunities*

## Resources for Reducing Solid Waste

MassDEP has extensive information and assistance on solid waste management at: [www.mass.gov/dep/toxics/toxicsus.htm](http://www.mass.gov/dep/toxics/toxicsus.htm) or [www.mass.gov/dep/recycle](http://www.mass.gov/dep/recycle).

### ***Service Providers or Consultants:***

Earth 911.org is a non-profit organization that provides online waste reduction resources for businesses, including a recycling service provider locator and step-by-step online assistance for evaluating and setting up a business waste reduction program: <http://earth911business.org>.

***Massachusetts Waste Reduction Assistance Programs:*** MassDEP has developed numerous guidance documents and tools, and provides technical assistance to businesses on waste reduction, including the Massachusetts WasteWise Program, a voluntary program designed to help private and public organizations reduce solid waste and non-hazardous industrial wastes; Resource Management Contracting, which uses the solid waste contract to provide contractors incentives to reduce waste; and source reduction, donation and reuse and composting links for businesses: [www.mass.gov/dep/recycle/reduce/assistan.htm](http://www.mass.gov/dep/recycle/reduce/assistan.htm).

The state Operational Services Division's Environmentally Preferable Purchasing Program has rigorous environmental procurement standards and recommends environmentally preferable products. Although businesses cannot purchase from the states contracts, they may review the guidance and standards set by the Commonwealth. The website includes case studies and reports, and an EPP Buyer Update newsletter: [www.mass.gov/osd](http://www.mass.gov/osd).

***Federal Programs:*** The US EPA has developed a number of online tools and guidance for business waste reduction that can be found on the EPA New England's website at: [www.epa.gov/region1/topics/waste/swaste.html](http://www.epa.gov/region1/topics/waste/swaste.html). US EPA's Business Guide to Reducing Solid Waste is a complete step-by-step guide to conducting a waste assessment, which includes worksheets: [www.epa.gov/epaoswer/non-hw/muncpl/pubs/red2.pdf](http://www.epa.gov/epaoswer/non-hw/muncpl/pubs/red2.pdf). Another information resource includes the EPA's Pollution Prevention webpage with upstream resources for reducing materials found in found solid waste, such as environmentally preferable purchasing, waste minimization, and Design for the Environment: [www.epa.gov/p2](http://www.epa.gov/p2).

## **(D) TOXIC SUBSTANCES EXEMPT FROM TURA REPORTING AND NON-LISTED CHEMICAL SUBSTANCES**

For purposes of this guidance, this asset is broken down into two categories because the planning process is different for each category<sup>3</sup>:

1. *Toxic substance (TURA chemical) use at the facility below reporting threshold or in exempt operations (such as research and development and the use of non-TURA listed chemical substances).* This chemical use is grouped together because the planning process typically follows TUR Planning.
2. *Toxic substances used in articles or products.* This category includes chemical use in products that the facility purchases such as janitorial products and pesticides, rather than direct use of the chemical at the facility. These chemicals are presented separately because they require a different planning process that focuses more on up-stream supply chain management.

### **1. TOXIC SUBSTANCES EXEMPT FROM TURA REPORTING**

There are 1,422 TURA listed chemicals or chemical categories, and thousands of other chemicals that are not listed that may exhibit toxic and/or hazardous properties. Many countries have begun implementing laws to limit hazardous chemicals from being used, such as the European Unions Restriction of Hazardous Substances in Electrical and Electronic Equipment (EU's RhoS Directive) and the EU's Registration, Evaluation, Authorization and Restriction of Chemical substances program (EU's REACH program). While TUR planning addresses many chemicals used in Massachusetts, there are many chemicals not covered by TUR planning.

One option for a company is to identify toxic substances that the facility uses in its processes that are not currently subject to TURA reporting and toxics use reduction planning as an asset for resource conservation planning. This asset includes:

- TURA-listed chemicals used below reporting thresholds
- TURA – listed chemicals in processes or operations not required to report and plan under TURA (e.g., research and development and pilot equipment).
- Non-TURA listed chemicals (chemicals that are not listed under 301 CMR 40.00) that have emerging hazard information (e.g., brominated flame retardants) or are of low hazard but have significant opportunities for source reduction.

### **Benefits of Reducing Toxic Substances Exempt from Reporting**

Reducing or eliminating toxic and hazardous substances reduces the risk of exposure for facility employees, suppliers, customers and the environment. It also can increase

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<sup>3</sup> This section refers to the last two assets listed on page 3 of this guidance document: (4) Toxic Substances used below threshold amounts and (5) Chemical substances exempt from TURA reporting. For purposes of the guidance and the planning process, these two assets are grouped differently than they are in the regulations (see 310 CMR 50.92 (2).)

*Resource Conservation Planning for Toxics and non-listed chemical substances closely follows TUR planning, except that it focuses on chemicals not already subject to TUR planning.*

efficiency, improve competitiveness, and reduce or eliminate chemicals on customers' restricted substances lists. This is an opportunity to use the TUR planning framework to reduce toxics that are not reported under TURA or exempt from reporting but where there may be significant TUR opportunities. Companies can identify chemicals of concern, chemicals with emerging hazard information or are of low hazard but have significant opportunities for source reduction.

### **Planning for Toxic Use Reduction**

A facility should conduct a broad review of its facility-wide use of either TURA chemicals used that fall below reporting thresholds, TURA chemicals that are exempt from reporting, or non-TURA chemicals. For TURA listed chemicals, the facility should be tracking that information. Other chemical use may be identified through different departments or tracked through the purchasing division.

Once a facility has identified chemicals, the facility should consider whether each chemical has significant opportunities for toxics use reduction, is used in large quantities, or potentially presents significant risks. A facility may want to check with its customers to find out if they have a list of restricted toxic or hazardous substances or are considering adopting one. In the resource conservation plan the facility should summarize the uses of the chemicals considered, the specific operations the chemicals are used in, and explain why the chemicals and the operations was chosen as the focus of the plan.

The facility should then follow the TUR planning process for the chosen chemical or chemicals and facility operations.

### **Sample Plan Scope**

This plan scope serves as a summary of the plan (please refer to section II B of this guidance for more information on developing a plan scope). The example below illustrates a sample scope where non-TURA chemicals are the asset chosen for the resource conservation plan.

<b>Sample Plan Scope for non-TURA Chemical</b>
<p><u>Natural Asset Selected as the Focus of the Resource Conservation Plan</u> Facility X chose to focus the resource conservation plan on non-TURA listed chemicals.</p> <p><u>Summary of the Facility's Use of the Selected Natural Asset</u> The facility reviewed purchasing records of all non-TURA listed chemicals. The facility identified a variety of different non-TURA listed cleaning solvents that were used in large quantities:</p> <ul style="list-style-type: none"><li>• <i>N-propyl bromide</i>: used as part of the production process in a vapor degreasing system with a freeboard chiller, to remove dirt and oils from metal parts. The degreasing system originally used 1,1,1-trichloroethane (TCA), then an HCFC, but was modified in 2003 to accommodate a switch to n-propyl bromide, an acceptable substitute under EPA's SNAP program, and not regulated under TURA. The company had planned to replace the old vapor degreasing system with a new one. The cost of a new vapor degreaser equipment and installation is estimated at \$171,000.00. The</li></ul>

annual

-continued-

### Sample Plan Scope for Non-TURA Chemical

existing operating cost estimate for the n-propyl bromide degreasing operation is \$70,000/year.

This includes:

- *800 gal/year of n-propyl bromide at \$20.00/gallon = \$16,000/year*
  - *Waste cost- \$8,000/year*
  - *Labor = \$30,000/year*
  - *Maintenance = \$6,000/year*
  - *Utility = \$8,000/year*
  - ***800 gal x 11 lb/gallon = 8,800 lb/year***
- Thirteen other non-TURA solvents were used in aerosol cleaners by the maintenance department to clean various dirty, oily parts as a regular part of the maintenance process of facility and production equipment at a purchasing cost of \$4,500/year.

*Facility-wide scope of Non-TURA listed solvents used:*

- *N-Propyl Bromide – 8,800 lbs/year*
- *Aerosols - terpenes, esters and hydrocarbons – 2,200 lbs/year*

#### Identify and Rank Opportunities for Resource Conservation of the Selected Natural Asset:

The facility identified the following potential resource conservation opportunities, ranked in the following order:

1. The use of n-propyl bromide solvent in the degreasing system could be eliminated by substituting a less hazardous or toxic alternative, or by identifying a different degreasing system. The volume and cost of the n-propyl bromide used is high, and the potential health effects of the solvent are of increasing concern. Additionally, employees have complained about the strong odor of this degreaser and requested a replacement.
2. The use of multiple, high VOC, high odor aerosols for maintenance. There are opportunities to identify non-toxic or less toxic alternatives or to change operating practices to reduce the use of the solvents. Further research is needed on whether there is a need for so many different solvents.

#### Procedures for Identifying Options and Resource Conservation Techniques

The Facility Manager reviewed the company's purchasing and hazardous waste disposal records, reviewed potential replacement cleaners, reviewed similar facilities cleaning methods, and met with staff to determine suitability to their operation. Maintenance personnel were consulted in gathering specific technical criteria and shop floor input for maintenance aerosols.

#### Description of Operations Selected for more Detailed Evaluation

The facility decided to focus their detailed evaluation on eliminating N-propyl bromide use in the vapor degreasing operation.

#### Description of the Resource Conservation Technologies, Procedures, or Training Programs Identified and Option(s) Selected for Implementation:

*Option Selected:* The facility selected to implement the ultrasonic cleaning with an estimated cost savings of \$57,000/year and a reduction of 8,800 lbs/year in the use of n-propyl bromide. Installation cost is estimated at \$180,000, which includes the ultrasonic equipment filter and skimmer, aqueous cleaner with corrosion inhibitor and rinse tanks. The annual operating cost estimate includes \$13,000/year:

- Chemicals = \$2,100/year (\$175.00/month which includes chemical purchases and waste disposal)

- Water = \$2700/year

**-continued-**  
**Sample Plan Scope for Non-TURA Chemical**

- Electricity = \$8,200/year.
- Training will be done in-house at no additional cost.
- Drying time will be increased but will be offset by the increased capacity.

The aqueous cleaner is an alkaline (Ph=10), with 1-5% 2-dimethylamino ethanol (108-01-0) and would increase water use.

*Options Not Selected:* Two HFC (hydrofluorocarbon) products and one VMS (volatile methyl siloxane) product were considered for use in a new vapor degreasing system. The HFC options were rejected due to concerns over global warming potential, and the VMS had insufficient environmental health and safety data. These options were also more costly over their life cycle than the chosen aqueous system.

## 2. CHEMICALS USED IN ARTICLES AND PRODUCTS

TURA currently exempts toxics in articles and in certain products used at a facility from TURA reporting and planning requirements. This category of chemical substances includes chemicals used in products that the facility purchases, rather than direct use of the chemical at the facility. These chemicals require a different planning process that focuses more on upstream supply chain management.

There is growing consumer concern about toxics in articles and products and Massachusetts is currently implementing legislation addressing management of mercury containing products. Resource conservation planning for non-listed chemical substances allows facilities to focus on reducing toxics in the following areas:

- Toxics present in articles and products used at the facility (e.g., products used for janitorial and facility grounds maintenance, pesticides)
- Toxics in articles used by the facility in its manufacturing processes (e.g., mercury in lamps, lead in batteries).

### **Examples of Toxics in Articles**

- Lead and other metals in batteries being used at the facility.
- Mercury in switches, where the switch is purchased from another vendor, brought in and included in the product at the facility.
- Metal arms for chairs containing lead that are purchased and attached to chairs at the facility.

Because there are many combinations of articles that contain toxic chemicals, this guidance covers how to conduct an assessment in order to identify a chemical that may be used in multiple products for further analysis, or a specific category of products that contains known chemicals of concern. The guidance uses the terms “articles” and “products” interchangeably.

### **Benefits of Reducing Chemicals Used in Articles and Products**

Reducing or eliminating toxics and other chemicals in articles and products reduces the risk of exposure for facility employees, suppliers, customers and the environment. It also can increase efficiency, improve competitiveness, and reduce or eliminate chemicals on customers’ restricted substances lists.

*Resource Conservation Planning for Chemicals Used in Articles and Products requires working upstream on supply management issues.*

## Planning for Chemicals Used in Articles and Products

You should conduct a general assessment to identify opportunities for resource conservation at your facility. This could begin with a brainstorming session with your TURA team, or preliminary research into potential resource conservation opportunities. The facility-wide assessment should broadly identify uses of toxics in articles and gather enough information to select for detailed evaluation substances with known, significant uses of toxics in articles (e.g., mercury), or of a specific product category with know toxics (e.g., batteries used in office equipment and process equipment). You then would identify specific operation that use the chemical, and evaluate options for reducing toxics use.

### 1. Sample Plan Scope for Toxics in Articles and Products

The following is an example of a plan scope for toxics in articles using a fictional facility Please refer to Section II B of this guidance for more information on developing a plan scope.

<b>Sample Plan Scope for Toxics Use Reduction in Articles</b>
<p><u>Natural Asset Selected as the Focus of the Resource Conservation Plan</u> The facility selected toxics in articles for its resource conservation plan.</p> <p><u>Summary of the Facility's Use of the Selected Natural Asset</u> The facility reviewed purchasing lists to identify potential toxics in articles that are used in the facility. The facility identified mercury because it had already begun some initial planning in electricity conservation and were considering replacing its existing fluorescent lamps with T5 fluorescent lamps that use 75% less energy than the old ones and contain about 80% less mercury. The facility disposes of 2,080 pounds of mercury-containing items each year as part of its normal maintenance of their production and facility equipment. The facility is a 250,000 square foot building built in the 1960s and uses 313, 4-lamp fluorescent fixtures to light the operations. There are also 10 thermostats with mercury and 80 mercury switches throughout the facility.</p> <p><i>Facility-wide scope: all articles/products containing mercury</i></p> <ul style="list-style-type: none"><li>• <math>313 \text{ fluorescent lamps} \times 4 \text{ lamp fixture} \times \sim 50 \text{ mg Hg/lamp} = 62.6 \text{ grams of Hg}</math></li><li>• <math>80 \text{ industrial switches} \times \text{estimate } \sim 3.5 \text{ grams Hg/switch} = 280 \text{ grams of Hg}</math></li><li>• <math>10 \text{ thermostats} \times 3 \text{ grams Hg/thermostat} = 30 \text{ grams of Hg}</math></li><li>• Total Mercury in Facility: 372.6 grams of Hg</li></ul> <p><u>Identify and Rank Opportunities for Resource Conservation of the Selected Natural Asset:</u> The facility identified the following potential resource conservation opportunities, ranked in the following order:</p> <ol style="list-style-type: none"><li>1. Fluorescent lamps:<ul style="list-style-type: none"><li>○ Replace lamps purchased/yr with low mercury lamps (with 4 mg Hg/lamp) which are also more energy efficient: high priority</li></ul></li></ol>
<p style="text-align: center;">- Continued -</p> <p style="text-align: center;"><b>Sample Plan Scope for Toxics Use Reduction in Articles</b></p>

2. Mercury thermostats
  - Replace thermostats with electronic thermostats: building HVAC thermostats already proven feasible, high priority
3. Mercury switches:
  - Replace switches with non- mercury switches, feasibility will depend on individual equipment requirements: need further assessment, medium priority

Procedures for Identifying Options and Resource Conservation Techniques

The facility manager reviewed the company's purchasing and hazardous waste disposal records, reviewed potential replacement articles, and met with facility staff to develop an inventory of mercury containing items. The switch inventory is categorized into different groups based on function (e.g., float, temperature, tilt, etc.). Equipment vendors were consulted for information on non-mercury alternatives.

Description of Operations Selected for more Detailed Evaluation

The facility decided to focus on the following facility operations for more detailed evaluation:

- Lighting with fluorescent lamps
- Mercury-containing float switches
- Mercury-containing thermostats

Description of the Resource Conservation Technologies, Procedures, or Training Programs Identified and those Selected for Implementation:

*Options Selected:*

- Replacing 1960 vintage lighting with T5 fluorescents that contain about ¼ the mercury and use fewer fixtures to light same amount of square. This project will have an estimated \$65,000 annual savings, increase lighting in the facility, decrease energy usage and will reduce the amount of mercury in the facility by approximately 40 grams. Existing bulbs will be recycled; the future accidental release of mercury from broken bulbs will also be reduced.
- Float switches will be replaced by various mechanical and optical switches appropriate for the specific applications.
- Electronic thermostats will be installed in all office and personnel areas.
- Facility purchasing procedures will be modified to include a review of all future equipment purchases, to avoid purchasing mercury containing components whenever possible.
- Facility staff will receive training on mercury-containing devices, available alternatives, proper disposal, as well as maintenance and use of new alternative devices.

*Options Not Selected:*

Thermostats in production areas will be considered for replacement following a study planned for next year on the production area HVAC system.

**2. Characterize Facility-wide Use of Toxics in Articles and Products**

Your facility should start with a general assessment to identify toxics in articles and products used in your facility. Your facility may want to conduct a brainstorming session with your TURA interdisciplinary team and review records (such as facility purchasing records) to identify articles and products that typically contain chemicals of concern and the operations that use them. The purpose of this review is to identify either a known chemical that is used in significant quantities in articles used at the facility *or* known articles used at the facility that typically contain one or more TURA chemicals. The facility is not required to identify all toxics in articles at the facility, especially since there is an existing TURA exemption for

reporting toxics in articles and the facility may not be currently tracking these materials. However, there should be a good faith effort to identify toxics in articles and assess the operations that use them. Some typical places that you may want to check include:

- Customers' restricted substance lists
- Persistent, bio-accumulative, and toxic chemicals such as lead and mercury and other higher hazard substances
- Existing MSDSs and product specification sheets
- Conversations with your major suppliers

Once the facility has identified either a chemical or product category, the facility would conduct a more complete assessment that would include all of the operations that use the chemical or product category across the entire facility, not just the TURA listed production units.

Collecting and tracking this information is necessary to establish baseline information and managing the chemical or articles use. The facility should also identify how much of the known toxic is in the article – on a per unit basis - so that you are able to estimate the amount of the chemical used at the facility. A list of possible articles or type of toxic substances will need to be included in the plan. Once the assessment is finished, the facility would summarize and characterize the use of chemicals assessed across all articles or products considered.

### **3. Identify Toxic Use Reduction Opportunities and Select Operations for Detailed Evaluation**

The facility should analyze the facility-wide assessment results and select specific operations for detailed planning. The following provides examples for both cases:

- The facility chose mercury as the chemical to focus on. It would then identify all the operations where the mercury was used in the facility. One operation could be mercury in switches in production equipment. Detailed evaluation would review options for reductions or removal of mercury in switches.
- The facility chose batteries as the article containing chemicals. It would then identify all of the batteries used in the facility and determine which ones had chemicals of concern. One operation could be batteries containing lead and cadmium and used in generators. Detailed planning would review options for reductions or elimination of the identified chemical in the batteries.

### **4. Detailed Evaluation of Specific Operations**

The facility may have completed some detailed evaluation in assessing overall opportunities for resource conservation. Once one or more toxic chemicals in an article or product category and relative operations have been chosen, the facility should evaluate specific options. You will likely need to work closely with your purchasing department and supply chain to identify, evaluate, and implement options (e.g., reviewing and evaluating existing supplier contracts and/or management standards for existing specifications, preferences or prohibitions that result in reduced toxics in these articles). Options could include:

- Replacing the article with another article that does not contain toxic chemicals or

constituents.

- Replacing the article with another article that contains a less toxic chemical.
- Eliminating or reducing the use of the article.

In the case of toxics in articles, the process flow diagram would be used differently than in typical TUR planning. The facility should identify the amount of each toxic used, in what article, products, and operations the toxic is used and in what amounts, and how and where those products are used at the facility.

### **Resources for Toxic Substances Exempt From TURA Reporting and Non-Listed Chemical Substances**

TURI and OTA have a wealth of existing TUR planning resources that are applicable to planning for this asset area. In addition, TURI maintains information on emerging contaminants of concern and contaminants that are restricted by major companies on TURI's web site ([www.turi.org](http://www.turi.org)). There you will also find information and referrals to programs such as the US EPA's Design for the Environment and Environmentally Preferable Purchasing (EPP) programs, and Northeast Waste Management Officials Association's (NEWMOA) Mercury Reduction Program. These programs provide information about the presence of toxics in articles as well as information about safer alternatives. Also, the Massachusetts Operational Services Division's EPP Program has a wealth of information about the benefits of EPPs, guides, and tools.

**TURA Partner Agencies:**

**MassDEP, Toxics Use Reduction Program**

[www.mass.gov/dep/toxics/toxicsus.htm](http://www.mass.gov/dep/toxics/toxicsus.htm)

**Toxics Use Reduction Institute (TURI)**

[www.turi.org](http://www.turi.org)

**Office of Technical Assistance and Technology (OTA)**

[www.mass.gov/envir/ota](http://www.mass.gov/envir/ota)



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Ian A. Bowles, Secretary

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Laurie Burt, Commissioner