Vocational Institutions, Colleges and Universities:

A Self-Assessment Guide to Waste Prevention, Education and Management

Hazardous Waste Minimization Program
Wisconsin Department of Natural Resources
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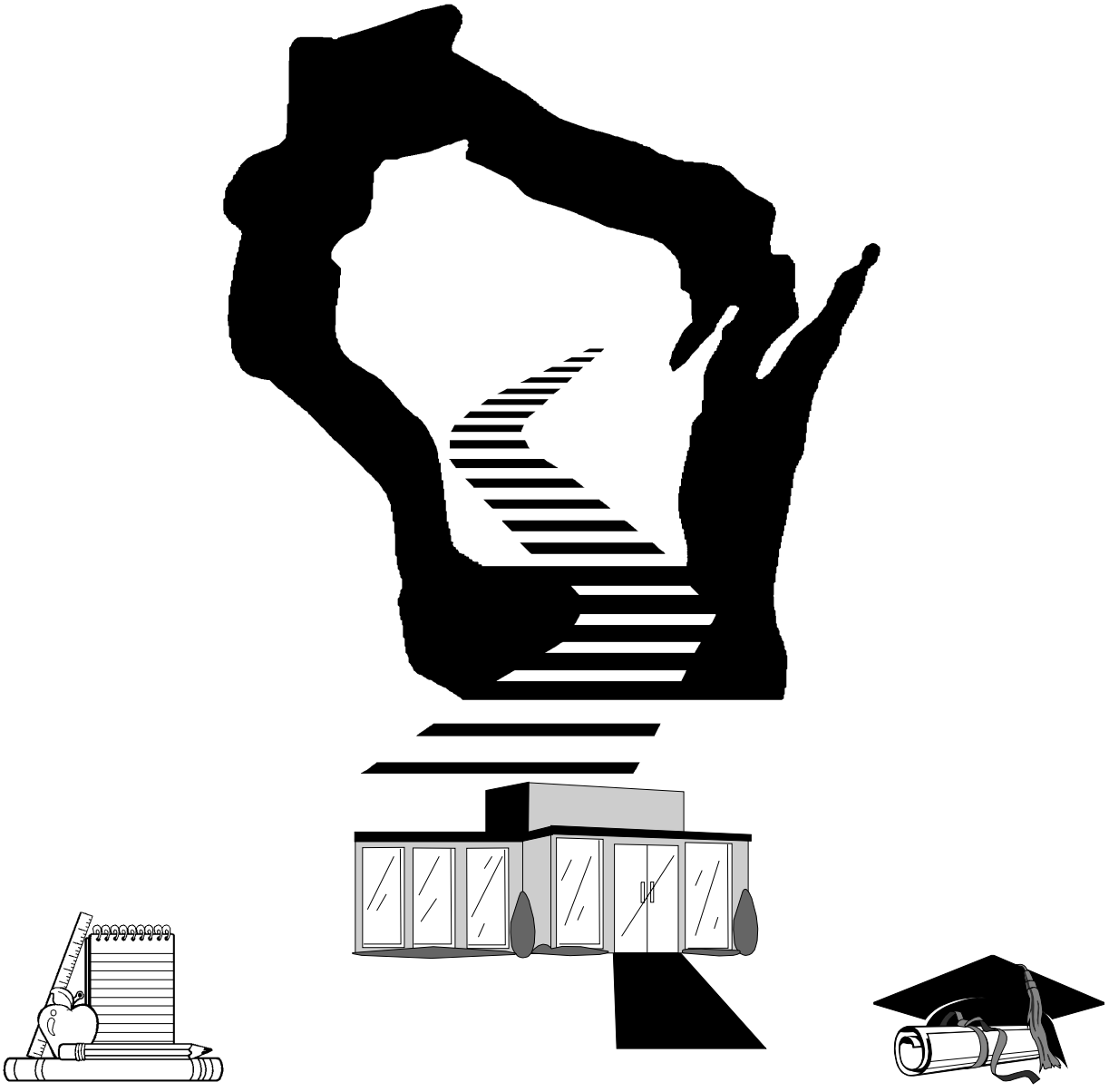

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ABSTRACT

This guide provides you, the manager of your school or university's hazardous waste programs, with information to reduce the amount of hazardous waste generated in your school. The purpose of the guide is to provide a step-by-step method for **you** to evaluate your hazardous waste records, review current management practices, analyze alternative processes, and determine which waste minimization strategies will work for your school. Ideas developed during this process are meant to be tested through actual practices by students and staff. Future changes in staff or programs will present additional opportunities to develop and apply new waste reduction strategies. Throughout this guide, you will find a variety of sample tables designed to assist you in completing the self-assessment checklists. Reproducible checklists have been included in the appendix for your use.

ACKNOWLEDGEMENTS

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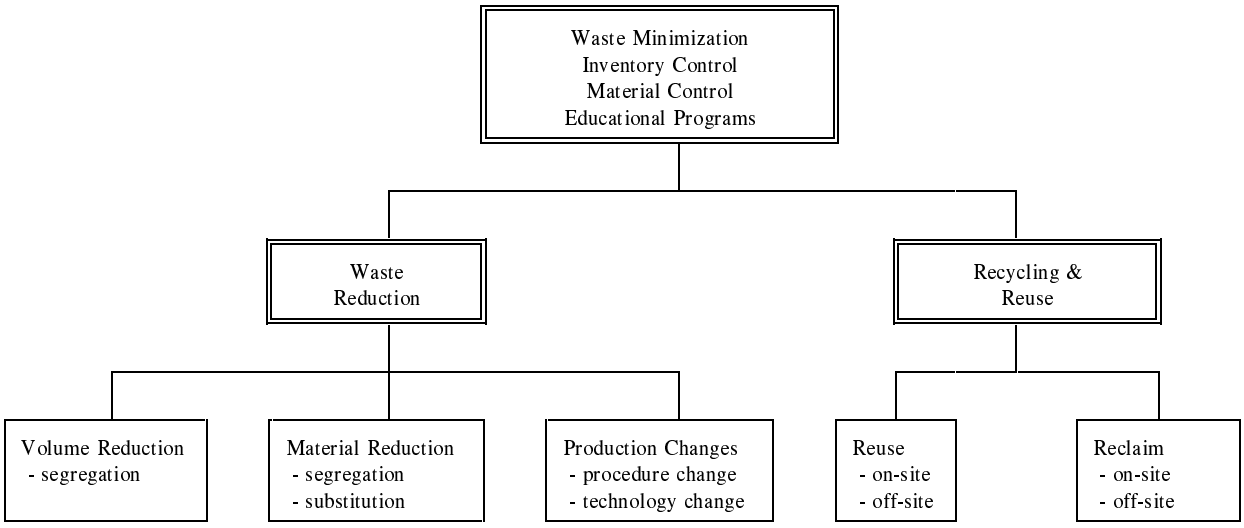
Introduction

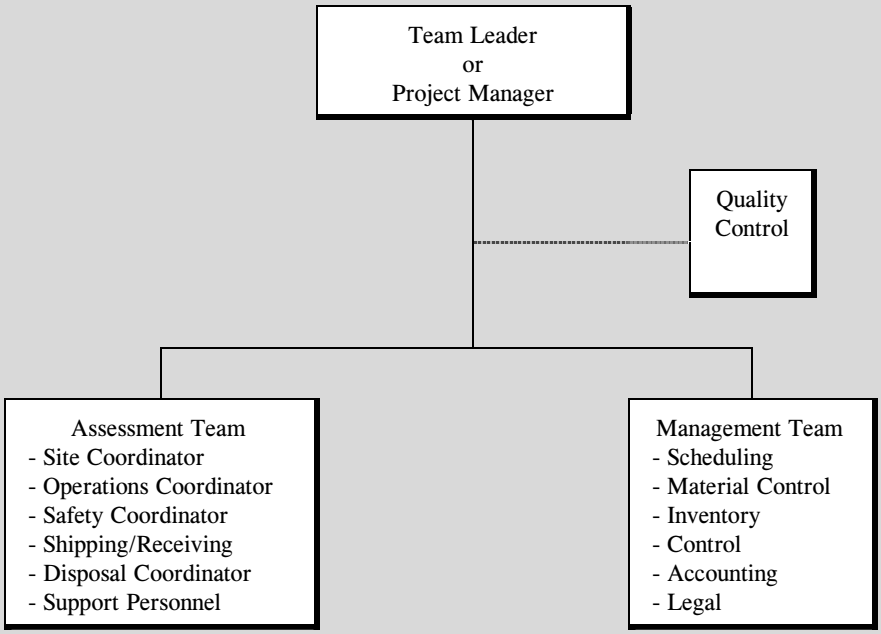
This guide provides you, the manager of your school or university's hazardous waste programs, with information to reduce the amount of hazardous waste generated in your school. The purpose of the guide is to provide a step-by-step method for **you** to evaluate your hazardous waste records, review current management practices, analyze alternative processes, and determine which waste minimization strategies will work for your school. Ideas developed during this process are meant to be tested through actual practices by students and staff. Future changes in staff or programs will present additional opportunities to develop and apply new waste reduction strategies. Throughout this guide, you will find a variety of sample tables designed to assist you in completing the self-assessment checklists. Reproducible checklists have been included in the appendix for your use.

Waste Minimization Components



Best results are achieved when full support is developed **prior** to beginning the waste minimization process. Developing a team approach will provide for more successful follow through. Ideally, a variety of personnel can be involved in the self-assessment process, including those directly involved in the assessment process, as well as a management group responsible for procedural changes. The following chart illustrates the key components needed for a successful minimization program.

WASTE MINIMIZATION ASSESSMENT TEAM



STEP 1 - Evaluate Current Hazardous Waste Records

Typically, your school or university will use and dispose of a variety of materials, depending upon the process used. Evaluating the types and amounts of waste generated will provide you with a benchmark for future action. For example, the auto repair shop will likely generate solvents and waste fuels, while a chemistry lab generates labware cleansers. The following activities will help you determine your current hazardous waste generation.

Review Manifest and Disposal Records

As a hazardous waste generator, you (or your hazardous waste disposal contractor) are required to submit manifests to the Wisconsin Department of Natural Resources for the types and amounts of waste disposed of during the year. The following worksheet provides a permanent record (or log) of five basic pieces of information essential to the development of an accurate Hazardous Waste Report. These manifests are a historical record of your waste generation and can also be used to monitor hazardous waste generation trends in your facility.

TABLE 1

WASTE IDENTIFICATION AND QUANTITY WORKSHEET				
Waste ID Number	**Waste Description**	**Generating Source/ Activity**	**Quantity (Pounds)**	**Log Entry Date**
D001	*Turpentine*	*Paint Shop*	*80*	*6/1/90*
D012	*2, 4-D Herbicide*	*Building/Grounds*	*40*	*6/2/90*
D008	*Waste Oil with Lead*	*Vehicle Garage*	*400*	*6/2/90*

Once you have completed the Waste Identification and Quantity Worksheet, a Waste Disposal Summary should be developed. The summary should maintain the same units of measure as used in the Quantity Worksheet (i.e., lbs./lbs. or gal./gal.). The following worksheet provides a sample of a Waste Disposal Summary. It will be easier to complete your annual waste generation report by updating the Waste Disposal Summary on a regular basis.

TABLE 2

WASTE DISPOSAL SUMMARY			
Waste ID Number	**Waste Disposal Category**	**Quantity (Pounds)**	**Percent of Total (lbs./lbs.)**
D001	*Solvents*	*3690*	*56.0*
D002	*Corrosive Wastes*	*460*	*7.0*
U188	*Phenols*	*66*	*1.0*
U122	*Formaldehyde*	*66*	*1.0*

Step [redacted]ate Current Hazardous Waste Records

Review [redacted]partmental Purchasing Practices

The waste disposal summary shown previously provides you with a concise snapshot of current disposal records. Reviewing purchasing practices with your purchasing agent will assist in determining the source of these wastes. In order to monitor waste sources, an inventory and material control worksheet should be developed. Proper control over source materials can be used as a waste reduction technique, since in many areas generated wastes are due to materials that are out of date, contaminated or damaged upon shipment. As you complete the following worksheet, look for instances where excess materials are purchased which later require disposal. Maintaining accurate records of waste materials and quantities are an important step in setting up a waste minimization program. Using this type of information, you can determine material losses due to spills, contamination and poor handling.

TABLE 3

INVENTORY AND MATERIAL CONTROL WORKSHEET			
Department	**Material Type**	**Amount Purchased**	**Primary Usage**
Chemistry	*Solvents*	*30 pounds*	*Cleaning Equipment*
Auto Shop	*Brake Fluid*	*10 gallons*	*Brake Repairs*
Print Shop	*Turpentine*	*40 gallons*	*Cleaning*

STEP 2 - Analyze Management Practices

The easiest and least costly way to reduce wastes is through changing current management practices. Now that you have a good idea what materials are being used, an assessment of management practices will provide an opportunity to initiate a waste minimization program.

Management initiatives require a school-wide commitment to the goal of reducing hazardous waste. Your program should include:

- Notifying all employees of your waste reduction commitment and goals.
- Providing employee incentives (including honorary or monetary awards) to encourage employee waste reduction ideas.
- Providing employee and student training in hazardous material handling and emergency response to prevent injuries and property losses.
- Developing practical guidelines for material suppliers and delivery procedures.
- Developing equipment evaluation guidelines which facilitate the use of equipment designed to minimize or reduce wastes in a safe and healthy manner.
- Providing inventory polices which address all materials inventory, shelf life, container sizes, storage space and procedural methods.
- Ensuring only the needed quantity of material is ordered, and require that afl materials be approved prior to purchase.

Improve Housekeeping Practices

Hazardous wastes are often generated by a lack of good housekeeping practices. The following is a checklist and examples of ways in which to improve your housekeeping practices:

☑ **Maintain good inventory control.**

As you review purchasing records, you may notice examples where excess materials were purchased which had to be disposed of at a later date. For example, the paint shop may be buying more materials than needed in order to have the necessary supplies for a wide variety of jobs. Utilize just-in-time purchasing practices to minimize excess inventory. Also make certain that the oldest material is used first ("first-in, first-out" material use).

☑ **Segregate waste stream components.**

Combining different waste materials may eliminate opportunities for recycling or reprocessing. Solvents generated in auto shops, for example, should be segregated in order to provide for recycling by a solvent recycler. Check frequently for leaky containers.

☑ **Prevent spills and leakage.**

Inadvertent spills and leakages should be minimized, as both a waste Minimization practice and for health and safety concerns. Old storage barrels should be disposed of and replaced with new ones. Use a gravity spigot or pump to dispense bulk liquid materials. Keep solvent containers closed when not in use.

☑ **Encourage innovative management practices.**

As mentioned before, students and staff will often identify effective waste reduction strategies. Encourage them to submit their ideas and then follow through with implementation where appropriate.

☑ **Emphasize employee education programs.**

Waste reduction practices are continually being updated, specifically with regard to new technology, management practices, and health and safety issues. Regularly scheduled safety seminars and hazardous material reviews are useful ways to communicate and educate employees and students.

STEP 3 - Identify Alternative Waste Minimization Processes

A variety of technologies are available today that can aid in waste minimization programs. Waste minimization strategies should consider the use of alternative technologies, alternative chemicals and substitute materials. For example, a process that relies on the use of nonhazardous materials that can be substituted for a current operation or practice would be a candidate for an alternative waste minimization process. In specific cases, you may find that recycling, process-equipment change, segregation, chemical recovery or changing equipment designs will minimize wastes.

Prioritizing Wastes

Waste materials should be prioritized before alternative waste minimization processes are identified. For each type of waste generated, the hazard rating of the material should be examined prior to determining if a reduction alternative is available. The waste minimization process should focus on the most important waste problems first, followed by lower priority materials. Typical considerations for prioritizing wastes include treatment/disposal costs, waste quantity generated, health/safety concerns, recovery potential and properties (flammability, explosivity, corrosivity, readability, etc.). The waste minimization priority worksheet shown below can be used to determine an overall ranking, based on a scale of 10 points for each criteria.

TABLE 4

WASTE MINIMIZATION PRIORITY WORKSHEET						
Waste ID/Category	**Rating Criteria**					**Priority Rating Score**
	Treatment/ Disposal Cost	**Quantity Generated**	**Health Safety**	**Hazardous Properties**	**Recovery Potential**	

D002/Solvents	*6*	*10*	*7*	*8*	*10*	*41*
D002/Corrosive	*9*	*2*	*10*	*10*	*2*	*33*
U188/Phenols	*5*	*10*	*8*	*7*	*1*	*31*
U122/Formaldehyde	*6*	*2*	*8*	*4*	*0*	*20*

Waste Minimization Alternatives

Once you have identified where you need waste minimization, identify alternatives for the priority wastes. Specific procedures for waste minimization should be tailored to the type and quantity of waste generated. Recycling, materials substitution, volume and material reduction, good housekeeping, and production modifications can minimize hazardous wastes.

TABLE 5

WASTE MINIMIZATION ALTERNATIVES CHECKLIST	
Waste ID/Category	**Waste Minimization Alternative**
D001/Solvents	• Keep solvent containers covered to reduce evaporation losses • Monitor solvent composition • Use mechanical blasting for paint stripping • Use nonchlorinated solvent substitute • Use solvent recycling system • Use solvent distribution and filtration equipment • Contract with solvent recycling services
D002/Corrosive	• Segregate incompatible wastes • Use a less hazardous material substitute • Reuse by filtration or regeneration • Remove sludge buildup in corrosive baths • Optimize chemical utilization methods
F003/Waste Oil	• Segregate oil from other materials • Recycle used oil • Use drip pans to avoid spillage • Change oil at extended intervals
F005/Paint Wastes	• Segregate tank cleaning solvents and reuse in paint • Substitute latex for oil paints • Install paint mixer • Establish paint exchange
D002/Chemistry Lab Wastes	• Segregate chlorinated and non-chlorinated solvents to allow off-site recovery • Purchase smaller lots and quantities • Use micro-scale experiments • Encourage reuse in experimentation • Substitute nonhazardous solvents and cleaners • Store chemicals in a well organized, central location • Use older chemicals first • Maintain waste exchange list of all unused chemicals • Provide separate containers for reagents and reaction products and byproducts suitable for recycling • Check equipment cleaning procedure • Use on-site distillation and filtration equipment • Use chemical destruction techniques

STEP 4 - Select Effective Waste Minimization Techniques

Technical Assessment

If identified alternatives for waste minimization include physical or chemical processes, then these alternatives should next be evaluated technically. Many waste minimization alternatives identified will include reuse and recovery techniques. Although some wastes can be directly reused, many wastes will be required to undergo some type of purification before it can be reused. Examples of physical and chemical waste minimization techniques include:

- Molecular separation - membrane processes, ion-exchange, electrolysis
- Sorption - activated carbon, diatemaceous earth
- Phase-transition - condensation, distillation, evaporation
- Physical separation - filtration, flotation, decanting, centrifugation
- Chemical processes - precipitation, destruction, amintation

Each of the physical or chemical waste minimization techniques must be evaluated technically, since in many cases operating procedures and level of sophistication requirements may preclude the use of certain techniques. The evaluation should take into account such factors as: operation and maintenance requirements, applicability and reliability of the technique, safety and health requirements, waste minimization efficiency, and special design considerations.

Cost Assessment

In addition to technical evaluations, an economic analysis evaluation of each minimization should be conducted. This evaluation must take into account current waste management costs, implementation of alternative technique costs, and cost savings from the use of the alternative. Current costs typically include transportation and shipping costs, labor and time costs associated with managing inventory and waste disposal, insurance costs and anticipated regulatory compliance costs. Both long-term process modification costs should be weighed against short-term inventory control costs. In addition, consolidation of waste minimization techniques may effect overall cost reduction.

Some waste reduction options will result in increased capital expenditures or changes in disposal costs. For example, reducing ink disposal costs from a print shop by substituting nontoxic inks may increase purchasing costs. The following cost comparison worksheet is designed to assist you in a step-by-step cost assessment. Utilize this cost worksheet for each proposed strategy. As you complete the cost assessment worksheet, you may have to estimate some of the costs, particularly labor cost, where data is not available. However, even with "best estimates," the worksheet will provide evidence of the viability of waste minimization alternatives.

Waste [redacted]: _____

TABLE 6

COST COMPARISON WORKSHEET			
	Cost of Current Management Method	**Costs of First Alternative**	**Costs of Second Alternative**
Method/Process:			
Labor Cost ($/hour x number of hours)			
Material Cost ($/units x number of units)			
Disposal Cost			
Operating Cost			
Leasing Cost ($ per month)			
TOTAL Cost ($ per month)	**1**	**2**	**3**
Savings current management cost -	**TOTAL cost of proposed alternative**	**A = 1 - 2**	**B = 1 - 3**
Capital Cost (new equipment)		**C**	**D**
Payback Time (months)	**Capital Cost / Cost Savings**	**C divided by A**	**D divided by B**

STEP 5 - Implement and Monitor Your Program

The last step in your waste minimization assessment is to implement those options selected for waste minimization. Often this is a highly subjective process, but one that is critical to your program's success. By listing the pros and cons of each waste minimization option, you will be better able to make a decision as to their feasibility. Below is a checklist to help you evaluate the implementation strengths and weaknesses in order to move your waste minimization program forward.

TABLE 7

Implementation Assessment Options	Pros	Cons
Example: Install paint mixing machine	• Will reduce paint inventory • Saves money on purchasing • Will allow better customization of colors • Paint shop staff like the idea	• Will require out-of-cycle budget request • Current paint vendors will lose some business • Staff lacks familiarity with devices
Install distillation equipment	• Reduces volume through reuse • Reduces purchasing costs • Reduces shipping and storage	• Increases power costs • Increases potential for fires • Requires operation skills and monitoring
Develop micro-scale laboratory education programs	• Decreases chemical use • Decreases waste generation • Improves laboratory techniques	• Uses expensive glassware • Requires pure grade chemicals • Causes overheating problems
Use intermediate bulk containers (IBCs)	• Containers are reasonable and refillable • Eliminates drum inventories • Reduces drum disposal	• Requires containers and dedicated storage area • Significant increase in capital costs • Not applicable to small quantity wastes

The checklist can be used to evaluate such items as implementation schedule, equipment requirements, health and safety, training and management requirements, and relative cost comparisons. To ensure continued waste minimization program effectiveness, procedures should be established for monitoring and evaluating, or modifying the selection techniques once in place.

Those wastes that have been identified as having short payback investments should be addressed first. For example, many wastes can be minimized by simply improving inventory control management, modifying operational procedures, changing maintenance requirements and implementing employee education programs. The large quantity and extremely hazardous wastes can now be addressed in great detail, and implementation procedures for the safest waste minimization method can proceed.

Conclusion

The waste minimization process is continuous. This self-assessment guide is designed as a starting point for summarizing waste generation; evaluating alternative management practice, technologies and processes; and determining appropriate waste reduction options. Successful implementation will require the support of administrators, staff and students. These activities are complex and you may require further technical assistance. A variety of references are available to further assist you in this effort. These include:

Guides to Pollution Prevention:

Research and Educational Institutions. EPA/625/7-90/010, June 1990.
Program Implementation. SHWEC SW-216 1993.

Waste Minimization Case Studies:

Madison Area Technical College. DNR SW-253, 1991.
University of Wisconsin - Milwaukee. DNR SW-253, 1991.
Waukesha County Technical College. DNR SW-255, 1991.

Waste Minimization: Environmental Quality with Economic Benefit. EPA/530-SW-87-026. 1987.

The In-Plant Hazardous Waste Survey: How to Investigate Hazardous Waste Management in Your Plant. UWEX and DNR, 1983.

Managing Your Hazardous Waste: A Guide for Wisconsin Small Quantity Generators. DNR SW-071, 1993.

Recycling Hazardous Waste: DNR Requirements in Brief. DNR, SW-191, 1993.

American Chemical Society, *Less is Better: Laboratory Chemical Management for Waste Reduction*. Washington, DC, 1985.

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INVENTORY AND MATERIAL CONTROL WORKSHEET			
Department	**Material Type**	**Amount Purchased**	**Primary Usage**

APPENDIX 4

WASTE MINIMIZATION PRIORITY WORKSHEET						
Waste ID/Category	**Rating Criteria**					**Priority Rating Score**
	Treatment/ Disposal Cost	**Quantity Generated**	**Health Safety**	**Hazardous Properties**	**Recovery Potential**	

APPENDIX 5

Implementation Assessment Options	Pros	Cons

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