Hazardous Waste Reduction Plan for Tennessee State University

INTRODUCTION: This plan is in accordance with, and required by, the Tennessee Hazardous Waste Reduction Act of 1990 (TCA 68-212-301 et. seq.).

PURPOSE: To establish university-wide policies, practices and procedures to ensure that the generation of hazardous waste is tracked and reduced.

DEFINITION: A waste material is a hazardous waste if it exhibits a characteristic of a hazardous waste or if it is listed as a hazardous waste by the U.S. Environmental Protection Agency (EPA) or by the Tennessee Department of Environment and Conservation (TDEC). Hazardous waste exhibits one or more of the following characteristics: ignitability, corrosivity, reactivity, and toxicity.

HISTORY: Past efforts to reduce the amount of hazardous waste include switching from the use of oil-based paints to latex paints in most applications, exchanging mercury-containing thermometers for mercury-free thermometers, and converting teaching labs in the Chemistry Department to micro-scale experiments.

POLICIES:

All university departments generating hazardous waste will abide by the following:

1. Faculty and staff shall receive training on hazardous waste reduction at the time they receive their annual Hazard Communication (Hazcom) chemical safety training. Reduction methods to be covered include: inventory control, source reduction, exchanging chemicals, chemical substitution, etc. Hazcom and hazardous waste reduction training can be done "in-house" by members of the department or arranged through the Environmental Health and Safety specialists in the Department of Facilities Management, or on-line. Training records should be maintained at the individual department level. Copies should be sent to Facilities Management, Office of Environmental Health and Safety.

2. Prior to the implementation of new processes and the procurement of new equipment and chemicals, the Principal Investigator or Instructor should review the new process to determine which type(s) and amount(s) of hazardous waste, if any., will be generated. This review should be noted in the Standard Operating Procedures for the process or in the experiment manual.

3. Each department shall record and keep on file the amount of hazardous waste generated each month. The amounts shall be reported in pounds.

4. Each department shall submit a report annually that includes the following information:
    a. Name of the person within the department who will be responsible for implementing the reduction efforts.
    b. Amount(s) and type(s) of hazardous waste generated, reported in pounds.
    c. Method(s) of hazardous waste reduction implemented.

Copies of all reports will be sent to the chair of the University Biosafety Committee and the Environmental Health and Safety Office in the Department of Facilities Management. The Environmental Health and Safety Office will review all reports, monitor compliance, and will be available to provide technical assistance and training.

PRIMARY WASTE STREAMS:

There are two primary waste streams - #3 and #7.

Waste Stream #3, Laboratory Chemicals for Lab Pack

Laboratory chemicals are generated by teaching laboratories and research laboratories, primarily in the Chemistry, Biology, and Agriculture departments. A wide variety of chemicals is generated in small amounts. The amount of laboratory chemicals generated varies according to the following factors: 1. Student enrollment 2. Curriculum offered 3. Research grants awarded 4. Clean-out activities promulgated.

The amount of waste generated shows a trend of an overall increase over the past few years as seen below:

2004	1,138 pounds
2005	1,387 pounds
2006	1,340 pounds
2007	1,890 pounds
2008	515 pounds

Figures for 2009 show a large increase in this waste stream:

2009 –18,838 pounds. The increase is due to a comprehensive clean-out of outdated chemicals.

Reduction activities for this waste stream should include:

1. Substitute less- toxic or non-hazardous chemicals to the extent feasible and minimize the amount and toxicity of waste materials produced. Limit the use of chromic acid for glassware cleaning or use a commercial glass cleaner such as Alconox, or Nonchromix. A potassium hydroxide solution in alcohol or a dilute hydrochloric acid solution may also be effective or the equipment may be cleaned using an ultrasonic cleaning bath.
2. Do not dispose of chemicals as hazardous waste if they can be recycled or

reused. If a material is not needed, determine if a colleague can use it.

3. Centralize purchasing of chemicals through one person in the laboratory/department.
4. Inventory chemicals at least once a year, noting date of purchase.
5. Update the inventory when chemicals are purchased or used up.
6. Purchase chemicals in the smallest quantities needed. Date chemical containers when received and use a first- in, first- out (FIFO) inventory system so that the older ones will be used first.
7. Label all chemical containers as to their content (even those with water). Disposal costs for "unknown" chemicals are very high.
8. When setting up or reviewing current experimentation, evaluate whether less-hazardous or non-hazardous reagents could be used.
9. When researching a new or alternate protocol, consider the kinds and amounts of waste products and determine whether they can be reduced or eliminated.
10. Use detergent and hot water for cleaning parts instead of solvents, when possible.
11. Purchase compressed gas cylinders, including lecture bottles, only from a manufacturer who will accept the empty cylinders back.
12. Put hexane through the rotavap for reuse.

The above administrative and procedural measures will reduce the amount of products stored on campus as well as the amount of waste generated. Many of these measures may have only limited applications but will still contribute to an overall reduction in hazardous waste generation.

Barriers to waste reduction of this waste stream exist. Due to the variety in curriculum and varying numbers of students enrolled, efforts to reduce the amount of waste generated in this category may not be completely successful. It is not always practical to limit the number and types of experiments that the students perform in teaching laboratories.

Additionally, seeking to reduce the amount of waste produced by research activities may be counterproductive to the mission of the University. It is sometimes not in the best interest of academia to limit the type and amount of research that is conducted. However, reducing the generation of hazardous waste wherever possible is a highly desirable action.

Waste Stream #7, Waste Paint and Related Products

This waste stream consists mostly of outdated paints, varnishes, and other coating materials. The Facilities Management Department is primarily responsible for this waste stream. The University has nearly 60 structures. The variety in types and colors of coatings is broad so many different types of paints and coatings are kept in storage. The amount of waste generated for this stream shows an unpredictable pattern.

2004	400 pounds
2005	50 pounds
2006	150 pounds
2007	1,300 pounds
2008	2,400 pounds
2009	900 pounds

Waste reduction activities for this waste stream include:

1. Limit the amount of paint procured to only the amount needed for the project.
2. Work with contractors to ensure that the amount of paint procured is what is necessary for the job.

Since the majority of the waste from this stream is outdated product, the above administrative controls will be taken in order reduce the amount of excess paint being stored.

Waste Stream #'s 1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, Intermittent and One-Time Waste Streams

The university often ends up disposing of various hazardous materials on an intermittent or one-time basis. These are often outdated, obsolete, or degraded products. Other items are materials donated to the university.

Waste reduction activities for this waste stream include:

1. Proper inventory control to prevent products from sitting on shelves past their expiration dates.
2. Refusing to accept the donation of items of a hazardous nature, unless there is an immediate use for the items.
3. Networking within the university to find those who can use products that may be nearing their expiration dates.

Because many of the one-time waste stream disposals are items that are kept beyond their expiration dates, the administrative procedures outlined above will lead to an overall reduction in the amount of hazardous waste generated for disposal.

Approved:

Vice President, Business and Finance — Date: 10/14/10

Vice President, Research and Sponsored Programs — Date: 4 Jan 2011

Vice President, Academic Affairs — Date: 10-14-10

President — Date: 1-11-11

Appendix A

Waste Stream Calculations

Waste Stream #3, Laboratory Chemicals

Year	Waste Generated (lbs)	# of Students	Waste per Student, lbs.	Cost of Waste
2004	1,138	9,100	.125	$6,120
2005	1,387	8,880	.156	$5,860
2006	1,340	9,038	.148	$10,085
2007	1,890	9,065	.208	$7,775
2008	515	8,254	.062	$2,808
2009	18,838	8,679	1.9	>$112,759

The cost for the disposal of this waste stream varies substantially. If wastes are not labeled, then the cost of categorizing them before proper disposal is dramatic. Some particularly hazardous materials are very expensive to dispose of. The university has used different contractors over the years to dispose of waste. The costs charged by these contractors vary quite a bit.

With the implementation of stricter inventory controls and a complete cleaning out of out-of-date chemicals, the university can reduce the waste for this stream to .11 lbs. per student.

Waste Stream #7, Waste Paint and Related Materials

Year	Waste Generated (lbs)	# of Work Orders for Paint Shop	Waste Per Work Order, lbs.	Cost of Waste
2004	400	321	1.27	$780
2005	50	307	.16	$465
2006	150	418	.36	$465
2007	1,300	1,015	1.28	$2,145
2008	2,400	550	4.36	$5,136
2009	900	623	1.44	$2,840

The cost for disposal of this waste stream varies substantially. The cost varies by the contractor used. The cost also varies according to the packaging of the paint. Spray cans, 1 gallon cans, 5 gallon buckets have to be repackaged and the disposal cost is significantly more than pouring up the paint into drums that do not have to be repackaged.

Working with contractors to reduce the amount of waste left behind and implementing inventory controls can reduce this waste stream to .15 lbs. per work order.

Appendix B

List of All Waste Streams and Current Status

#1	Waste Paint with Lead, Closed in 1996 report, Reopened in 2008
#2	Waste Paint with Mercury, Closed in 1996 report
#3	Lab Chemicals/Lab Pack, Remains Open
#4	Chiller Oil, Closed in 1997 report, Reopened 1999, Close in 2003 report
#5	Octanol, Closed in 1996 report
#6	Duplicating Fluid/Waste Flammable Liquid, N.O.S., Closed in 1997 report, Reopened in 2008
#7	Waste Paint - Flammable, Remains Open
#8	HVAC Cleaner, Closed in 1997 report
#9	R111/R11, Closed in 1998 report
#10	Thinners, Remains open
#11	Kerosene (Petroleum Hydrocarbon), Closed in 1998 report
#12	Pesticide Liquid Toxic Flammable, N.O.S., Closed in 2000 report
#13	Pesticide Solid Toxic, N.O.S., Closed in 2000 report
#14	Spent Lab Solvents, non halogenated, Closed in 2005 report
#15	Liquid Scintillation fluid, Closed in 2005 report
#16	Spent Degreasing Fluid, Closed in 2004 report, reemphasized closure in 2005 report.
#17	Waste Herbicide/Fertilizer, Opened and Closed in 2006 report, Closed again in 2007 report.
#18	Waste Hydroxide Solution, Opened in 2008
#19	Arsenic Containing Herbicide, Opened in 2008
#20	Waste Mercury, Closed in 2009
#21	P-Listed Lab Packs, Open
#22	Aerosol Paint Cans, Open
#23	Methane - compressed gas cylinder, Closed in 2009
#24	Solvent Naptha/Petroleum Distillate, Closed in 2009

Total Quantity of Hazardous Waste Generated (All Waste Streams Combined)

1994	7,974 lbs.
1995	2,160.5 lbs.
1996	1,683 lbs.
1997	1,405 lbs.
1998	623 lbs.
1999	442 lbs.
2000	6,107 lbs.
2001	1,130 lbs.
2002	1,547 lbs.
2003	1,090 lbs.
2004	1,688 lbs.
2005	1,442 lbs.
2006	3,199 lbs.
2007	3,180 lbs.
2008	4,515 lbs.
2009	18,637 lbs